

ICQSS 2011

14th QMOD conference on Quality and Service Sciences

From Learn*Ability* and Innov*Ability* to Sustain*Ability*

29-31 August 2011, San Sebastian, Spain

Book of full papers



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QMOD Conference on Quality
and Service Sciences 2011

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*From LearnAbility & InnovAbility to
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Welcome message

It is an honour for us to welcome you to the 14th QMOD/ICQSS conference. The aim of the Conference is to focus on the three key themes of **LearnAbility, InnovAbility and SustainAbility**, all of which are necessary in today's business environments, which are constantly evolving towards higher complexity. All three key concepts indicate the importance of meta competencies in terms of our capability to learn (learnability), capability to innovate (innovability) and capability to sustain (sustainability). It is our belief that these meta competencies will become increasingly important in the coming years. Among the many issues which challenge modern management theories and practices are: The hyper competition, the increasing importance of intangible assets, cultural and ethnic diversity, the focus on quality of life, gender, organisational ecology, environmental sustainability, corporate social responsibility and risk management.

The QMOD conference has become one of the largest scientific conferences within the research fields of Quality, Service, Organisational Development and related research areas. The yearly QMOD conference is also proven to be a major forum where academics as well as practitioners from all around the world have the opportunity to exchange their knowledge and experiences and thereby built a '**QMOD Community**'. Through this forum, we can discuss and share our research and experiences in order to be able to draw a more accurate picture of organisational and business realities, and thereby to improve our diagnosing capabilities of current problems and improvement opportunities.

We take this opportunity through this written welcome to express our recognition of the effort and work put in by all those people who have made it possible to organise **QMOD 2011**: we pay tribute to the Scientific Committee who have assured the quality of the accepted papers, to the members of the organising committee for their keen motivation and to all the people who have directly or indirectly influenced the smooth progress towards the conference.

Finally, we would like to express much gratitude to all of the authors for contributing their papers. We hope you will find the conference schedule we have prepared interesting and worthwhile, and we encourage you to enjoy the delights offered to us by San Sebastian, our host city.

Donostia – San Sebastián, August 2011

QMOD Organising Committee

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I have no idea what I'm doing. Customers as Incompetent Service Workers

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Introduction

The role of the customer is increasingly put forward as a key factor for achieving a sustainable compatible advantage, not least within the evolving perspective of the service dominant logic (Vargo & Lusch, 2004, Grönroos, 2008). As co-creators of value the customers are recognized as a resource in the realization of the value proposition (Vargo & Lusch, 2004). By integrating resources – such as time, effort and skills – customers in practice become key “part time employees” within the service delivery system (as Bowers et al (1990) noted some twenty years ago). When it comes to skills, these are of obvious importance in self-service settings, where the customer is supposed to actually co-produce the service by performing operative tasks in the service process (Meuter et al, 2000). However, customer skills also profoundly related to value co-creation in the service experience (Lusch & Vargo, 2006): in order to experience the value of a service, the customer must be able to comprehend and understand it by putting it in to a meaningful context. That is, customers’ skills and knowledge, i.e. competence, is required both on an operative level and an experiential level.

Following this intensified focus on customers, ambitions to stimulate customer co-production are increasingly informing service design, giving rise to services and customer-company relationships that both assumes and promotes this active customer participation and even direct work efforts in the service process. These ambitions are readily apparent in the industry of our empirical study, internet retail banking, where customers are actively encouraged to perform many work tasks themselves that were previously carried out by bank clerks. Financial services are characterized by development where the customer is increasingly offered opportunities of producing her own services. In fact, this “offering” is often more or less mandatory for the customer in order to get access to the service (Auh et al, 2007). Despite the interest in gaining access to customer resources, research on customers as “service workers” is surprisingly scarce (cf. Woodruff & Flint, 2006). The lack of research could be due to the often stated assumption that customers are active, skilled and willing to partake in the service process (cf. Prahalad & Ramaswamy, 2000). This notion often hides the fact that not all customers want to, or have the capacity to, co-produce.

Notwithstanding the advantages of having the customer performing all these tasks, there is also a substantial risk involved when delegating service work to the customer, in that the customer is not a professional service employee. Customers might lack the

necessary skills and simply be incompetent “service workers”. This naturally causes problems in the service production and the realization of service value. It is argued that if customers do not have the skills needed to make use of the resources provided by the supplier, value-in-use will be lower than otherwise and maybe even non-existent (Grönroos, 2008).

It is clear that customers’ skills are crucial for service value co-creation and the lack of skills might cause severe problems. It is therefore relevant to scrutinize not only the skills required of the customers, but also situations where skills are absent and the customers are incompetent. The purpose of this paper is to illuminate such situations and in particular to address how customers have difficulties to fulfill their role as “services workers”. Consequently, this paper focuses on customers who are not qualified to fulfill their role as “service workers” within the context of financial services.

Methodology

In the paper, we take departure in customers’ actual behavior during the service process to broaden our understanding of customer co-production and the customers’ role as a co-creator of value. We problematize this role by drawing attention to potential conflicts between the idea of the value co-producing customer and service encounters *in practice*. The idea of the value co-producing customer instills a particular customer role, namely that of an active participant – “a part time service worker” – in the value creating process. It is this “service working customer” that is the object of our study. Our empirical object of study is young bank customers’ attitudes and behavior towards internet based bank services and financial life in general. Bank services are fundamental to the modern life and of particular importance for young people entering adulthood. Having an organized financial situation is a key step in becoming an independent member of society. Empirically we draw on a multitude of data sources, including focus group interviews, individual interviews, financial diaries and observations of customer self-service use documented by video recordings, each described below.

Five focus groups interviews have been conducted with bank customers in the age between 17-18 years. In groups of two to six people a total of 21 respondents participated. The interviews focused on a number of themes such as the customers’ attitudes towards bank services and financial matters, previous experiences of financial services, habits and behavior in practice regarding finances, knowledge and interest of economy and expectation and strategies. We constantly asked the respondents to exemplify, explain and reflect upon their experiences in order to obtain rich and vivid accounts. Focus groups interviews have several advantages, for example that the participants are given opportunity to develop themes that are most important for them, which in turn disclose unexpected issues (Wilkinson, 2008). Group discussion is closer to everyday conversations as it has a more naturalistic feature and information and description of the subject are more elaborated since the participants stimulate, react to and build upon responses of the other group members (ibid). In particular we noticed, in our study, how the participants talked about the issue, giving us insight into young customers habitually language.

Further, our empirical data also include diaries from 19 students. In a total the material consists of entries on approximately 270 days. A diary is a personal record which gives

account over time of daily events, observations and thoughts which allowed us to access ongoing everyday behavior, reactions, motives, feelings and activities of the respondents (Bolger et al, 2003). Diary studies has a great advantage in that it make it possible to attain knowledge about aspects that would remain hidden to traditional qualitative designs, for instance understanding of the world in which the young customers live and their motives (Patterson, 2005). The respondents have the opportunity to describe aspects that are personally meaningful as well as subjective perceptions of relevance for them at that point of time. As a consequence, through the diaries we gained knowledge about the young customers' context and behavior. During a period of three weeks the respondents were asked to document everything in connection to their economy and relation to bank services. The diaries consist of thick descriptions of the respondents everyday thoughts, behavior and problems in relation to financial services and foremost their own finances. As could be expected, some respondents made very brief notes, while others were more extensive. Patterson (2005) argues that people tend to write more than asked for, giving rich empirical data, which is also the case in our study.

Our third data set consist of 32 one-to-one interviews, 11 with respondents in the age between 18-19 years and 21 with 21-23-year olds. These groups were chosen because of their different economic situation. The younger group is still in school and has a limited amount of money. The older group has entered the labor market and has a higher income - a salary or unemployment allowance. By using one-to-one interviews we were able to capture the respondent opinions and experiences of financial issues. The interviews included questions about economical situation and how they handle financial matters, and it also included an experimental situation where the respondents performed a selection of predefined tasks. In the interviews we thus were able to gain access to both customers' attitudes as well as actual behavior when using the bank's self-service.

The observation part of the interview study focused on self-service use and were arranged to capture behavior in relation to commonly used services. Some of the assigned tasks were of an easy kind, like finding the opening hours on the webpage, while others were more advanced and connected to the use of self-service, like buying a fund. This task was appropriate since we considered it to be just enough complicated for this customer segment, considering that all applicable information is available on the banks webpage. We also offered them 100 SEK (app €10) if they completed this task. While the respondents tried to execute the assignment the computer screen was videotaped and they were asked to think aloud. In this way we came close to the actual perceptions of the customer (Echeverri, 2005) and it allowed us to analyze how they actually performed. Hence, we have a rich data material consisting of both statements and authentic behavior.

The transcription of the interviews and observation study as well as the diaries, were analyzed using NVivo qualitative data analysis software program, enabling us to categorize the material. Techniques of a grounded theory approach were applied to identify categories, concepts, and variables of key importance for our research aim. We also constantly used memo-writing about how they perceived emerged problems and how they solved them. A number of these "grounded" codes, such as, "insecurity", "awareness", and "laziness", were then arranged into categories. In this process we constantly compared and revised codes and categories in order to create a coherent structure (Miles & Huberman, 1994). In our result we chose to separate our findings

into two main categories, each representing “ideal types” (Weber, 1978). The ideal types of “non-doers” and wrong-doers” thus describe generic characteristics of incompetent customers.

Selected literature review

Customers’ contribution in the service process are well known and has been described as a competitive advantage for companies (Prahalad & Ramaswamy, 2000), including in the financial industry (Auh et al, 2007). It is also argued that customers’ individual participation and contribution in the service process are positively related to experienced beneficial outcomes (Lengnick-Hall et al, 2000). In service innovation and development research it is argued that customers as future users possess distinct knowledge and can provide unique experiences that are of great value when new services are to be developed (von Hippel, 1988). Besides being in focus for service development, customers’ competence is also pivotal for realizing the service as customers participate in and bring resources to the value creating process itself.

The concept of customer competence refers to the knowledge and skills they possess, their willingness to learn and their ability to engage in an active dialogue (Prahalad & Ramaswamy, 2000). Customer competence hereby constitutes a crucial service resource. Within the Service dominant logic a separation is made between operant- and operand resources, where the former denote resources, such as mental skills and knowledge, that has the capacity to produce effects on other resources, for example raw materials. The latter refers to resources that are used or consumed during the service process. The resources that the customers contribute with as a co-producer are primarily of an operant nature (Vargo & Lusch, 2004) that can act on operand resources provided by the company as well as by the customer herself throughout the service process (Kalaignanam & Varadarajan, 2006). Customer must learn to use and if possible adapt the operand resources to her unique needs, usage situation and behaviors (cf. Vargo & Lusch, 2004). However, our understanding of the customers’ competence in the creation of service value is still limited, although there are a few exceptions.

Xie et al. (2008) and Dabholkar and Bagozzi (2002) argues that customers’ inclination to engage in service co-production is dependent on attitude towards success, attitude toward the process and self-efficacy. The later refers to the customers’ know-how and competence regarding the service at hand. Hence, the more knowledge a customer possesses and how she evaluates her ability to perform, the more she tends to engage in value co-production. Expert customers have therefore greater ability to make meaningful contributions to service delivery (Auh et al, 2007). Customers’ propensity to actively engage in co-production can also vary depending on a range of system factors, such as service design, unclear directions, time constraints, economical limitation but also insufficient skills (Xie et al, 2008). Besides customers’ ability and motivation, role- and task clarity is of importance for co-production (Lengnick-Hall, 1996). In the financial service industry, one example is that the client- advisor communication in counseling sessions where clarifications of the customer role strongly enhance the customers’ possibilities to co-produce. The customer thus learns to fulfill her co-producing role more efficiently and conveniently over time (Auh et al, 2007).

The customer’s participative role is particularly significant in situation of self-service solutions (Meuter et al, 2000) where the customer is not only co-producing, but in fact

producing the service herself (Grönroos, 2008). Self-service technologies refers to technological interfaces that enables customers to produce a service independent of direct service employee involvement, for example banking by telephone and services over the internet (Meuter et al, 2000). Here, the customer constitutes part of the core competence of the service system.

Taken together, customers' role and contribution in the co-production is of great importance, but it also raises demands on customers both on operative skills and attitudinal inclination to engage in value co-creation. We would like to critically scrutinize customers' ability to fulfill this role by focusing on customers who in fact do not always possess necessary competence.

Result

In our empirical material we have identified behaviors and attitudes that indicate that the customers are not always embracing opportunities of co-production. Instead they seem markedly uninterested and even actively avoiding the service work required of them. The reasons for this can partly be related to interface and service design issues known from the literature. However, we also see clear evidence of direct resistance against engaging in co-production as such. The unwillingness to work in the service process is related to an apparent lack of interest in, and knowledge about financial services in general. In addition, we also identify a group of customers who indeed engage in co-producing activities but do so in an "erroneous", e.g. non-value producing way.

Below we elaborate on two main categories of manifested "incompetence" among the bank customers in our study: "non-doers" and "wrong- doers". Within each category we highlight a number of significant characteristics that together seeks to describe the essence of these two "ideal type" customers.

Non-doers

The non-doers are characterized by an avoiding behavior vis-à-vis invitation to co-producing activities. There might be several reasons for their position in this respect. Although it is obvious that they have the technical ability to use the banks self-service, as young adults they are familiar with internet based services, they lack important knowledge to carry out even simple financial tasks. However, the customers are aware of these shortcomings and because of this a common denominator for the non-doers is concern - and even fear - of doing wrong when trying to carry out bank services by themselves. Since they consider financial services imperative, as money and economical issues are vital parts of daily life, they are quite cautious, and sometimes they simply refuse to complete the service at hand.

I am usually very careful when visiting this kind of web page and then I do things I know how to do, because it is probably quite easy to lose [money] if you do something wrong...

This cautiousness is expressed in the interviews and in the diaries at several points, and often it is related to the respondents not having sufficient experience and knowledge.

Consequently, familiarity is important for customer co-production, and the absence of previous experiences results in insecurity.

R: I'm not that familiar with this. I don't think I have the guts actually.

I: What do you think could happen?

R: No, I don't know. (Laughing) No...

I: Why do you feel insecure?

R: Because I have sort of no idea what it is actually, or sort of...

This insecurity could be attenuated by embracing information, but in many cases they seem to avoid this possibility. Searching for information requires at least a minimum of interest and engagement, something that our respondents lack. During the interviews the respondent were given the opportunity to buy funds using the banks self-service via internet, and we provided them with the money needed for this task. Although they did not risk their own money (in fact they only received the money if they accomplished the task), many of the respondents were hesitant and some of them even chose to refrain from this assignment. The following excerpt illustrates how the respondents' lack of interest prevented him from going through with the exchange.

I: What do you say, would you like to go through with buying?

R: No, it seems quite complicated so you can take this [money] back... It, no... It doesn't interest me, actually.

As mentioned, customers need to integrate time, effort and skills to be able to co-produce services. In our study, these three aspects are closely interrelated seeing that the respondents' ignorance is partly due to a general apathy towards financial services. They do not want to spend neither time nor effort accomplishing bank services. Some respondents tried to understand accessible information, but they found it to be tiresome and too complicated and they still would not accomplish the task. In the below excerpt the respondent did not want to make the effort to even try. It took some persuasion, but once he was convinced that he was not risking his own money he started glancing at the web page but soon came to the conclusion that he simply would not buy funds.

R: No, I can't be bothered (to).

I: You can't be bothered (to)?

R: No. What am I to do with that?

As we can see, even though they are given the opportunity and have the technical ability, their insufficient knowledge prohibits them to actively engage in co-production. Some of them are aware of this knowledge gap, while others act anxious towards self-services even though they actually have adequate know-how. One customer expresses "Ugh, I'm really not good at this!", when using the bank self-services, although we got the impression that she was very experienced and in fact had the ability to perform the task we gave her. This is only one of the examples we found of customers that actually have necessary understanding of the banks services and how to enact, but do not seem to confide in their own knowledge. Hence, this results in avoiding or not fully utilizing all available service possibilities.

The lack of confidence in their own abilities induces the customers to ask others for help in executing the service in their place, instead of actively trying to find and

comprehend available information. Hence, they turn to someone who possesses the necessary skills. The two excerpts below illustrate how the customers rather address bank employees and thus avoid not only the work effort but also having to make a decision they do not feel qualified for. By turning to a bank employee, the customer can feel assured that any mistakes due to the customers own incompetence is reduced.

I don't, it feels like, I don't know, like I'm afraid that I might do something wrong or that there will be some hassle. So it feels better to pass it on and maybe consult someone about deals and what's best...

I didn't have the energy to check which debit card were the most suitable for me, for example. The last time I... Well, yeah... This one time I sent an e-mail [to the bank] asking 'what is suitable?' And then they replied immediately and I went with [their suggestion].

Hence, customers' reluctance towards self-service use causes them to seek help from a second part. In the above examples they conferred the bank staff, but we also found that they relied on personal network and thus consult friends and relatives when carrying out the service. One respondent always has her boyfriend to guide her:

Usually he just sits next to me and tells me what to do, and I do the clicking.

Since she is the one performing the task she obviously has the ability and skill to perform the task in practice, but when it comes to making a decision on her own she does not find her own knowledge trustworthy. Instead she chooses a "safe option" by buying a fund her boyfriend previously picked for her. Turning to her personal network for help is just another way of not having to make a decision that she does not feel qualified for.

To sum up, the fact that the customers are aware of their lack of knowledge, or does not confide in their knowledge, results in an anxiousness of doing wrong when executing the service. If they cannot turn to a professional or their personal network as discussed above, this leads to avoidance and they simply do not use the available service. This of course is problematic from a value creation point of view. However, at least the non-doers do not obscure the banks value proposition in itself.

Wrong-doers

In contrast to non-doers, our second category, the wrong-doers, have no problems acting in the service process, although they do so in a way that is not compliant with the envisioned service offering. In fact they might even act in a directly contra productive manner. Often they are unaware of their "wrong - doing" due to lack of knowledge. Hence, as they are not aware of their own ignorance they readily perform "co-production" activities and utilize the resources provided by the service supplier. Even if they, as in some cases, they are acknowledging their shortcomings they persist in their behavior anyway, and might provide quite elaborated explanations for their actions in self-service use. But without the required knowledge and insight, the result is seldom the full service value envisioned in the company offering. The customers do the wrong things, make the wrong choices and interpret both the service and their own role in the

value creating process in an erroneous manner, not only in regard to the banks version of the service concept but often also in regard to their own interests. The consequences of using financial services without having the necessary skills might at the best be confined to a mere absence of value creation, but there are also several cases where the effects are more severe, involving loss of money or even being put in debt.

When assigned the task of buying funds some respondents oscillated quite readily between, on the one hand, acknowledging their lack of knowledge and reluctance to actually do the tasks required (as discussed above) and, on the other hand, a far more active and certain approach. One respondent told us that he had conferred a bank employee about funds and been taught how to use the self-service in order to buy funds. At that time he found the administrative fees too high and therefore abstained. Despite this meeting with the bank employee, he is not showing signs during the interview of interpreting the information about the funds correctly and is actually acting against his previous insight of high fees. Eventually he selects a fund placed high in the listings and ignores the administration fee altogether. When asked about his selection, he explains the rationale behind his choice:

I: Why do you select a Japan fund?

R: I don't know. Looked good.

I: What made it look good?

R: I trust Japanese people so to speech. You know, they can't build cars, but they might be able to fix funds...

I: But you didn't click for further information, was it the information in the list that made you select Japan?

R: The list, yes, they were placed fairly high. Probably they have developed well, if I understand it right, Eh, and then I thought I'll buy...

When he is requested to approve his purchase he receives an error message and it turns out that he had confused the price of the fund share with the amount he was about to invest.

R: No, too small, change to a larger [amount]. No, all the same with Japan then! But don't they cost 45? 46?

What is interesting with this respondent is that he is indeed acting as a co-producing customer, and he does deem himself capable in his role. From our perspective though, he is acting against his own interest and ignores important knowledge that he actually possesses. This tendency to make un-informed financial decisions extends beyond the mere execution of operative service tasks to financial life in general. Although the respondents express that money and economical issues are crucial parts of life, many of them seem to lack fundamental understanding of economical issues and how to handle money.

I: Would you say you're a saver or a spender?

R: Spender.

I: Spender?

R: Definitely! I am. Since I haven't been able to save anything I am... I guess I have been able to [save] sometime, but then I reckon it's a lot more

fun to go out and spend it on something unnecessary (laughing). But that's not, it's not very clever, but... That's the way it is.

Although being well aware of herself being a “spender”, and at least implicitly expressing concerns about this, she shows no real ambition to modify her behavior. In fact, later in the interview she reveals that she had overdrawn her debit card and had it revoked for six months. Despite this clear warning signal, she is still spending (but now on a cash basis). From the bank's perspective, this lack of “proper” financial attitude is problematic as many bank services (and bank relationships) rests on the assumption that the customer has, or at least strives, for an ordered private economy. In the diaries as well as the interviews we have noted a tendency to overspend and “break the budget” and the respondents often complain about their shortage of money in the end of the month. The customer quoted below does attempt to keep track of his economic situation, but he fails in doing so in practice. He continues to do “wrong” although he knows that his behavior is not sustainable in the long run.

I: Do you make some kind of budget?

R: No, not a very complicated one but I know roughly how much money goes to bills and stuff, and how much I should save, generally. And so, so I almost have kind of a small ‘half-budget’... That I never stick to.

I: How come?

R: It is the impulsive shopping that breaks it.

The two excerpts above suggest that they are aware, or at least not entirely unaware, of that they should handle their economy differently, but we also have examples of people who actively do wrong without being aware of their “wrong-doing”. One respondent tells us that he uses his credit card for “essentials” (like gasoline for his car) when he runs out of money. He then “repays” to the credit card company, but always with a substantially less amount than his spending – although his income is high enough to cover this monthly expenditure. His credit card debt therefore continues to grow month by month. However, since he is ignorant towards economical issues in general, this poor financial situation does not seem to bother him. Another interesting phenomenon we have noticed among our young respondents is that they seem to save money when they are short of it and overspend when they have money. This rather counter-intuitive financial behavior could cause problems for the bank, as their services are usually designed to accommodate the opposite behavior. The ideal bank customers should save when they have money in order to cover economical downswings.

Discussion

It is previously known that customers face several impediments in financial self-services, for example complicated web pages, safety/privacy issues and technology failure. A common denominator of these obstacles is that they ascribe the problem to the design of the service and the service system. The customers' role and own ability to participate as “service workers” have often been neglected in service research. Our study suggests that customers' presumed service work and value co-creation are clearly obstructed by their ‘incompetence’, i.e. their lack of knowledge and/or capacity to act in the value creating process. This holds both for the operative activities related to direct service co-production and for the more profound role the customer has to play in the realization and appreciation of value.

The banking industry early adopted self-service systems and most services are nowadays offered in this way. In effect, this means that the customer has taken over many core activities necessary for the accomplishment of the service previously performed by service employees. Acting as financial service workers, not least in the context of self service, requires a substantial amount of professional knowledge. Lack of this competence makes the customer feel insecure and uncomfortable during the service process, and obscures the execution of the service. This is evident among the non-doers in our study: they frequently show signs of uncertainty and even fear when it comes to make even simple decisions and perform simple tasks in the service process. In fact, even in situations when they do possess the knowledge, we see examples of customers who refuse to perform their co-producing tasks.

Arguably, this is a reflection of the fact that customers' service work requires not only a significant effort from the customers, but also a responsibility for the service process and outcome. Consequently, the customer is held partly accountable for service failure in self-service use (Meuter et al, 2000). Obviously, the non-doers in our study are at least to a considerable extent aware of that the responsibility for the service process outcome is partly theirs. On frequent occasions we have witnessed how respondents try to escape this responsibility by transferring it back to the bank ("I want to go to the bank and talk to someone about this"). In some cases, they even resorted to their personal networks for advice and instructions. Although this might partly be due to knowledge deficits, it is also in effect a way to avoid the responsibility of making decisions.

Customer who will not perform their ascribed activities in the co-producing process due to lack of confidence even if they have the necessary 'technical' knowledge naturally poses a challenge for banks. However, too much confidence in the own financial ability could be equally detrimental for value co-creation as is shown by our wrong-doing customers. These customers readily perform tasks and make decisions with sometimes far reaching consequences without sufficient knowledge. It has recently been suggested in the literature – through the concept of value co-destruction – that value can actually be destroyed by customers (Echeverri & Skålén, 2011, Plé & Cáceres, 2010). The wrong-doers in our study clearly show signs of such destructive approach, even though they do not seem to be aware of this. There are several examples in our empirical material of customers engaging in destructive financial behavior who either firmly believe they are acting as responsible financial agents, or who simply ignore their acknowledged lack of competence and acts anyway. The latter group even includes persons who are explicitly aware of their "wrong-doings" (e.g. over-spending) but persist in their behavior anyway. The promotion of self-service banking strategies increases the opportunities for the wrong-doers as there is no representative from the bank present to correct their wrong-doings.

As the logic of active value co-production is central to the strategies of many banks and other financial institutions, the presence of "incompetent" customer poses a real managerial challenge for the financial industry. Naturally, all measures possible should be taken to make the customers co-producing activates as smooth as possible. The web-interface used by the bank in our study could for example be improved in several regards. However, our study indicates that simple measures like redesigning the bank's web pages or simplifying self service procedures are not sufficient to address the

problem. Instead innovative strategies for managing customer financial knowledge – *and lack thereof* – are called for.

Letting the customer do the work is inherently an attractive strategy for the bank as it often involve considerable cost reductions. However, one conclusion from our study is that self service, or even value co-creation in general, is not necessarily the best way for creating value with all customers. Prahalad & Ramaswamy (2004) contemplate if customers really should shoulder responsibility over possible risks when realizing the service. In some cases it might be better that the company performs the service work and makes the decisions for the customer. There thus lies a value in being relieved the role of being a value co-creator, and this value might even overweight the cost reductions gained by enrolling the customer as a “part-time service employee”. Many of the customers in our study express a preference for such an approach to value creating financial services.

This requires interaction/dialogue with the customer and not merely providing information about possible options available. Such a dialogue can reduce the customer’s responsibility and bring some of it back to the bank. Similar service concepts are common within private banking where they are offered to wealthier customer segments. Our study indicates that a corresponding service adapted to the cost level of retail banking might provide an important complement to the prevailing self-service strategies. Not least could such service concepts help prevent overzealous customer to engage in service activities that they are not qualified for and that could damage both themselves and the bank.

The identification of “non-doers” and “wrong-doers” in our study provides an important first step in developing a conceptual basis for a more nuanced view on value co-creation. To acknowledge “incompetent” and reluctant customers in the value creating process is not only a managerial endeavor, but in all essential a research challenge that needs further investigation.

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The rising power of Lean Six Sigma within the Gulf Cooperation Council Countries: a Case Study in the Service Sector

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The lean six sigma approach

The lean Six Sigma method is a combination of both Lean Manufacturing and Six Sigma (Gitlow 2009, George 2005, George *et. al* 2004). The lean Six Sigma methodology is based on the Six Sigma DMAIC methodology, modified to include the Lean Manufacturing tools within each phase. Lean Six Sigma is introduced focusing on its importance within the service and non-manufacturing areas (Gitlow 2009, George 2005, George *et. al* 2004).

El-Haik and Al-Aomar (2006, p.23) suggested, “Lean Six Sigma provides a set of methods that companies can apply to any manufacturing, transactional, or services process to reduce variability, eliminate or reduce waste (non-value-added), and cut process lead time”. In other words, Lean addressed the waste aspect and Six Sigma addressed the variability aspect. When combined together, the rewards increased. To better highlight this fact Lean principles are addressed first and then the combination with Six Sigma is presented.

Lean is mainly based on improving the process cycle time by eliminating any waste or what is also called non-value added. George (2003, p. 28) suggested six principles that guide Lean.

Principle One

When flowcharts are drawn the activities will be divided into two parts value-added and non-value-added. Different colors are used for every category in order to show the waste within the process itself. George (2003) mentioned that organizations that did not embark on such improvement journey are likely to be faced with at least 50% of their activities falling into the non-value-added category. Eliminating these non-value-added activities would improve the lead times tremendously.

Principle Two

Lead time is a function of both work in progress and average completion rate as shown in the below formula.

Equation 1 Little's Law

Thus to decrease the lead-time we can increase the ‘average completion rate’ and/or decrease the ‘amount of work in process’. The first principle targets the average completion rate by decreasing the cycle time. Since a decrease in the cycle time would increase the average completion rate.

The second principle addresses decreasing the amount of work in process thus leading to an improvement of the lead-time.

Principle Three

Using the pull system is one of the key methods for decreasing the amount of work in a process. The pull system would provide the ability to businesses to know when to release or not items into the process so that the work in process stays in control. The ways of implementing the pull system depends on the nature of the process. Two such natures were identified:

- 1- Processes in which the customer is waiting in front of the clerk to be serviced.
- 2- Processes in which customers requiring the service are now in front of the clerk providing the service

In the first case where customers are physically present within the system the treatment becomes different, the only way of decreasing the lead-time is by increasing the average completion rate. This can be done through either increasing the capacity or making things faster (e.g., through automation, additional training...).

George (2003) mentioned that though from the theoretical point of view it is easy to evaluate the required average completion rate, however, from the practical point of view it is difficult. This is due to the fact that customers vary in their requirements from the system and their arrival to the system (e.g., for a teller at a bank branch, customers might arrive at any point in time to the branch and the time needed to tend to their wide range of potential transactions also varies a lot.). In this case a careful study should be conducted on the arrival rate and its variations, and the processing rate and its variations leading to better assess how many tellers are needed and/or a change in the way transactions are done.

In the second case, the planner or scheduler would know when to take or not take orders so that the work in process is kept to a minimum. Therefore, when the capacity is reached, an item is added to the process only when that item is completed and thus becomes outside the process.

The pull system ensures that processes are balanced and managed in a way that no over promising is done for customers. This guarantees a certain service level that is promised to customers. Items that are not admitted into the process are kept in a buffer until a place becomes available within the process, and only when admitted are customers then notified of the completion date and time. One main tool used in the pull case is the Kanban (translated from Japanese where Kan means ‘Card’ and Ban means ‘Signal’ (Ohno, 1988). Kanban or signal card is a “card attached to a storage and transport container” (El-Haik and Al-Aomar, 2006, p. 256). The card is used in a pull system for controlling the flow of materials and reducing the work in process. So whenever the quantities from a certain process have been consumed the Kanban card is used to place a similar order from the supplying arm and if it is being manufactured then this can be considered as an order to start the production.

Principle Four

$$\text{Process Cycle Efficiency} = \frac{\text{Value Added}}{\text{Total Lead Time}}$$

where

$$\text{Total Lead Time} = \text{Value Added Time} + \text{Business Value Added Time} + \text{Non-Value Added Time}$$

Equation 2 PCE

The PCE equation is related to the availability of waste within the process. The total lead-time is the amount of time needed to get the order through from beginning to end. The value-add time is the time needed to change the state of the work elements throughout the process. Time value maps are used to better display the stages work elements go through. Within the time value maps each activity is flagged as being:

- 1- Value-added work: this will be related to what the customer is willing to pay for
- 2- Waste also called business value added: are activities that the customer does not want but maybe needed for some other business internal reasons
- 3- Delays also called non value added: described previously as work in process

George (2003, p36) suggested different world class cycle efficiencies from different applications, the best being 50% PCE for service businesses processes.

Principle Five

The Pareto rule applies not just for sales but also in the case of Lean. It is suggested that when embarking on an improvement drive aimed at decreasing the lead time to focus on the activities that contribute the most to the waste. As Pareto rule suggests that 20% of activities contribute to 80% of the delays, and thus focusing on these 20% activities would improve the lead-time by up to 80%. George (2003, p. 38) calls these 20% of activities as “Time Traps”.

Principle Six

To better analyze processes the use of visual aids becomes very crucial. Within the Lean field Value Stream Map are the most common to use. The value stream map identifies the process work elements have to go through from beginning to end. Information like cycle time and people doing the work are included along with the average waiting times at the queues. The power of value stream maps becomes apparent when the activities are labelled and coloured using the earlier mentioned categories, thus the non-value added activities and the delays will be visually seen leading to better analysis and ultimately better improvement plan.

Comparison between lean, six sigma and lean six sigma

To better illustrate the power of LSS a comparison between Lean and Six Sigma is conducted while highlighting four major deficiencies that can be eliminated when both (i.e. Lean and Six Sigma) are combined together. El-Haik and Al-Aomar (2006, p.25)

compare both lean and six sigma on a set of characteristics that identify the similarities and differences between both approaches as follows:

	Six Sigma	Lean
Goal	To improve process capability and reduce variation	To reduce lead time and process waste
Focus	Process outcomes	Process flow and waste
Philosophy	Variability within specifications is cost	Time in system and overcapacity is cost
Tools	Statistical analyses	Factor physics
Application	Production and business processes	Production and business processes
Approach	DMAIC problem solving methodology	Value stream mapping and lean techniques
Major measure	Defects per Million Opportunities	Lead time
Major driver	Critical to Quality	Value-added
Project	Problem solving	Continuous improvement
Skills	Mainly analytical	Mainly process knowledge
Gains	Process accuracy	Process effectiveness and delivery speed

Table I Lean Vs Six Sigma as adapted from El-Haik and Al Aomar (2006, p. 25)

As the above table shows both Lean and Six Sigma have a lot to offer to improve the business. On the deficiencies side, the following four are identified whereby the first two relate to Lean and the following two to Six Sigma and it shows when combining Lean and Six Sigma together how those deficiencies are dissolved:

	Description of the Deficiency	Lean Six Sigma to the Rescue
Lean Deficiency 1	Lean does not have a structured approach	DMAIC is now used within LSS which resolved this deficiency
Lean Deficiency 2	Lean only attributes waste to non value added activities while ignoring financial waste (i.e. increased costs) stemming from process variations	Six Sigma process capability addressed in the measure and analyze phases mainly resolved this deficiency
Six Sigma Deficiency 1	Six Sigma focuses only on process outcomes while ignoring any further areas of improvement relating to non value added activities	Lean tools help in identifying the non value added activities which resolves this deficiency
Six Sigma Deficiency 2	Six Sigma focuses on process accuracy while not	Lean tools help in eliminating the non value

	addressing effectiveness and speed of delivery	added activities which resolves this deficiency
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Table II Deficiencies addressed by LSS

The Lean Six Sigma approach as mentioned builds on both methodologies to create a stronger one that can tackle a wider range of problems.

When Six Sigma was first introduced all the efforts were focused on manufacturing processes, since the quality can be measured through defects rates. Six Sigma with its rigorous methodology provided a roadmap businesses can follow to improve processes. With years passing, businesses that improved their manufacturing processes to the perfection were still faced with variations. These variations were mainly originating from the transactional-based processes that were supporting manufacturing processes on both ends. As cited in George (2003, p.3), Bob Galvin the former CEO of Motorola stated, “the lack of initial Six Sigma emphasis in the non-manufacturing area was a mistake that cost Motorola at least \$5 billion over a four year period”. Anthony (2006) argues that implementation of six sigma in the service sector is still not as popular as it is in the manufacturing sector. In accordance, Kaushik and Khanduja (2009) found through their review of the literature that most Six Sigma work has so far been carried out in the manufacturing industries. They further argue that there is a scope for improvement in the service industries through the application of Six Sigma techniques.

Six Sigma is even a newer concept in the Arab countries (Salaheldin and Abdelwahab, 2009). One of the factors hindering the increased popularity of Six Sigma in the services sector in general and in the Arab world in particular could have been related to the fact that implementation of some of such projects were a total disaster leading to negative impacts (Gijo and Rao, 2005). Despite this, there is agreement in the literature that a fundamental objective of Six Sigma is to achieve customer satisfaction with continuous improvement in processes. According to Mahanti and Antony (2005), Six Sigma focuses on improving quality by helping organizations produce products and services better, faster and cheaper. Furthermore, Mathew *et al.* (2005) have also maintained that the main idea behind Six Sigma is doing things right and keeping them consistent. Despite all those benefits, the deployment of Six Sigma does not come easy or cheap, because in order to reap the benefits considerable investments (both financial and top management commitment) are needed. The following section addresses both an implementation framework for Lean Six Sigma and how change management can help in increasing the chances of a successful implementation.

Lean six sigma deployment

Since its inception in early 1980’s, Six Sigma has been adopted by a large number of large, medium and small sized companies (Snee and Hoerl, 2003). According to Harry and Schroeder (2000), many organizations that have implemented Six Sigma have achieved improvements in their market share, customer satisfaction, reliability and performance of their products and services with impressive financial savings. However, this is not always the case. In a few instances, the implementation of the six sigma methodology has not given the expected benefits. Snee and Hoerl (2003) argue that the success of the implementation varied from extremely successful to extremely not successful. They also argued that Six Sigma can work for all sectors irrespective of the company size even in the software sector where hard coding is the key to success (Mahanti and Antony 2009) and supply chain (Dasgupta 2003) demonstrated in their

respective papers. Irrespective of the applicability of Six Sigma the secret in reaping the benefits, lies in the deployment.

In this section, we will present the reasons behind a successful implementation of Six Sigma initiative and highlight the pitfalls that should be taken into account to help minimize the chances of implementation failure. This will help in providing the LLC Company with a clear roadmap for implementing the Lean Six Sigma.

Snee and Hoerl (2003) studied four cases of implementing Six Sigma, two of which were successful and two unsuccessful. The following table summarizes two tables taken from Snee and Hoerl (2003, p. 30 and p. 35) outlining the key attributes while deploying Six Sigma:

Successful Implementation	Unsuccessful Implementation
Senior Leadership (especially from the CEO) provided full commitment and support to this initiative	Senior management did not exercise any leadership at the corporate level
Six Sigma objectives were set earlier on and key performance indicators were put in place to evaluate achievements and ensure objectives are met	The choice of Master Black, Black and Green Belts was not based on talents
The best people were put on board to ensure effectiveness. Those chosen to take part were relieved from their day to day normal duties to focus on Six Sigma	The Master Black and Black Belts were part time and thus any Six Sigma project was an addition to their already busy schedule
An infrastructure to support projects identification, setting-up teams and following-up on results was put in place to ensure transparency and accountability	The project selection process was very poor, and they were not related to bottom line savings
Training programs and Six Sigma hierarchy were set-up earlier on	No clear objectives for Six Sigma were put in place
Focus of all projects should be directly related to bottom line financial results	There were no rewarding scheme to motivate the people
A good reward scheme for the success of Six Sigma initiative was put in place, creating a big boost among all employees	

Table III Key Factors for Successful and Unsuccessful Six Sigma Deployment

Snee and Hoerl (2003) recommended a process for the overall deployment of Six Sigma within any industry. This process was devised after reviewing the reasons behind the unsuccessful implementation of Six Sigma as shown in the table above. In their view, successful Six Sigma deployment needs the following main pillars:

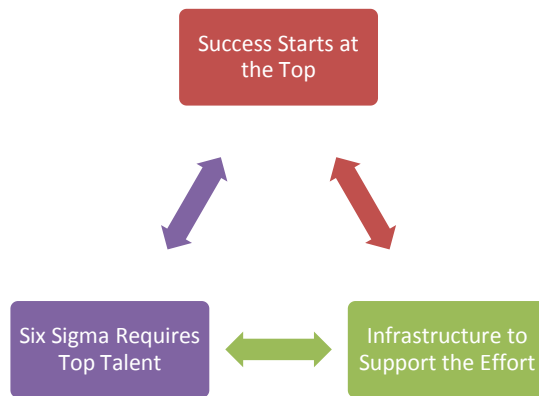


Figure 1 Six Sigma's Pillars of Success

To ensure the success of Six Sigma deployment Snee and Hoerl (2003, p. 53) suggested a framework illustrated below and described after:

Process



Major Transition Point



Keys to Success



Figure 2 Six Sigma Proposed Deployment Process

During the **launching phase** the following elements need to be completed:

- 1- Setting the overall vision and justification for deploying Six Sigma
- 2- Selecting an external Six Sigma provider if needed
- 3- Developing a long term deployment plan, including objectives
- 4- Developing a short-term implementation plan, based on the long term deployment plan. This task includes selection of initial resources and projects which as Kumar et. al. (2009) suggest that it is one of the most crucial criteria for a successful six sigma project though not well researched
- 5- Writing a clear communication plan to explain this direction to the entire organization

After starting the Six Sigma initiative **managing this effort** on either a large or smaller scale becomes very crucial. Also Snee and Hoerl (2003) proposed that the successful managing the effort process is composed of following requirements:

- 1- Place strong leaders in Six Sigma roles

- 2- Devise and run an effective project selection scheme
- 3- Provide a multitier project review system
- 4- Make sure that budgets are available
- 5- Make sure that a good communications plan is put in place
- 6- Devise the recruitment and progression plans within the organization
- 7- Create a rewarding scheme

Once the ball gets rolling and the efforts are being managed by **sustaining momentum growth** making sure that the same levels of savings are being achieved becomes an integral of the day to day activities. The main key requirements identified are as follows:

- 1- Define the organizational structure, especially a functioning Six Sigma Council. The Council will develop annual objectives and budgets, manage the Six Sigma systems and processes, and provide leadership for the overall effort
- 2- An in-house training centre will provide the required skills for new employees, as well as continuing education and training for experienced MBB's, Black Belt and Green Belt
- 3- Create and follow in accordance to the policies already in place both the refrigerated areas and the new one
- 4- Provide frequent reviews for Six Sigma

Once the effort has been managed for a period of time the ultimate achievement will be when Six Sigma becomes the '**Way we Work**'. Though this stage of the process needs a longer time to be attained, but once established continuous improvement becomes really the motor of the organization. Embedding Six Sigma within the organization.

Methodology

In the Mid 1990's General Electric and Allied Signal "popularised the Six Sigma approach" as Gitlow and Levine (2005, p.6) outlined followed by American Express, Boeing, Citibank as mentioned by Van Der Heuvel *et. Al.* (2006). The acronym used is DMAIC as described below:

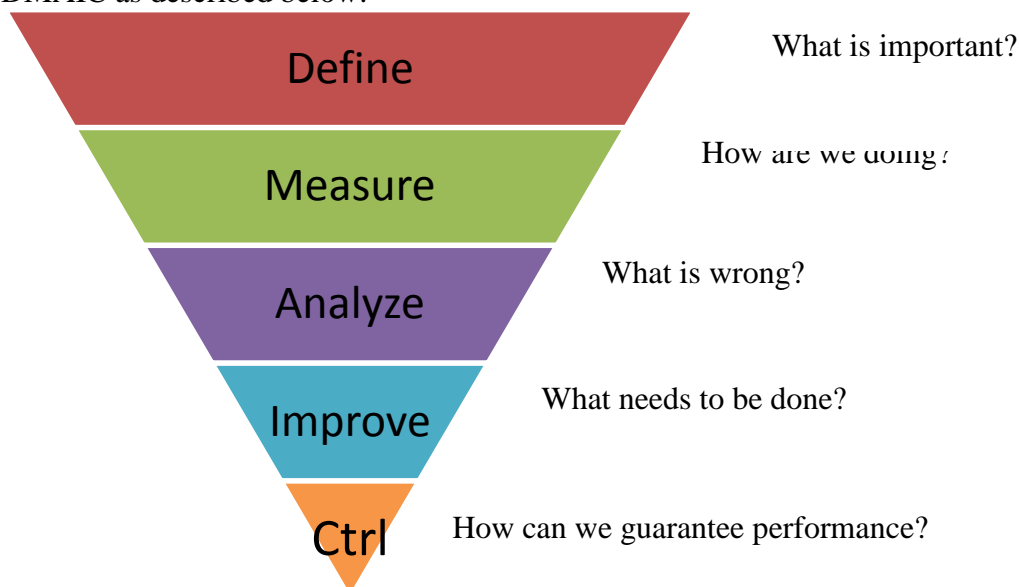


Figure 3 DMAIC Cycle Funnel

The lean six sigma project

The project described below follows the DMAIC methodology. Each stage is first described in terms of its objective and expected deliverables then how it was applied within the project.

Define Phase

According to Henderson and Evans (2000), this phase is used to define the problem and define what the customer requires. This initial phase allows the project team to hone in on the processes that are considered the most crucial to the organization and provide some kind of a project specific roadmap. There are two main deliverables:

- 1- Project charter: the charter is a living document that will outline elements that are specific to the project. This will include team members along with their roles and responsibilities, the area/scope of the improvement, the expected financial benefits, and the expected customer (internal or external) benefits. It ends with a projected timeline for completing each of the phases within the DMAIC.
- 2- SIPOCR: an acronym for Supplier, Input, Process, Output, Customer and Requirement providing a 50,000 feet view of the process under investigation for improvement. The Requirement within the SIPOCR will provide the team members with the voice of the customer.

The define phase is very crucial in allowing all parties involved in the project to better set their expectations. Pande and Holpp (2002, p.31) suggested that while building your team charters and the SIPOCR the following questions should be asked:

- 1- What are we working on?
- 2- Why are we working on this particular problem?
- 3- Who is the customer?
- 4- What are the customer's requirements?
- 5- How is the work currently being done?
- 6- What are the benefits of making the improvement?

To reach the expected outcome from the Define Phase, several interviews were conducted with the different stakeholders and the main theme that emerged was related to the delays in delivery and installation of the units at the customer site. After multiple reiterations, the following charter was produced:

<i>Project / Process Name</i>	<i>Delivery Note to Installation Process</i>
Project Description	Improve the process starting with Generation of the Delivery Note and ending with receiving the Customer Acceptance Form CAF to enable finance to issue the customer invoice
Project Owner	XXX
Project Type	Lean Six Sigma
Project Objective(s)	The objective is to reduce the time for issuing the invoice by 70%. This will reduce the cycle time from 42 working hours to

	just over 12 working hours		
Problem Statement	The time between Delivery Note and issuing the invoice is long resulting in customer complaints on delays in installation lead times and finance complaints on delays for issuing the invoice from time of order delivery and thus impacting cash flows		
Project Scope	The project focuses on the installation process for new machinery and it does not cover the installation of any additional features and peripherals to existing machines		
Project Goals	Reduce the lead time for customer deliveries from 42 working hours to just over 12 working hours		
Project Metrics	Customer delays and Internal Delays in working hours		
Defect Definition	1- Number of deliveries made after 12 working hours. 2- Number of invoices issued after 24 working hours		
Performance	Current	Target	Stretch
	42 hours	12 hours	10 hours
Project Timing	Estimated Start Date		Estimated End Date
	Oct/02/XXXX		Dec/29/XXXX
Customers	External: Customers who bought a new machine. Internal: Finance department		
Projected Return Benefits	AED = 2,700,000 for the first year		
Customer Benefits	Lead time decreased by 70%		
Project Concerns	Availability and access to data		
Team Members			
Role	Name	Title	Email
Project Sponsor	XXX	Sales Director	
Core Team	XXX	Business information System Consultant	
Core Team	XXX	Sales Administrator	
Extended Team	XXX	Services Director	
Extended Team	XXX	Account Manager	
Extended Team	XXX	Distribution Supervisor	
Extended Team	XXX	Logistics Manager	
Extended Team	XXX	National Service Support Exec	
Lean Six Sigma Advisors	XXX	LSS Master Black Belt	
Lean Six Sigma Advisors	XXX	Deployment manager - LSS Black Belt	
Project Reviews		Millstone	Date Completed
	Define	Oct/11/XXXX	
	Measure	Oct/25/XXXX	
	Analyze	Nov/1/XXXX	
	Improve	Nov/15/XXXX	
	Control	Dec/29/XXXX	

Table IV Project Charter

SIPOC

After completing the project charter, the high level map for the process included into the project was devised with the subject matter experts (SMEs). This map helps in providing a shell for the next phase. The SIPOC for the project described was as follows

Supplier	Input	Process	Output	Customer
Receptionist	Man Machine Interface(MMI) Form	Receive MMI Fax	MMI Form	Finance (Internal Customer)
Store Keeper	Delivery Note	Register MMI Form	Installed Machine	Client (External Customer)
Logistics Manager	Customer Acceptance Form	Enter the data on the system	Signed Customer Acceptance Form	
Assistant Store Keeper	Machine Delivery Schedule	Allocate, pick and place machines and accessories		
Customer Service Engineer	Machine	Prepare the Pre Installation Sheet		
Clearing Agent	Vehicles	Assemble Machine and Check its Operation		
Driver	Vehicles Maintenance Schedule	Stamp Check		
Sales Administrator	Machines Pre-Installation Checklist	Prepare Machine for Shipping		
Vehicles Maintenance Company	Training	Generate the shipping document		
Customer Machine Requirements	Engineer Schedule	Assign Driver		
		Dispatch Machine to customer site		
		Inform Engineer of Delivery		
		Engineer Installs Machine at customer site		
		Engineer Trainis Individuals at Customer Site		
		Sign the Customer Acceptance Form		
		Engineer Delivers a Copy of the Customer Acceptance Form to Sales and Finance		

Figure 4 Project SIPOC

Measure Phase

Once we identified what is important in the define phase we now need to evaluate how we are doing on the project metrics identified in Table IV. Thus, we need to measure our process capability compared with the customer requirements (Rasis et. al. 2003a-b). A data collection plan and the implementation of the plan are the two milestones from this phase.

The data collection plan as Eckes (2003, p.36) mentioned should address the following points:

- 1- What to measure: this is mainly driven from the voice of the customer (i.e. the requirements identified in the define phase).
- 2- The type of measure: team members should identify how many measurements are needed and the rule of thumb as Eckes (2003, p.38) mentioned is “two to three output measures, one or two input measures and at least one process measure”.
- 3- The type of data: the team members should decide if they are gathering discrete (e.g. pass/fail) or continuous data (e.g. weight, time...).
- 4- Operational definitions: this is the detailed data description allowing all team members to talk the same language with respect to values. This is essential because the last thing that is needed on a Six Sigma project is different data interpretations.
- 5- Targets/specifications: these targets and or requirements are taken from the voice of the customer. They are the boundaries or specifications limits against which our process should be assessed.
- 6- Data collection forms: in case the data is not already available, data collection forms will be designed.

After the plan is devised, the implementation starts and at this stage the calculation of the baseline sigma is conducted. Some tools like the Cause and Effect Matrix and the initial part of the Failure Mode Effect Analysis are also good tools to be used at this stage especially helping in the funnelling process of identifying the most critical inputs.

To bring this to the project level, the team mapped the process using a Spaghetti diagram and a flowchart. That was followed by a non-value added map that was

generated to help in pinpointing some of the non-value added routes that can only delay the process and make it none lean. The as is current process as shown in the below Spaghetti diagram shows that there are no straight through processing. The same departments are involved in the process at multiple stages. Redundancy is the common factor throughout the full process.



Figure 5 Spaghetti Diagram

The non-value added map detailed the process in stepwise and then every step was categorized as:

- a- Value Added
- b- Business Value Added, and
- c- Non-Value Added

The final analysis from the report showed that 71.17% of the process time is considered non-value added as shown in Table V below:

	Value Added	Business Value Added	Value Non-Value Added	Total
Time (Hrs)	11.3	0.73	29.7	41.73 Hrs
Percent Time	27.08	1.76	71.17	100%

Table V Value Added-Non Value Added Summarized report

This report helped in identifying the targeted time reduction for every process to 12 hours instead of 41.73, which is just over 70% reduction in the throughput time. The non-value added report triggered the usage of a filtering tool for prioritizing the process inputs that are contributing to the non-value added timings. The tool used is Cause and Effect matrix; this tool provides a venue for the subject matter experts to quantify the magnitude of the relationship between the inputs and the process output. The below snapshot provides the top inputs that affect the process outputs:

Rating of Importance to Customer >>		10	9	
Process Inputs		External Delays (Customer)	Internal Delays (Financa)	Total
1	Man Machine Interface Form	9	9	171
2	Delivery Note	9	9	171
3	Work control staff	9	9	171
4	Engineer	9	9	171
5	Delivery schedule	9	9	171
6	Sales Person	9	3	117
7	Machine and Accessories Inventory	9	3	117
8	Machine configuration	9	3	117
9	Requirement from Customer Site	3	9	111
10	SOP for checking delivery	3	9	111
11	Store Assistance	3	9	111
12	Machine Pre-Installation Form	1	9	91
13	Delivery note register book	0	9	81

Figure 6 C&E Matrix

The identification of the top inputs that are leading to the delays in the process were transferred to another tool called FMEA (failure mode effect analysis), which helped in identifying the main causes behind these defective inputs. Below is a snapshot of the

Key Process Input	Potential Failure Mode	Potential Failure Effects	SEV	Potential Causes	OCC	Current Controls	DET	RPN
What is the Key Process Input?	In what ways does the Key Input go wrong?	What is the impact on the Key Output Variables (Customer Requirements) or internal requirements?	How Severe is the effect to the customer?	What causes the Key Input to go wrong?	How often does cause or FM occur?	What are the existing controls and procedures (inspection and test) that prevent either the cause or the Failure Mode? Should include an SOP number.	How well can you detect cause or FM?	
Requirement from Customer Site	Inadequate/No Information on pre Installation Requirements	Aborted Delivery Installation	8	No Pre Site Durvey	7	Site Survey Requirement on MMI Form	10	560
Sales Person	Not meeting the Customer Requirements	Unsatisfied customer	6	Product Knowledge	8	Product Training and Testing	9	432
Man Machine Interface Form	Imcomplete/Wrong Information	Wrong Items/Incomplete Delivery	7	Accurate Information	6	None	10	420
Machine and Accessories Inventory	Unavailability of the stock when requested	Machine Model not available at time of request	8	Wrong sales forecast/Delays from supplier	7	Rigorous Sales Forecast Exercise	7	392
Delivery Note	Process not strictly followed	Wrong/Delay in delivery to customer site	8	Work Pressure/Miscommunication	5	Train and monitor compliance with the delivery process	4	160
Work control staff	Customer not getting required support	Inability fo meet the standard response time	8	High number of service and repeated calls	8	Ability to measure response time	2	128
Machine configuration	Unfulfilling Customer Requirement	Incomplete/wrong product delivery	8	Customer requiremet not understood	5	Machine pre-installation check list	3	120
Engineer	Inability fo meet the standard time	Delay in machine installation leading to customer dissatisfaction	9	Work load	6	Manpower Planning	2	108
Delivery schedule	Poor scheduling	Delay in delivery	8	Planning/Resources	6	Worl Load/Manpower planning	2	96

FMEA:

Figure 7 FMEA

The identification of the causes behind these defective inputs helped in devising a data measurement plan. The data gathered was transferred to Minitab and several graphs and reports were generated. The main one shown below (Figure 8) suggests that the process is not centered and not capable. The boxplot showed many orders that took an extremely long time to be delivered to customers. It also showed that more than 50% of

these orders took more than 12 hours (the median). This further resulted in 50% dissatisfaction from the delivery services.

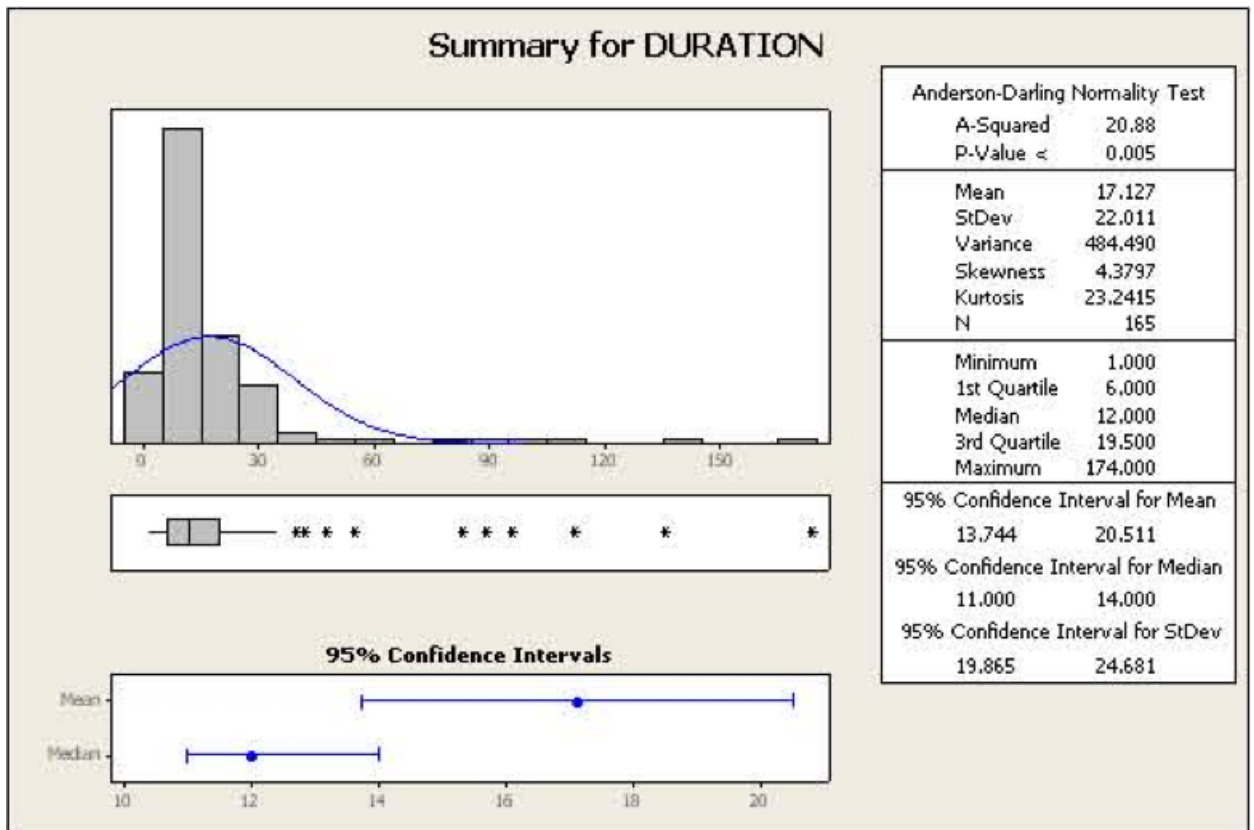


Figure 8 Duration Data

Analyze Phase

There are multiple ways of analyzing the current situation. Irrespective of the method the aim of the analyze phase is to find the root causes (Snee and Hoerl 2003) that are contributing to the defects. As such, in this phase, data are analyzed in order to discover the causes of any problems (Kapur and Feng, 2005). Some authors, like Gitlow and Levine (2005) propose dividing the causes into two parts. These are *Common* causes and *Special* causes.

The common causes can be divided into 6 categories as outlined in the 6M's method (Snee and Hoer 2003, Rasis et. al. 2003a-b). **M**ethod: the way the activity is done, **M**achine: the actual machines or equipments used within the process, **M**aterials: the components used in the process, **M**easures: the actual capability of the measurement system used (i.e. we need to ask ourselves if the tools used for measuring good accurate enough), **M**other Nature: look for the effect of the environment on the process under investigation, **M**an: finally the human resources involved in the process. Some authors call this method differently 5Ms and 1 P (for people) or Cause and Effect as suggested by Pande and Holpp (2002, p.38).

After sifting through the data a fishbone diagram was created in order to better identify the root causes of the problem in the delays. The below diagram was completed with the SMEs and was a great help for both the green belt individual running the project and the SME who were able to see the big picture.

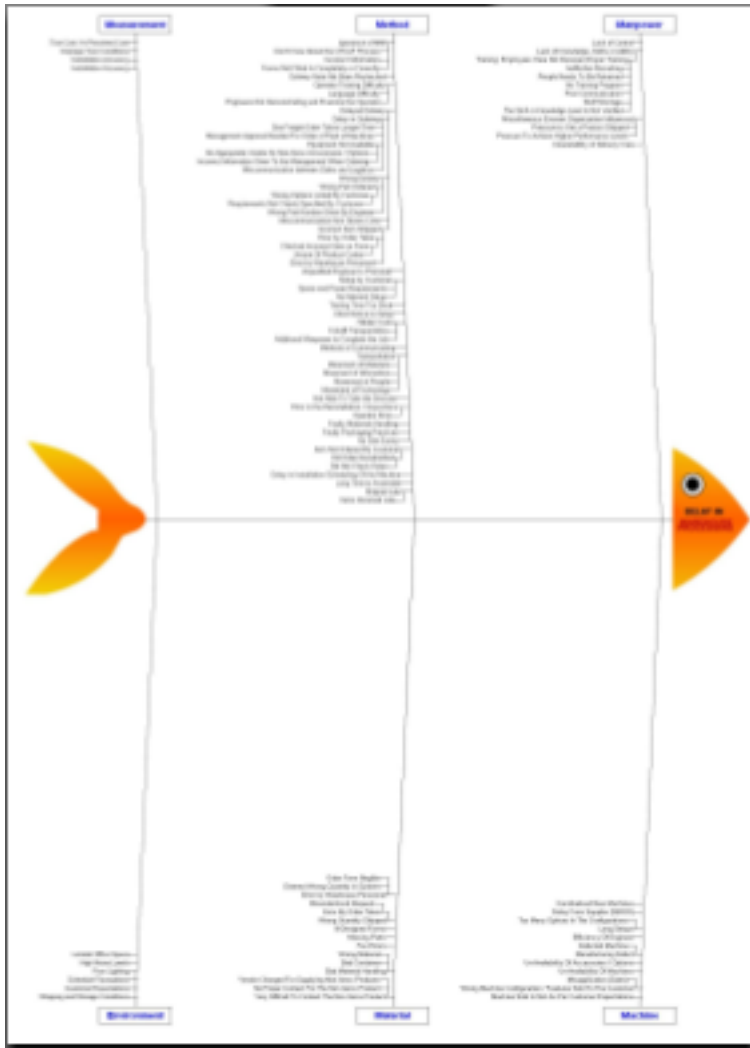


Figure 9 Fishbone Diagram

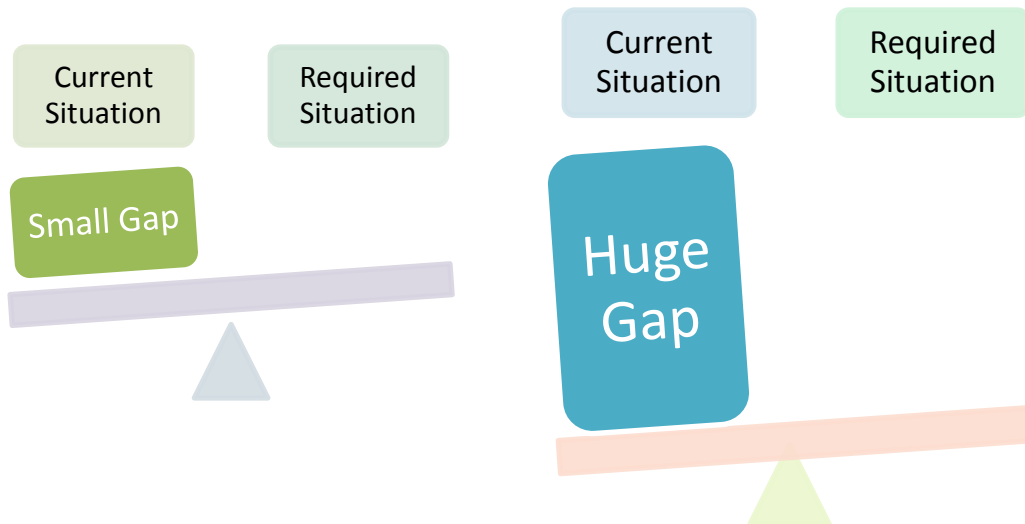
More in-depth analysis was conducted on the provided data; the main delays that are occurring can be categorized into two parts:

- 1- Time spent in office (average of 1.7 days)
- 2- Time spent at the warehouse (average of 15.2 days)

This narrowed down the search for solutions during the improve phase to those relating to the warehouse. Since a 50% reduction in that time will have a great effect onto the overall time required to deliver units to customers.

Improve Phase

Once the root causation is completed the improvement phase will provide a detailed solution (Mahanti and Antony, 2006). Depending on the gap between the current measure and the required measure, there are multiple methods that can be adopted during this phase.



In case of a small gap, some controls can be embedded within the system to address all the faulty inputs. In case of a huge gap, the common method used is business process re-engineering, where the team members will start from an empty sheet and build the process according to the set requirements in the define phase.

Due to the large gap between the as is situation and the to be a full re-engineering exercise was carried out. The process has been redrafted with the SMEs and a new spaghetti diagram and a value added report of the new process was generated



Figure 10 Reengineered Spaghetti Graph

Re-engineered process:

- 1- Sales consultant generated the orders
 - a. Before they generate the orders they should prepare themselves in accordance with the following requirements:
 - i. Check credit history and decide on whether it is valid or not.

- ii. Check product in stock before final agreement and filling of a customer purchase requisition form.
 - b. Sales people conduct their sales calls and will only transfer these calls into orders if they fit both the financial and availability of stock requirements.
- 2- Sales consultants will fill-in their orders on business workflow management system as such:
 - a. All the information will be provided through the use of drop downs to ensure readability, conformity and standardization:
 - i. Customer details
 - ii. Product details
 - iii. Customer requirements
 - b. Expected delivery date is generated in accordance with the new lead times and the vans schedules (a maximum of 12 working hours are allowed for delivery).
 - c. Transfer the order to five stakeholders at the same time
 - i. Sales manager
 - ii. Finance
 - iii. Warehouse for getting the products from the warehouse
 - iv. Engineers will prepare the product in accordance with the customer requirements
 - v. Delivery for scheduling the delivery
- 3- Sales consultants follow-up on the order delivery status.
- 4- PARALLEL Finance receives the approved order from the sales. They review the order and make sure that the financial requirements are met.
- 5- PARALLEL Warehouse get the product from the warehouse and place it in the work station area, once ready an automated message is sent to the engineering department informing of the status of the machine.
- 6- PARALLEL engineers fix the machine in accordance with the customer requirements that are available on the system. Small machines are delivered by the engineers directly and installed by them.
- 7- Delivery people pick-up the machine once a final confirmation from the engineers, financial and sales manager is generated.
- 8- Products delivered and the customer signs the form.

Control Phase

In order to maintain the gains that were made after implementing the solutions that emerged from the improvement phase, the next phase is the control phase. The aim of this phase is to ensure that defects do not re-occur (Mathew *et al.*, 2005). This phase pushes the Six Sigma team to draw a control plan (Rasis *et. al.* 2003a-b) which has the following components as mentioned by Mahanti and Antoy (2006):

- 1- Evaluation
- 2- Monitoring
- 3- Maintaining

This plan is divided into two parts as Eckes (2003, p. 61) mentioned:

- 1- Technical method of control: in here there would be some run charts reviewed on fixed intervals. The aim is to identify any deviations from the set objectives during the improve phase
- 2- Response plan: in case of any deviations an escalation mechanism is instigated. This plan will help to identify in a quick manner if the causes are common or special and assess their severity and potential occurrence

The review of Six Sigma presented the framework that needs to be followed along with some of the tools that are used in different stages.

Once the improved process has been designed and implemented a control plan was put in place in order to make sure that every individual involved in the process are working in accordance with the expected process outcomes. The control plan also allows higher management to identify any deviation from the expected output. The control plan presented the graphs and charts that are to be used in order to monitor the performance of the process.

Recommendations to top management

Different sources outline the requirements for a successful six sigma project, which can also be categorized in different ways. Mehrjerdi (2011) divided them into three types of critical success factors as such:

- 1- Executive Management
- 2- Communications
- 3- Projects

Zhang *et. al.* 2011 suggested that there are five core elements of Six Sigma stated below:

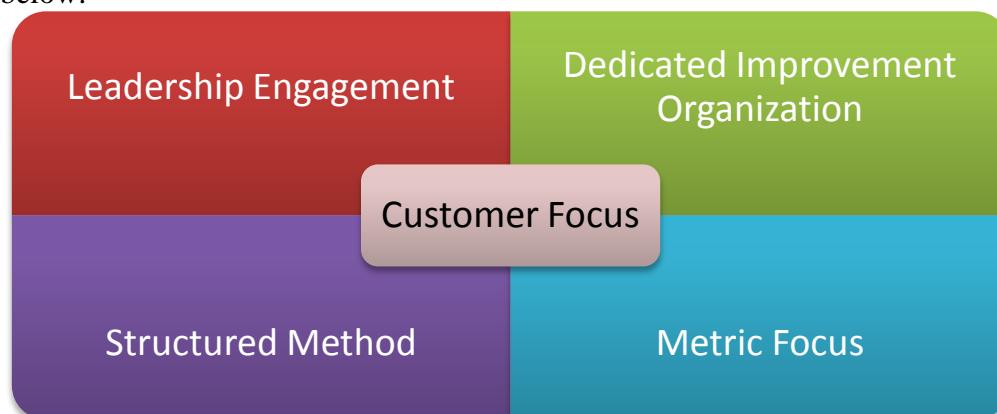


Figure 11 Five Core Elements of Six Sigma

Throughout the project described earlier two of the above core elements and two of the critical success factors described by Meherjerdi 2011 were not fully met and hence problems occurred and hampered the smooth progression to completion. Below a more detailed count of how low lack of leadership engagement and lack of overall Six Sigma drive strategy impacted the project.

Leadership Engagement

There was a problem in assigning a champion to oversee the project and be the link with higher management to get necessary approvals on time. This led to the emergence of a lot of friction between the team working on the project and the units' heads of the different departments that were involved throughout the project. Scheduling the necessary time with the subject matter experts was always problematic and multiple cancellations and rescheduling occurred.

In addition to that, all the time that needed to be allocated to the project was additional to the day-to-day activities the assigned team had to continue performance to the best on. The team worked extra hours and week ends in order to complete the project.

The lack of leadership support led to problems with the procurement department resulting in delays to order or acquire the necessary technological tools necessary to conduct the different analyses including the value added and spaghetti diagrams. Another result of the lack of leadership stumbling block was access to work areas where people can meet and discuss the different aspects of the project and in particular meeting the different stakeholders while running the mapping exercises.

Dedicated Improvement Organization

The lack of any project selection process made the process of finding a project itself problematic and thus the team had to set a large number of meetings before identifying a feasible project. By feasible it is meant that:

- 1- The project has the necessary elements for it to be considered a lean Six Sigma one
- 2- The people that will be involved in the project are willing to dedicate some of their time to the project
- 3- The expected returns are considerable

In addition to the long process of identifying a project, the lack of an overall improvement strategy that identifies the areas of improvement opportunities made convincing the finance department of the viability of the project problematic.

Based on the above pitfalls, it was recommended to the top management of the LLC that the following is needed before any full scale roll out to LSS:

- 1- Improvement strategy that builds on a customer (internal and external) satisfaction survey.
- 2- Mechanism of assigning champions with the right authority to shorten decision making timelines, and to have a scheme of relieving team members from some of their day to day tasks.
- 3- Design a project selection matrix that is in line with the improvement strategy.

Management faced with the high returns from running one project that exceeds some of the average returns as discussed by Miguel and Andrietta (2009). As a note, at the time of submitting the paper the company already conducted an improvement strategy stemming from their strategic planning exercise.

Based on the positive outcome from the above Lean Six Sigma deployment will be embarking on the deployment of LSS within local government and compares its results to those achieved by Furterer and Elshennawy (2005).

Conclusions

On the basis of the project results, the following conclusions have been drawn:

- 1- A successful business process improvement drive in general and six sigma in particular must be an integral part of the strategic plan of any organization that is planning to reach higher grounds of profitability and sustainability.
- 2- Leadership involvement in deploying the strategy is very crucial and to ensure its success adding it as part of their yearly objectives in the performance evaluation is needed.
- 3- Dedication of an in-house team makes sure the drive does not fade and benefits are sustainable in the long run.

An agenda for future research

Initiating Six Sigma projects in the services industry in the GCC can help organizations acquire rich dividends. More research on Six Sigma implications in service organizations in the GCC is required. This is necessary because it will allow us to design a specific deployment approach along with some additional tools and techniques needed for this region. The focus should be on how improvement in general and six sigma in particular become an integral part of the organizational strategic initiatives, and the use of more innovative tools that makes six sigma easier to grasp and adopt. One way of achieving the second part is through the use of Business Process Simulation (Abouzeid and Zeidan, 2011).

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University Services for regional Development - Ideas on Stakeholder Based Quality Management in a Region

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Introduction

It is commonly accepted that the rate of change is acceleration in all fields of society. Change Management is a common topic for private and public companies. Regional Development could be seen as part of this constant change. In Sweden all regions need to define long range goals and strategies. Seeing to the actual and future needs of all stakeholders is a formidable challenge. In most cases universities take part in development of their region. The regional university could be seen as the engine of Regional Development. One of the core values in Total Quality Management (TQM) is customer focus. This is often translated to the expression of having an outside-in perspective. However, universities traditionally could be seen to come from a tradition with more focus on their own knowledge – that is having an inside-out perspective. Universities in Sweden are required to include co-operation with the society both in education and research. This implies that there is a need for customer or stakeholder focus. In an organisational context TQM values and methodologies have been used successfully to improve performance. Often a process view is used where entire organisations can be viewed as processes. A region could be seen as a process that converts input to output in a repeated network of activities generating value to stakeholders. In Figure 1 a proposed generic process model based on common process theory and adapted from Isaksson & al (2008).

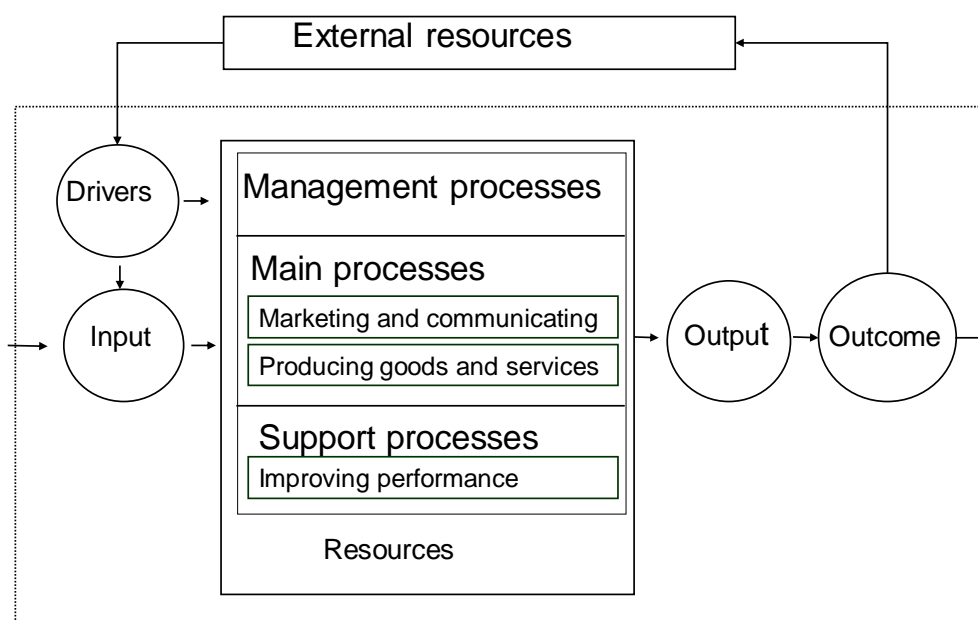


Figure 1. A process based system model proposing some generic main and support processes, adapted from Isaksson et al. (2008).

The general purpose of the study is to see how universities contribute and could contribute to regional development using quality management theory. The specific research questions in this study are:

For a region how can the present state, the visionary state and the chosen change strategies, be described with Quality Management values and methodologies with focus on the process view

How do the regional university mission, vision and goals align with defined regional objectives?

Methodology

An initial literature survey for how Quality Management has been used for regional development is carried out to create a structure for the data collection. We also look at general definitions of regional development.

The region of Gotland in Sweden has been chosen for a case study. Gotland is an island situated some 90 km from the Swedish mainland, which makes the regional and geographical limits very clear. Gotland is the smallest region in Sweden and Gotland University is the smallest university in Sweden and the only one on Gotland. This makes Gotland a well defined option for a case study.

The main documents describing visions and strategy for Gotland are studied. Responsibilities for regional development are clarified and people in charge are interviewed. Data is gathered from web sites and from interviews. The categorisation of information is based on a process perspective using process based system models adapted to the initial literature survey. The current change process is also portrayed. In order to see how the local university performance and plans align with the regional plans the Gotland University web-site is studied for relevant documents and persons involved are interviewed.

The regional performance is studied from a process perspective. This identification of processes is mainly done with the help of the official regional vision document. The current performance, the future performance and current improvement initiatives are described using officially existing information. The current state of progress is described and the potential for increased support from the university is identified. This is done by comparing the regional vision, goals and strategy with the university capacity within research and education. Additionally the university mission, vision, goals and strategies are studied to detect existing and possible synergies.

Theory background

The process view and process management are integral parts of Quality Management. The process view is used in many improvement approaches such as 6Sigma and Lean Management. The process view puts focus on value adding for customers and stakeholders. Based on the assumption that we can consider a region to be an

organisation we should also be able to describe it as a process. Dealing with the region as a system of processes might make it possible to use quality management values and methodologies to support more effective regional development. Common change management logic tells us to analyse the current state, visualise the future state and then decide on a strategy for change.

The process based system model in Figure 1 could be used to describe current and future state as well as the change process, see Figure 2.

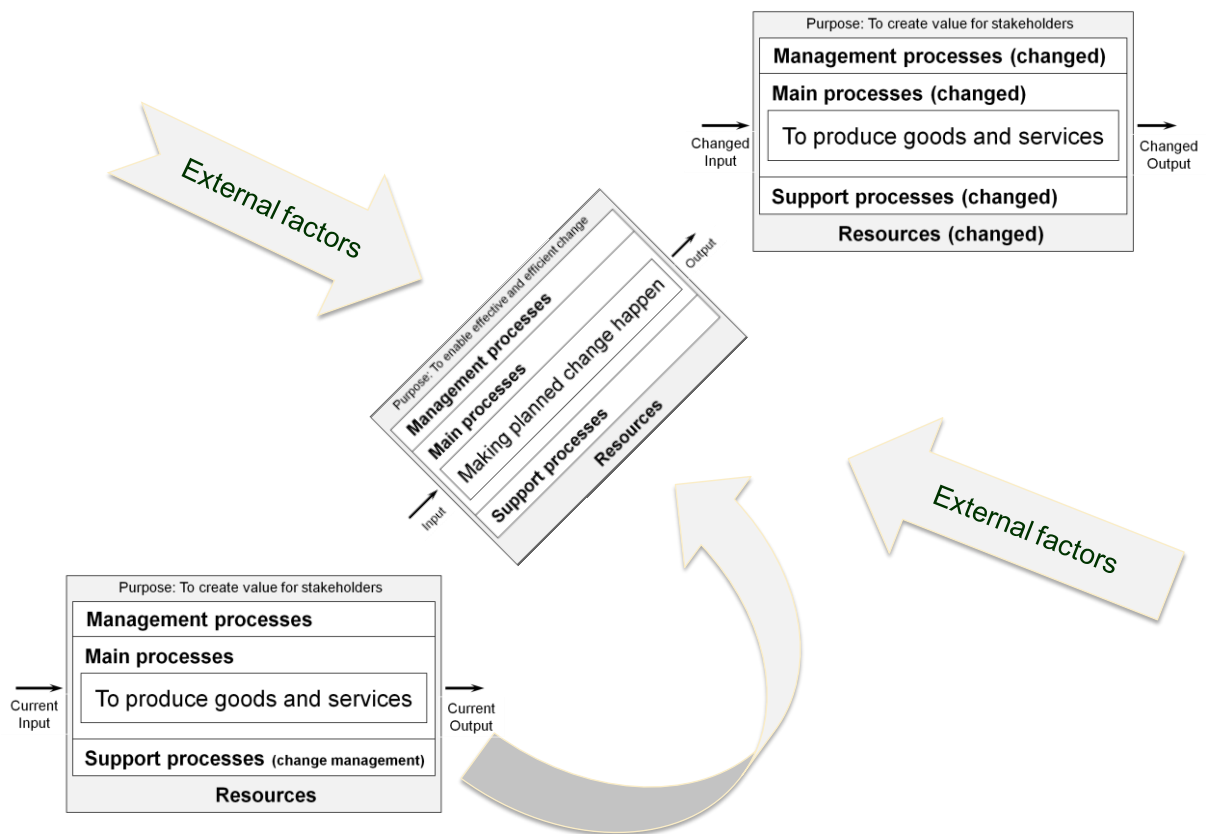


Figure 2. The current state and the future state as well as the change process using generic process models, adapted from Isaksson & al (2011).

Common change elements can be interpreted using the proposal of Bergman & Klefsjö (2010, 433) as mission, vision, goals and strategies. The mission or the purpose of the organisations sets the scene for the vision. The vision should give a good picture of the future state and it should be desirable and clear as well as easy to communicate, (Bergman & Klefsjö, 2010, 36). A good vision statement could be seen as an organisational resource. TQM could be seen as a management system that has an aim and that consists of Values, Methodologies and Tools (Bergman & Klefsjö, 2010, 419). The objective or aim of the system is to create increased customer satisfaction with less resource consumption (ibid). This objective should also be of help in the context of regional performance improvement as part of regional development. Proposed values in Bergman & Klefsjö (2010, 419) are Top Management Commitment, Focus on Customers, Improve Continuously, Focus on Processes, Let Everybody be Committed and Base Decisions on Fact. Methodologies supporting these values could vary but could include such as Process Management and Policy Deployment. The vision should be clear enough to be broken down in goals. Here the SMART goals system could be

used – Specific-Measurable-Accepted-Reasonable-Time set, (Bergman & Klefsjö, 2010, 439). The SMART goals can be challenged like with the Lean Management view of presenting challenging goals that might at least not in the beginning neither be accepted nor seem reasonable. However, as a starting point for an analysis with the purpose to see if TQM theory could be of help in describing and improving the change process the SMART goals are good enough. In order to categorise what to measure in the process we could use the logic of the Triple Bottom Line that divides performance in economic, environmental and social performance.

The customer is the one for whom the process is producing value. In the regional context there would be many customers and there are other stakeholders that need attention.

Additionally success factors and key processes should be identified, (Bergman & Klefsjö, 2010). Success factors should relate to the vision of a sustainable Gotland. Sustainable growth is described as economic development with concern for environment and social aspects (GRI, 2006). Economic performance could be measured as proposed in the GRI guidelines with sales value. Main environmental parameters are such as energy consumption and carbon emissions. Choosing a good social indicator for the region is not obvious. Here, we could use indicators for health, employment and wellbeing indices.

As a summary, existing information that describes the current and future state of the region and Gotland University are analysed based on what a vision should contain, which the guiding values and main methodologies are and how goals appear when using the SMART-approach including Key Performance Indicators for success factors and for key processes.

Results from the literature search

The literature analyses indicate that Total Quality Management (TQM) can be used with success within regional development. These principles and the ways of working with improvements are not limited to work places, but can also be used for improving life in local through collaboration (Brown *et al.*, 1994; Stratton, 1997). One way is through successful cooperation over organizational boundaries, with projects in, among others, the U.S., the U.K. and Sweden. One approach is the community health improvement model. The so-called ASQ/IHI model (American Society for Quality/Institute for Healthcare Improvement) provides a methodology and new approach to addressing important community issues in ten communities in the U.S., for instance, in Dallas (Texas), Denver (Colorado) and Waltham (Massachusetts); see Kinney (1998) and Knapp (1998).

Another example is provided by the community of Tacoma in Washington State, where the residents have worked with concepts from TQM and studied how compatible “The citizen-as-customer model” is to community-wide improvement work. In Tacoma most residents had little faith in institutions and elected officials. One aim of the project was therefore to rebuild public trust in the community as a viable unit for social and civic interaction. Another was to help the residents to find trust in their own capacities, as individuals, to make a difference. (Jaques, 1999).

Toqua village in the state of New York is another major example from the U.S. The programme, for a “total municipality of quality”, started in 1991 when a new mayor was elected. He became a central person in the daily management of the municipality. This programme had, besides a quality and customer focus, also strong efficiency in focus. The municipality established a Village Quality Council (VQC), with the mayor, the municipal department managers and two quality consultants. The Toqua village statement and quality policy were established and gradually accepted by the municipal executive board. (Hagedorn-Rasmussen, 2002)

In the U.S. there are several examples of organizations that have successfully applied concepts from TQM to other segments of society than just the commercial and public ones. The community of Pensacola in Florida has brought together people from different sectors to create a “Quality Community”. The state of Oregon is striving to create a high-performance society through benchmarking and human investments strategies. Communities in California, Wisconsin and Arizona are establishing mutually profitable partnerships among schools, city government and private business; see Osborne & Gaebler (1992) and Brown *et al.* (1994). These are examples of TQM-based collaborations over sector boundaries, where the community is seen as a system; see also Knapp (1998) and Scholtes (1997).

One example from the U.K. is the “Best Value Programme”, with the residents in focus. It is a governmental initiative in which the users of public services are invited to affect the shaping and the quality of the services. For further information, see www.audit-commission.gov.uk.

There are also examples in Sweden where municipalities work with quality in focus, after initiatives on either national or local levels. The Swedish communities of Gothenburg and Stockholm are two such examples where concepts from TQM have been transferred to community issues. The purpose is to inspire and stimulate quality development with the residents’ best in focus. See <http://www.goteborg.se> and <http://www.stockholm.se> for more information. The Swedish Institute for Quality (SIQ) supports quality work as well in Sweden, see <http://www.siq.se>.

Community work with improvements and the use of concepts from TQM are discussed in Crall (1998), Kinney (1998), Reavill (1999) and Corpuz & O’Hanlon (1999). The systematic approach, the system view and the preventive thinking in TQM can be used also for societal projects with a more limited scope. Examples are: to prevent negative economic and demographic trends; see Helling *et al.* (1998); to prevent domestic violence; see Corpuz & O’Hanlon (1999); and to reduce traffic injuries; see Knapp (1998).

Jacques (1999) cites Putnam (1995) when concluding that factors such as community wealth, educational levels, and political parties might explain why some community projects are successful, while others are not. However, the crucial factors in Tacoma turned out instead to be the skills of the community groups that brought people together for face-to-face conversations about local issues. Events and activities for training and awareness were important means of engaging the residents.

According to Jacques (1999), communication and work in processes are keys to overcoming political barriers in community improvement efforts. Quality professionals

involved in community work can contribute with their knowledge of improvement methodologies and system-approach thinking. Jacques refers to Scholtes (1997) when stating that poverty levels, unemployment rates and fiscal deficit are relevant measures for the outcome of the work. All this implies that new ways of thinking are needed to secure a successful outcome of community improvement projects.

The community of Åseda in southern Sweden provides another example of a local societal improvement project. It started in mid 1990's and is carried out with a system approach, with the aim of breaking a negative economic and demographic trend. The Åseda and Seskarö projects are two Swedish examples of the two different approaches, and both were motivated by the same type of negative trends in economy and demography. There was not enough public service, and it was difficult for the local industry to get competent personnel. In Seskarö it was important to develop the local industry and create employment (Fredriksson, 2004).

All these experiences, foreign and Swedish, give clues to a cooperation model based on TQM for organizations in regional development, which was developed (Fredriksson, 2004). In the start-up phase 1, the main issues are the leadership, the communication, the organization of the work, the education, the relations to others and the involvement. In this phase a core group is created, and it is preferable to have persons with experiences of work with Quality Management, because a systematic approach to improvement work is useful. It is essential that an inner core group is created in phase 1, consisting of representatives from the cooperational organizations, see Figure 3. According to Kinney (1998), community health improvement work benefits when a small group of key actors is established as a core team, then focuses on a specific aim, and acts to implement changes. This flexibility is crucial for success in implementing small cycles of change. The core team must achieve knowledge of customers, either through members or by other means. The membership in the core team should be updated regularly to maintain coherence between activities and membership.

In phase 2 (“establish”) the important factors of distinction and praise are added. The core group is extended with improvement groups and other advisory groups. In phase 3, where the continuous work is established, there might be a change of leaders, and the issue of a “public” mandate should be addressed. Two important factors permeate all three phases: leadership and communication. In the final phase 3 another enlargement is made in order to include other stakeholders in the community. Included here are the personal and professional networks of the core group and of the improvement groups, including the political sector. In each phase methodologies and tools from TQM can be used to systematize and structure the improvement work.

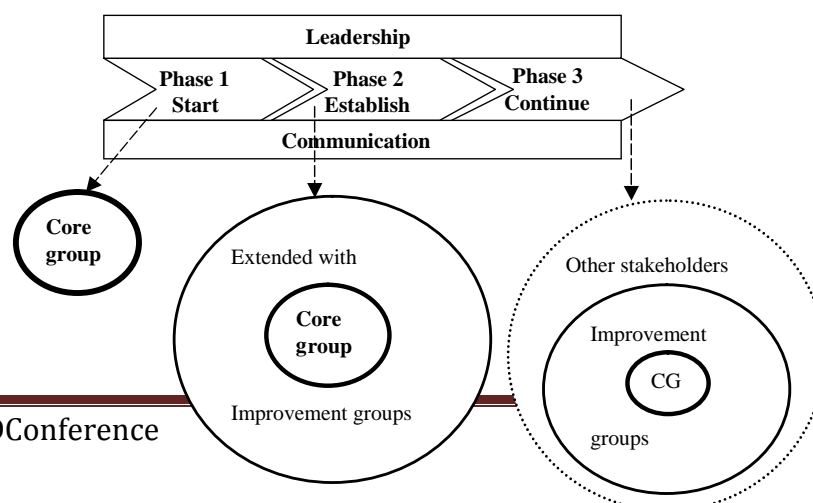


Figure 3. This figure is connected to the ASQ/IHI model (Kinney, 1998), and modified to illustrate how the improvement work in a local society such as within “Progressive Åseda” can be conducted in the three phases. An inner core group is created in phase 1 and extended with improvement groups in phase 2. In the last phase 3 another enlargement is made in order to include other stakeholders in the community (Fredriksson, 2004).

This core team should thoughtfully identify members to create an extended team and actively manage the connections with them. In this model the extended team should include the host organizations for team members, for instance, a public health department if the improvement work is a health issue. Kinney (1998) also suggests that the media and politicians be members of an extended team. The extended team can provide a foundation for sustaining the improvements achieved by the core team.

The model may be applicable to temporary organizations, such as networks, and to non-profit organizations. The model can be used from the municipal perspective, if politicians would like to take initiatives for improvements, or from the perspective of residents, if a “private” resident wants to do the same. A recommendation in the latter case is that the resident anchors the ideas in some organization, either a “private”, non-profit, one, or in “business”, such as a company or another organization. One conclusion from the case studies is that it might be difficult for a “private” person to get response for such ideas in a local community, if the ideas are not first anchored in smaller circles.

The region Gotland and the vision 2025

Gotland is an Island in the middle of the Baltic Sea. The land area is 3 140 square kilometres and the number of citizens is around 57 000. Agriculture/food, tourism, services and building material industry are the main businesses together with a number of small businesses. Around 26 000 people have employment. The city of Visby is the main city with around 23 000 citizens.

The municipal “Region Gotland” has the responsibility for the development of the region. This is documented and set in progress with the “Vision 2025” approved and communicated 2008. The foundation is a long-term sustainable development based on three interacting dimensions- economic, social and environmental. The Vision 2025 forms the basis for other plans and programs bearing on the development of the region. In order to satisfy overall objectives, a number of goals, brands and strategies have been defined.

Review of the Vision 2025, regional objectives and strategies

“Gotland is the Baltic region's most creative and magic place, characterized by closeness, sustainable growth and full of zest for life.” – Translated from the Swedish original.

”Vision Gotland 2025 is our regional development program”, (Vision 2025, 2008).

The Region Gotland has defined plans and programs according to a summary of objectives, strategies and activities for a specific area to achieve the vision / desired level.

The Vision 2025 document specifies the following overarching goals:

- At least 65 000 residents living on Gotland
- Gotland's prosperity is among the best in the country
- Gotland is the natural place for rendezvous in the Baltic Sea Region
- Gotland has a population with good health who experiences the highest wellbeing in the country
- Gotland is a world leading island-region of environmental and energy issues

The Specific programs and plans listed in the Vision 2025 are the overview, the growth program, the rural development program, the program for supplying apartments and houses, the health program, the cultural program, the plan for infrastructure, the energy plan and the environmental program.

The "Region Gotland" Balanced Score Card is used to follow up and inform citizens about the progress (Lindskog, 2011); (Region Gotland, Strategic plan and budget 2011–2013).

The Vision 2025 is assessed and evaluated against the elements in TQM according to Bergman & Klefsjö (2010).

- | | |
|----------------------------|--|
| • Values | Have not been identified and communicated |
| • Vision | Has been approved and communicated 2008 |
| • Missions | Partly described in Vision 2025 and described in special programs. |
| the | |
| • Goals | Partly described in Vision 2025 and actions plans |
| • Critical success factors | Partly described in actions plan |
| • Key Processes | Not identified |
| • SMART - Metrics | Suggested metrics in Balanced Score Cards for the goals |
| some of | |

The work that resembles work with values is the "learning map" that has been used in the implementation of the vision for the regional management and politicians, see Figure 4. We do not interpret that work as identifying and communicating values.

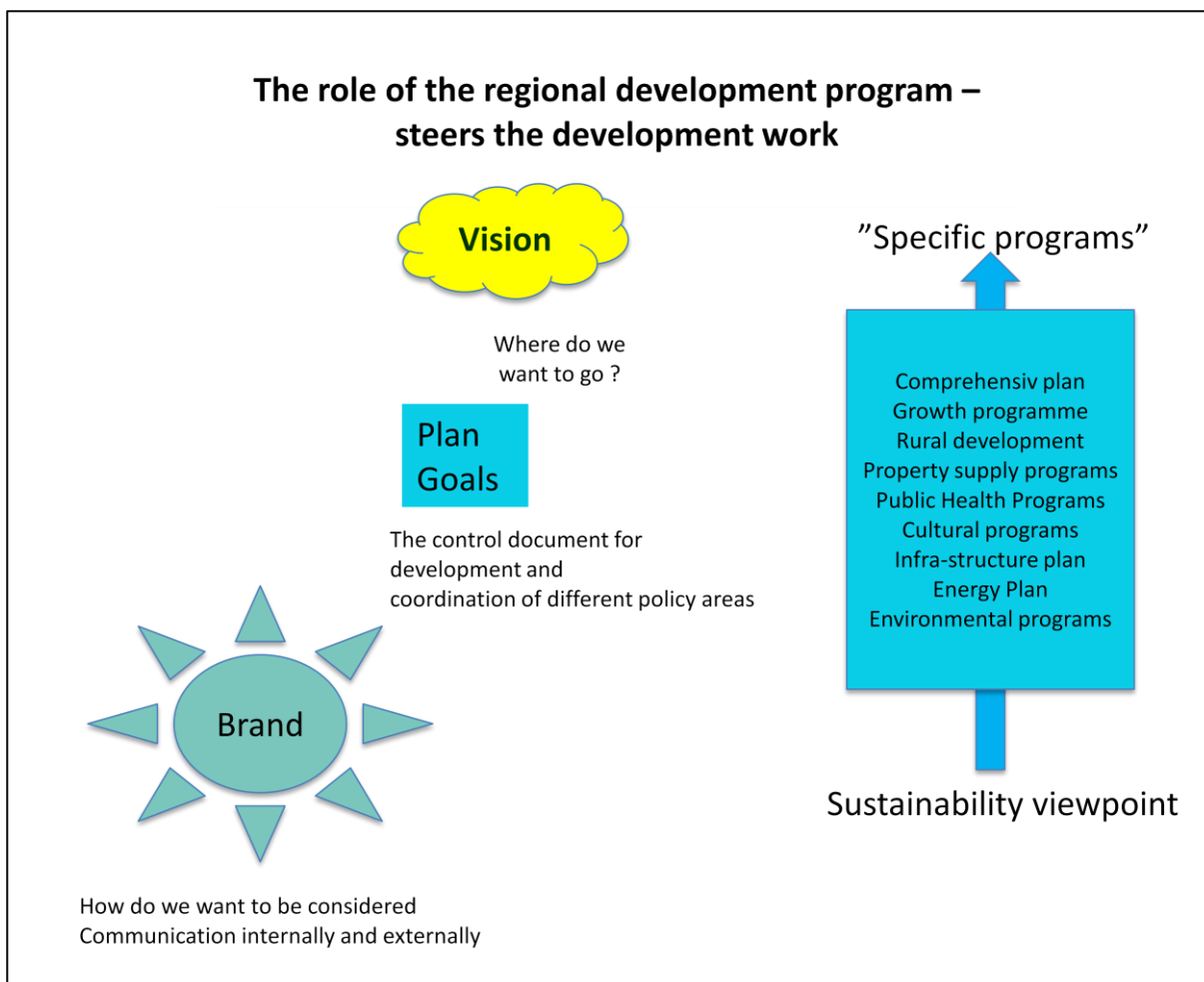


Figure 4. Overview of the Vision 2025 structure, (Vision 2025, 2008).

The expressed goals are not all corresponding to SMART requirements (Region Gotland, Balanced Score Card 2008-11-24), see Table I. The evaluation is carried out applying a positive interpretation, but even then we can see that 10 out of 24 goals are interpreted as not specified. Four out of 24 are not measurable and four out of 24 we do not interpret as reasonable. Most of the goals that are following SMART are goals connected to national goals and measurements. They are made specific by setting the level to average that of Sweden in general. From the goals in the Region’s Balanced Score Card we can also see that environment has few goals compared with the other overarching goals? This could be due to the fact that the overall responsibility for environment is divided between the region and the local government board.

Table I. Evaluation of the measurements in Region Gotland’s Balanced Score Card against the definition for SMART goals

Overarching goals	Specific	Meas-urable	Accep-ted	Reaso-nable	Time set
At least 65 000 residents living on Gotland	Yes	Yes	No	No	Yes
<ul style="list-style-type: none"> • More registered residents. • Reached targets for the number of homes 	No Yes	Yes Yes	Yes Yes	No Yes	Yes Yes

Gotland's prosperity is among the best in the country	Yes	Yes	Yes	No	Yes
• Share of employees (in private & public sector) in line with national average	Yes	Yes	Yes	Yes	Yes
• Business environment in line with national average	Yes	Yes	Yes	Yes	Yes
• New enterprises in line with national average	Yes	Yes	Yes	Yes	Yes
• Increased growth	No	Yes	Yes	Yes	Yes
• Increased share of the business in alternative form	No	No	No	No	Yes
• Increased tax capacity	No	Yes	Yes	Yes	Yes
• Education in line with national average	Yes	Yes	Yes	Yes	Yes
• Grade 9: Percentage approved in line with national average	Yes	Yes	Yes	Yes	Yes
• Improved education outcomes	Yes	No	Yes	Yes	Yes
• Percentage who go on to university in line with national average	Yes	Yes	Yes	No	Yes
• Proportion of foreign-born in employment in line with national average	Yes	Yes	Yes	No	Yes
Gotland is the natural place for rendezvous in the Baltic Sea Region	Yes	No	No	No	Yes
• Increased number of travelers	No	Yes	Yes	Yes	Yes
• More destinations	No	Yes	Yes	Yes	Yes
• Maintain frequency, capacity, time and price for communication to mainland	Yes	Yes	Yes	Yes	Yes
• Number of nights spent in hotels, etc.	No	Yes	Yes	Yes	Yes
• More meetings	No	No	No	No	Yes
Gotland has a population with good health who experiences the highest wellbeing in the country	Yes	Yes	Yes	Yes	Yes
• Citizen experience in line with the national average: Region / Municipality / influence	Yes	Yes	Yes	Yes	Yes
• The proportion of rural residents shall be maintained	Yes	Yes	Yes	Yes	Yes
• Equality indexed in line with national average	Yes	Yes	Yes	Yes	Yes
• Perception of security	No	No	Yes	Yes	Yes
• Public health figures	Yes	Yes	Yes	Yes	Yes

(including perceived health) in line with national average					
Gotland is a world leading island-region of environmental and energy issues	No	No	No	No	Yes
<ul style="list-style-type: none"> Green key figures in line with national average 	Yes	Yes	Yes	Yes	Yes

From the official web page of the region we have not found any systematical follow up of the goals. The vision was set in 2008 and three years have now passed which is more than 15 % of the time to reach the goals. Some of the activities should have produced results, for instance the increase in residents, see Figure 5.

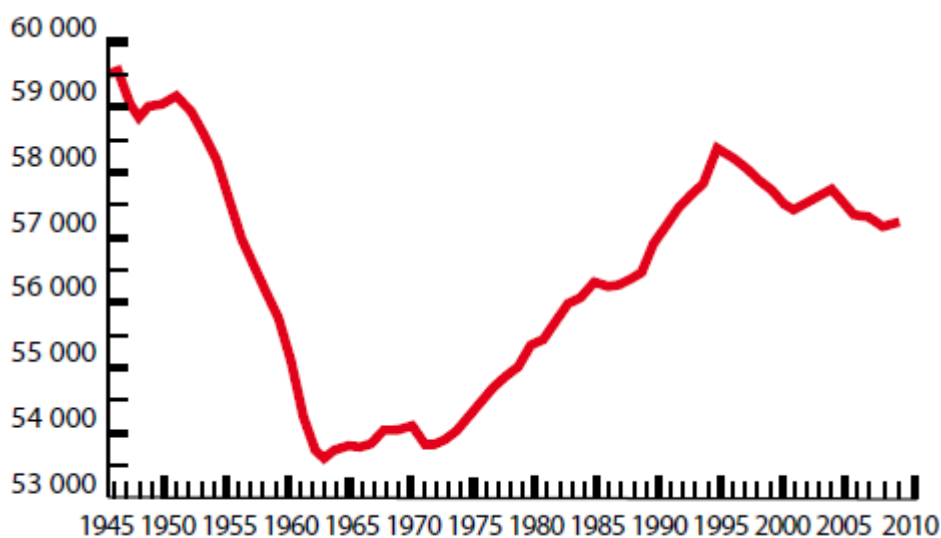


Figure 5: The number of residents in the region of Gotland from 1945 to 2010.

At the official web page (www.gotland.se) we have not found any sign of process related activity or a general approach to collect and merge measurement from different areas and programs.

No key processes have been identified.

In Figure 6 some of the main value adding processes in the region have been identified and introduced to the model template in Figure 1. The vision could be seen as an interpretation of drivers. The strength of the drivers is depending on the feedback from stakeholders in the Swedish context where Gotland exists. Out of the 26000 people employed some 7500 work in public services, some 1500 in agriculture, forest and fishing and the rest are in private business or as self-employed. Due to the large number of people active in these processes they could be considered key processes. Tourism is a particularly important business with Gotland being one of the main Swedish tourist locations in summer. Gotland has 25% of its electricity generated by wind. This is more than ten times the Swedish average. In a sustainable future energy production is a key process. Gotland is the region with the highest per capita carbon foot print measuring about 33 t CO₂/person and year. This is five times the Swedish average. The reason for this is the limestone based industry and mainly the large cement plant situated on the

island. This is the reason for having identifying “providing mineral products” as a separate process.

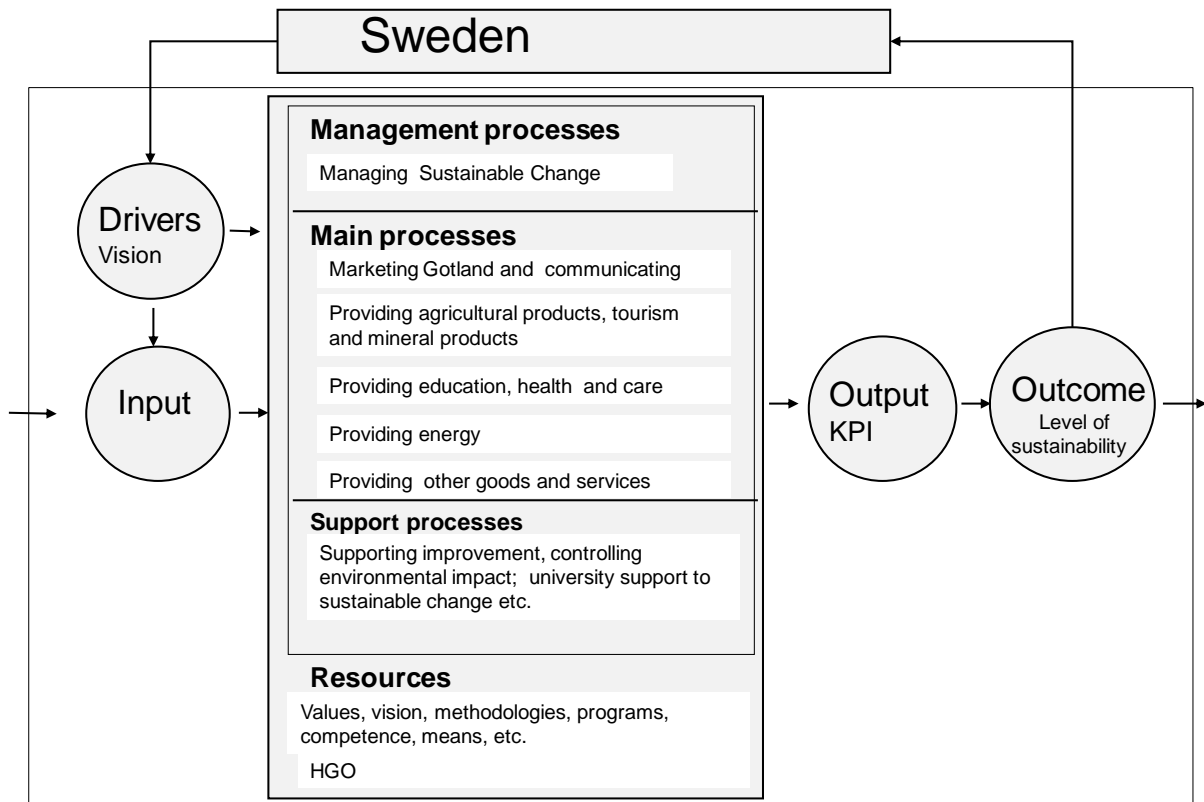


Figure 6. An interpretation of some of the main key processes in the region of Gotland based on Figure 1.

Current state of Gotland compared to vision

The current state is reviewed based on the main objectives of the Vision 2025 document.

- Population from 57000 to 65 000 residents in 17 years which means an increase of some 470 persons per year
- Gotland’s prosperity – Incomes per inhabitant lower than average for Sweden
- Gotland is the natural place for rendezvous in the Baltic Sea Region – No measurements or indication of status
- Gotland has a population with good health who experiences the highest wellbeing in the country – National figures show both good and bad results in different areas.
- Gotland is a world leading island-region of environmental and energy issues - Currently world level in Wind Power generation

Evaluation of change strategies

The vision has been active for three years and more than 15% of the time has passed. No systematic follow up of performance has been found in web page searches.

Population has increased two years in a row with some 30 persons per year which is less than 10% of the objective. It is unclear how the strategy looks to increase population. Employment is occasionally available but it is practically impossible to rent a permanent apartment and day care is struggling to cope even with current demand.

The first indicative results are that there is no “clear” connection from the vision to any type of SMART-goals that would be followed up. The main impression from how the current change process is working is that there are many opportunities for improvement.

Evaluation of the University mission, vision and goals

The University of Gotland is Sweden’s smallest University with around 7 000 students studying fulltime or part time. Converted to fulltime students the number is about 2500. The courses are given both at Campus Visby and as distance education. Seven out of ten students are using the distance option. The University of Gotland can also supply special customised courses that can be bought by organisations.

Vision of Gotland University

The latest vision for Gotland University was prepared and launched during 2010.

“The University of Gotland is a small university with a big idea. We are the leading university for modern education, Liberal Education. The quality of our training is strengthened by the link to our multi-disciplinary research environment and by our clear regional and international linkage.

The university is leading in flexible forms of teaching. Curiosity and a shift in perspective is the driving force for students and employees in accordance to the University's motto, "Passion and science".

Mission

The university law “Högskolelag” (1992:1434) defines the mission which can be expressed as:

Universities shall provide higher education and research that is based on scientific knowledge or art education and development which is based on proven experience.

The university’s task will also be to interact with the surrounding society and to inform of university activities and to ensure that research from the university will benefit society.

In the Research strategy 2010-2015 (2010-06-10 Dnr D11-2009/873) Gotland University has one goal for cooperation and interaction with the society.

Objective: High-quality research at the university should have noticeable effects outside the University

- The university will develop productive research collaborations with government agencies, associations and industry

- The university will contribute to knowledge transfer and long-term sustainable development regionally, nationally and internationally.

Goals

We did not find any connection between the goals and the vision. This could be due to the fact that the vision is rather new (February 2011). More worrisome is the indication we have found that almost none of the goals comply with the criteria for SMART. The goals in the investigated plans were mostly described as directions and improvements with no specified goals or measurements.

Identification of potential for HGo to participate in the work with Vision 2025

Education and research

The University of Gotland has several fields where education and research are carried out. A matrix is prepared comparing currently taught topics in Gotland University with five areas of importance for regional development, see Table II. The Triple Bottom Line logic has been used to identify Economy, Environment and Health and Care (Social) as being important and covering the main processes in Figure 6. Additionally management has been identified as a key area. The strength of the connection between the University topics and the identified core areas are rated from 1 to 5 with 1 as a weak connection and 5 as a strong connection. The rating has been done by the authors. The rating indicates the potential strength of the connection, not the actual situation. However, current activity has partly influenced the rating in practically indicating what is possible. For example training of Health and Care management in leadership by quality technology clearly demonstrates the possible strong connection.

Table II. Gotland University topics and an assessment of their connection to areas important for the regional development.

	Economy	Management	Health and Care	Education	Environment
Archaeology & Osteology			1		
Biology	1			2	5
Building Conservation	1		1	1	3
Cross-Cultural communication		2	2	1	1
Energy technology	4			3	5
English				1	
Etnology		1	1	1	
Business Administration	5	4	2	3	3
Geography	1			1	2
Geo science				1	4
History		1	1	1	
Law		3		1	2
Art history			1	1	

Quality technology	3	4	3	3	4
Teacher training		1		5	1
Mathematics	2		1	2	1
National economy	4	2	1		4
Software engineering			1	1	1
Renaissance studies					
Social geography	1		1	1	4
Game development	1		1	1	

The conclusion we can draw from the matrix is that Quality technology and Business Administration are the fields with the strongest connection to the core areas identified for regional development. The same relevance is assessed to exist with the goals and work with Vision 2025.

A summary of the result from the perspective of the overall goals for the Vision 2025:

- At least 65 000 residents living on Gotland
 - This is not really a pure vision, but the strategy that the region has chosen for achieving the vision. The unspoken assumption is that with more people there will be more tax money to pay for the public administration. This means that actually what is looked for is a higher earning potential. A direct link to the existing education and research fields could not be found.
- Gotland prosperity among the best in the country
 - Business Administration has basic higher education that fits in well with what the organization needs to fulfil the vision. Quality Technology and Management has evaluation models and development models for Organization Excellence (USK, MBNQA, EFQM)
- Gotland is the natural place for rendezvous in the Baltic Sea Region
 - This is not really a pure vision, but the strategy that the region has chosen for achieving the vision. A direct link to the existing education and research fields could not be found.
- Gotland has a population with good health who experiences the highest wellbeing in the country
 - Developments in health are clearly linked to the development of activities in service and the service sector. Lean in healthcare is the most obvious link for this. Quality Technology has higher education that fits in well with what the organization needs to fulfil the vision
- Gotland is a world leading island-region of environmental and energy issues
 - Environmental and climate issues are represented in several courses at HGO. Wind Power and Biology are among the topics that fit in well with what the organization needs to fulfil the vision. SWEDES and Quality Technology can provide good support in sustainable development, environmental management and monitoring and evaluation systems.

Research and knowledge transfer

The university has good facilities to perform research. The support from the combined university and regional library is good. The university should have a good possibility to encourage students to do their thesis work with issues relating to Vision 2025. We have not been able to find any examples of work that systematically builds on these connections, neither in Gotland University nor in the region. There probably are examples but the indication is that much remains to be done on the system level.

Conclusion

Using basic quality management practice and the process view enables to describe the region as a system based process. A review of the main elements of mission, vision, goals, strategies, critical success factors, key processes and metrics reveals that a good part of the basic elements cannot be found in planning documents. The objectives defined in Vision 2025 have not been translated in the SMART goals and there seems to be no systematically follow up. Provided interest the vision work structure could be considerable strengthened using quality management practice and using a cooperation model based on TQM. The conclusion is that for a region the present state, the visionary state and the chosen change strategies could be visualised more clearly using process models and quality management elements.

The Gotland University mission is defined by the state. The vision partly focuses on regional work, but it is difficult to find any clear objectives for this and there is no identifiable strategy.

Even with the current scope of curricula there would be good opportunities for increased collaboration between the university and the region that could support regional development.

Discussion

Both the vision 2025 and the University of Gotland has identifies the potential in co-operation between the region and the University. In a few groups and areas the work has been started and is in progress but we have still a lot unexplored identified common fields to work in.

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Assessment of Enterprise Quality and Export Performance: An Empirical Study on the Pharmaceutical Industry in IRAN

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Key words: Export performance, domestic performance, EFQM, EXPERF, ILL Index, Iranian Pharmaceutical industry

Introduction

Pharmaceutical industry is one of the most profitable businesses in the world. History of the science of pharmacy refers to the early stages of civilization, when humans were injured or were getting sick. Humans were looking for a remedy for pain and wanted to find a magical solution to remain young and powerful and get rid of death or postpone it. These wishes were the human's motivation to create the science of pharmacy. New pharmaceutical science began at the late 19th century when the knowledge of pharmacology emerged and helped human beings to invent new drugs. In the 20th century manufacturing of pharmaceuticals was changed, and different companies started to produce drugs in an industrial scale. By the middle of the 20th century, export activities have become important in globalization of the companies and the markets. The competition was especially intensified in pharmaceutical industry. Products became various and this variety led to segregation among producers and markets. Therefore for pharmaceutical products of a country, regional market became unfeasible considering the fact that mass production can create low cost advantage for manufacturers. Hence export became rapidly important and subsequently giant multinational pharmaceutical trusts appeared (Hasskarl & McGuire, 2007).

In Iran, most of the pharmaceutical companies are concerned with responding to local needs. Iran has not yet joined WTO (World trade organization) so local production enjoys government support on custom tariffs and capability to produce what is under patent protection in industrial countries. This situation has enabled companies to enjoy the advantage of economy of scope. At the same time branding of pharmaceuticals is not in an advanced structure like what is found in western countries. Iranian pharmaceutical companies are going to pass from total generic nomenclature of drugs to banded generic form. It means that few years ago all of the companies were producing their products under the same generic name and there were no distinction between the products of one company with other competitors regarding name and price. Nowadays, most of the companies have one or several specific brand names for some of their products. Actually, the Pharmaceutical industry in Iran has had several up-and-downs in its activities during the last century (Hasskarl & McGuire, 2007).

The main purpose of this study is to explore the relationship between export involvement and domestic market performance with a focus on pharmaceutical firms. The study embarks on answering the following three research questions:

Q1: How can export involvement/performance of Iranian pharmaceutical companies be assessed?

Q2: How can domestic performance of Iranian pharmaceutical companies be assessed?

Q3: How can the relationship between export involvement/performance and domestic market performance be examined?

In the course of the study different models of assessing export performance as well as domestic performance were evaluated. The selected models were used to analyse the relationship between export performance of pharmaceutical companies and their domestic performance.

Pharmaceutical industry in Iran

According to Porter's model, there are different factors influencing export success. Some of them can be summarized as firm strategy, organizational structure, readiness for competition, government law, decision and role, demand trend conditions, and supporting and related industries. In addition to these factors there is another important factor which we call "Element of Chance".

At the same time, most of Iranian companies need to develop their standards which require a lot of investment to survive in the local market. Ministry of health (MOH) put more strict regulation to improve the quality of production and products every year. Companies which are not able to fulfill the required GMP (Good Manufacturing Practice) cannot get a new product license and will face the consequences which are considered by the government's bylaws. Therefore, every company is thinking about improving the quality and overall performance both domestically and globally (Farzandi & Mostafavi, 2010).

Generally, the major current obstacles of Iranian pharmaceutical companies can be listed as follow:

- 1- Controlled price of pharmaceuticals: Ministry of health is the only source of pricing and companies cannot put their own calculated price on their own products. It does not let the companies to include the cost of R&D and promotion in the final price of their products so they cannot compete with foreign competitors in the local market.
- 2- Unpredictable market: Because of irrational drug consumption, it is very hard to estimate and forecast the market of pharmaceuticals in Iran. It prevents companies from precisely forecasting the market and long term planning.
- 3- Rate of inflation: rapid rate of inflation reduces the profitability of pharmaceutical companies year by year due to the fact that pharmaceutical companies have no control on the pricing of their own products.
- 4- GMP improvement: GMP improvement is an ongoing and never ending process which needs a lot of investment. Recruitment of specialized employees which get higher salary than normal employees is mandatory to fulfill the GMP requirements.
- 5- Market challenges: Problems in the sale resulting from over-production of pharmaceuticals by too many active companies in the market have caused tough competition for survival. Generic and branded generic policy of MOH has worsened the situation (because of lack of differentiation among products of different manufacturers). (Farzandi & Mostafavi, 2010).

Export Analysis destination of Iranian medicines

According to reports published by Iranian ministry of commerce and Iranian ministry of health, Iranian pharmaceutical companies have started to export their products to other countries. Export destination of Iranian pharmaceuticals is mainly the neighboring countries (including Commonwealth of Independent States -CIS-countries) and African countries. There are some records about export to European and Far East countries although the quantity and value is not considerable.

Most of the exported drugs go to Iraq and Afghanistan due to several reasons:

- 1- These markets are not regulated markets, and there is no need for time and money consuming procedures of registration of the companies and drugs in these two markets.
- 2- Iranian companies have several problems in translation of the product dossier and packaging. Normally, the technical dossier of the product must be translated into the official language of the importer country. For these two countries there is no need for any change in the outer package of the product and what is made for local market can be exported to these two countries.
- 3- Because of tight cultural and religious bounds among the people of Iran and these two countries, distribution channels of drugs in these countries are accessible and reliable for Iranian companies and merchants. Furthermore, people of these two countries believe in the quality and efficiency of Iranian drugs. These facts have facilitated the export procedure of Iranian pharmaceuticals to these two countries.
- 4- Iranian drugs are cheap so these products are affordable for people of these countries.
- 5- Because of political and security instability and existence of operational risks international competitors do not have active presence in the market of these two countries. (Shanesaz, 2010)

Iranian pharmaceutical companies select two approaches for exporting their products:

- 1- **Direct export:** In this way the manufacturer company directly goes to the target country and makes a direct connection with the distribution channels of the selected market. There are several examples for this type of export. Presence of Darou Pakhsh Company in the market of Russia by establishing an office in Moscow or direct export of Exir Company to Iraq, Afghanistan and Ukraine are some of the vivid examples. This type of export is mainly selected by big Iranian companies which can afford to invest on the export activities.
- 2- **Indirect export:** Most of small Iranian pharmaceutical companies which cannot afford to invest on the export markets have selected this method. In this method, there is a trader company which buys the pharmaceuticals from the manufacturers and sells them in the destination market. From some aspects, this method is favorable with the organizational structure of the small companies because export is specialized and complicated procedures which small companies cannot handle by their own. However, long term risk of ignorance about the market situation can damage the manufacturer companies. Most of these trader companies are owned and managed by people who have no information about the pharmaceutical sciences and even international marketing but have close relationship with the distribution channels and active parties in the destination market. This is another threatening factor for the companies relying on indirect export, that without enough knowledge

about the market and product and especially registration procedure, rapid change of regulations can destroy the export market. Almost all of Iranian pharmaceutical companies have exported their products in different extents. (Shanesaz, 2010)

Methods to measure export performance

Basic concepts of EXPERF model as an export performance system

EXPERF is a three dimensional scale first developed and applied to American and Japanese companies. The three dimensions are financial export performance, strategic export performance and satisfaction export performance measure (Zou, Taylor, & Osland, 1998). It is important to develop or use a generalized scale for measuring export performance. EXPERF is a generalized scale, which enjoys the following qualities:

1. It is measurable at the export venture level (that is the product market level);
2. It incorporates the major perspectives of export performance used in previous studies;
3. It is consistent with the existing export performance measures used by studies in different countries.

In the final questionnaire tested by Japanese and American firms, the following items were tested measuring export performance (all of these factors were weighted equally in overall export performance of the companies);

- Financial export performance
 - Export profits,
 - Export sales,
 - Export sales growth,
- Strategic export performance
 - Contribution of the export venture to firm's competitiveness,
 - Strategic position,
 - Market share,
- Satisfaction with the export venture
 - Perceived success of the venture,
 - Satisfaction with the venture,
 - Degree to which the venture meets expectations (Zou, Taylor, & Osland, 1998)

Summary of literature on export performance

The determinants of export performance are shown in the following list.

Independent variables of export performance:

- Export marketing strategy
 - Marketing research utilization
 - Export Planning
 - Export organization
 - Product adaptation
 - Product strength
 - Price adaptation
 - Price competitiveness
 - Price determination

- Promotion intensity
- Channel adaptation
- Channel relationship
- Channel type
- Management attitude and perceptions
 - Management export commitment
 - International orientation
 - Export motivation
 - Managements perceived export advantages
 - Managements perceived export barriers
- Management characteristics
 - Managers international experience
 - Mangers education and experience
- Firm characteristics and competencies
 - Firm's size
 - Firm's international competence
 - Firm technology
 - Firm characteristics
 - Firm capabilities and competencies
- Industry characteristics
 - Industry technological intensity
 - Industry instability
- Export market characteristics
 - Export market competitiveness
 - Export market attractiveness
 - Export market barriers
- Domestic market characteristics

Dependent variables of export performance:

- Sales
- Profit
- Export growth
- Success in export venture
- Satisfaction in export venture
- Export goals achieved (Shaoming & Simona, 1998)

This article proposes a three-dimensional scale for evaluating export performance of the enterprises (in the article it is referred to as export performance). The three dimensions are:

1. Satisfaction with short term performance improvement of the enterprise;
2. Short term export intensity improvement of the enterprise, and
3. Expected short term performance improvement.

Although the scale shows convergent, nomological validity, the excess of subjectivity factors in the scale raises questions about its overall reliability (Fillip Lages & Raquel Lages, 2003).

The success factors in marketing management in developing countries are described as below (Das, 1994):

- Nature of product
- Number of years being in business
- Past experience in exporting

- His foreign experience
- Overall nature of industry In the course of the article, critical success factors of the export activities were verified which are classified in three levels as following:
- Export marketing policy
 - Market research
 - Planning and control intensity
 - Internalization of marketing functions
 - Marketing policy adaptation
 - Product strength
 - Price competitiveness
 - Communication intensity
 - Channels support
- Firm characteristics
 - General firm resources
 - Export experience
 - Top management support
 - Internal export organization status
 - Content of product technology and knowledge wise
- Market characteristics
 - Attractiveness of export market
 - Number of trade barriers
 - Distance to export market
 - Cultural distance to export market
 - Domestic market attractiveness (Madsen, 1988)

Methods to Measure Domestic Performance

Dahlgaard & Dahlgaard Park's ILL index

Dahlgaard & Dahlgaard Park's ILL index has been used as an enhancement to the EFQM model. Below is a brief insight into the nature and application of the Dahlgaard & Dahlgaard Park's ILL index.

Respondents are asked to assess the importance and agreement on different Key Performance Indicators (KPI) related to the 5 enabler criteria and 4 results criteria of the EFQM models. Each KPI is formulated as a statement which respondents assess on two dimensions – agreement and performance. The agreement and importance of each statement is determined on a 7-point Likert scale, and Dahlgaard & Dahlgaard Park's ILL index is calculated as average agreement divided by average importance for each enabler and results criteria of the model.

The most important statement areas are where there are the biggest gaps between importance and agreement. The gap concept implies that the optimal situation is characterized by equality between importance and agreement (Dahlgaard & Dahlgaard Park, 2010).

The underlying assumption is an over-simplification of the improvement cost issue. Some improvements are *easy to pick fruits* but other fruits are more difficult to pick. So the assumption should be questioned when prioritizing the potential improvement areas.

If importance is significantly higher than agreement in a certain area, the area should be prioritized. In case the agreement is higher than the importance, fewer resources should be dedicated to the improvement of that area. In other words, the improvement area should be less prioritized. But it should be remembered that reasons of giving less importance to some improvement areas should be discussed to avoid ignoring important points, and when calculating the ILL index, areas where agreement is higher than importance should not be included (Dahlgaard & Dahlgaard Park, 2010).

Dahlgaard & Dahlgaard Park's ILL index can be used as an overall index, which can be compared from time to time. When the ILL index moves toward 1 it is an indication that the organization is becoming healthier. It means that the importance and agreement on all questions are converging and the organization is improving. Therefore, it is indicative of enterprise performance. The questionnaire in Appendix B was designed to measure domestic performance of the enterprises

Summary of literature review on domestic enterprise performance

Marketing performance of the companies affects their domestic performance. Also frequency of reporting and size of marketing budget can act as a mediating factor in this relationship. Marketing capabilities not only affect the domestic performance of the enterprise but affect its export performance, as well. Senior management should pay more attention to enhancement of the marketing capabilities (O'Sullivan, AnderewV, & Hutchinson, 2008).

Benchmarking of enterprise performance for extended enterprises is the source of concern for many academicians. K.W. Lai (2010) suggests 16 performance measures in the 8 categories shown below:

- Management
- Supplier
- Customer
- Employee
- Operation
- Technology
- Environmental
- Financial

Applicability of different performance measurement models in extended enterprises is very important, not all performance measurement models are compatible with extended enterprises. The main conflict exists between intra and inter-organizational measures. The article was important in providing insight into ways to measure performance of enterprise (Lehtinen, 2009).

Models of measuring the performance of SMEs suffer from certain fallacies. These fallacies result from lack of formal performance management tools. They are reflected in inability of managers and owners to produce accurate financial and situation reports. The article proposes the use of "enriched DuPont model" specific for SMEs (Brulhart, Gherra, & Rousselot, 2010).

Performance management systems emphasize the use of non-financial measures along with financial measures to view performance of the organization. Contextual factors

such as business size, industry and market position act as mediating factor in performance measurement of the enterprises. Also personnel knowledge of the management tools affects the choice of measurement tools such as BSC.

Research Methodology and Results

Qualitative as well as quantitative approaches were used when measuring export performance of the pharmaceutical companies and relating it to the domestic performance of. In order to achieve a true representation of Iranian pharmaceutical industry, the companies went through a clustering process and the centroids of the clusters were used for verification of the relationship.

Pharmaceutical company clusters and Company ILL Assessments

The clustering method used in this project was K-Mean (Kanungo, Netanyahu, & Wu, 2002). After running the clustering algorithm (MATLAB software) six clusters emerged.

Ideas of an *expert panel* were utilized in the course of the research; the expert panel was composed of the following people;

- 2 CEO's of pharmaceutical companies having extensive experience of corporate level management
- 2 Export managers of companies having extensive experience of exporting Iranian pharmaceutical
- 1 senior official expert in regulatory affairs of Iranian ministry of health
- 1 senior EFQM model expert who had extensive experience of evaluating Iranian pharmaceutical companies

The expert panel advised us to concentrate on pharmaceutical companies that already had applied for EFQM evaluation and had finalized their declaration documents for self-assessment. Therefore, a questionnaire based on the EFQM model was designed (Appendix A). The questionnaires were filled out by the target groups suggested by the expert panel in each company. According to the guidance provided by the expert panel, the questionnaires were filled out collectively by the group members. Once the data were gathered, they were checked by the expert panel members for its "truthfulness". Questionnaires with "incorrect answers" were returned to the companies for correction together with comments of the expert panel, and the questionnaires were only accepted when a true and fair reflection of firm's domestic performance was achieved. The ILL index was calculated for all 90 companies, and the companies were clustered by using the ILL indices based upon the data collected through the questionnaires. The clustering created a clear map of the 90 pharmaceutical companies. Centroids of clusters were selected to see if the export performances of the centroids affect their domestic performances and vice versa.

Then a questionnaire based on the EXPERF model was designed (Appendix B). The questionnaire measuring export performance was sent to the chosen centroids. The questionnaires were filled out by the groups of people suggested by the expert panel, and according to the guidance provided by the expert panel; the questionnaires were filled out by group members collectively. Once the data were gathered, the data of the companies were checked for truthfulness by the expert panel members. The

questionnaires with “incorrect answers” were returned for correction to the companies with comments of the expert panel, until true and fair reflections of the firm’s domestic performance were achieved. The gathered data were cross-checked with export data published by Iranian ministry of commerce.

Clusters

Some brief information on clusters emerged from study.

Cluster 1

There are 17 companies in the cluster. Most of the companies in this cluster are private and some of them were subsidiaries of multinational companies before the Islamic revolution. They are risk averse. Most of them have problem with their GMP compliance. Some biopharmaceutical manufacturers are included in this cluster whose operation and sales is a bit far from picking up. The companies do not benefit from international alliances. The number of new products they offer to markets is limited. This cluster can be named *cluster of traditionalists*.

Cluster 2

There are 6 companies in this cluster. Most of the companies in this cluster are semi governmental. Some of the companies are cooperating on an international scale with foreign companies. Their portfolio of products is limited. This cluster can be named *limited portfolio*.

Cluster 3

There are 13 companies in this cluster. Most of the companies in the cluster have outsourced their production to other companies, and they seek to fill empty production capacity of other manufacturers. Most of them are at the beginning of their operation and are not properly established. Usually they are small in size. This cluster can be named *outsourcers*.

Cluster 4

There are 33 companies in this cluster. Similar to cluster three, companies placed in this cluster are outsourcing their production to other manufacturers. They are small in size. Some of the companies in this cluster are producing herbal products. This cluster can be named *small outsourcers*.

Cluster 5

There are 13 companies in this cluster. Most of the companies in this cluster are small to medium sized companies. They are either private or governmental. They do not have any international cooperation experience, and they mainly focus on local Iranian market. The cluster can be called *domestic focus*.

Cluster 6

There are 9 companies in this cluster. The companies are main dominators of the mentioned export markets and they are governmental owned. There is strong intention among them to cooperate with international reputable companies. All of them are enjoying rich augmented product portfolio. They can be called *governmental exporters*.

Results

EXPERF related variables were measured for the cluster centroids by using the questionnaire data. All EXPERF related variables were weighted equally in contributing to the companies' export performance. Then overall ILL index of all 90 companies were calculated, and the centroids of each cluster were chosen to figure out if there is a linear relationship between export performance and domestic performance (measured with ILL index). The below figures 1 and 2 provide an overview of Export performance and ILL indexes of centroids of the clusters.

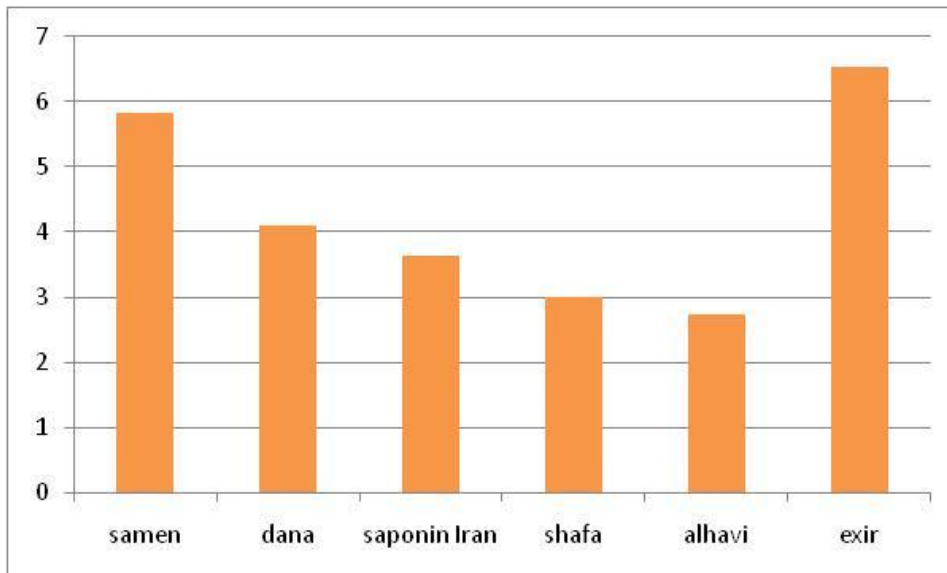


Figure 1: Export performance of the centroids

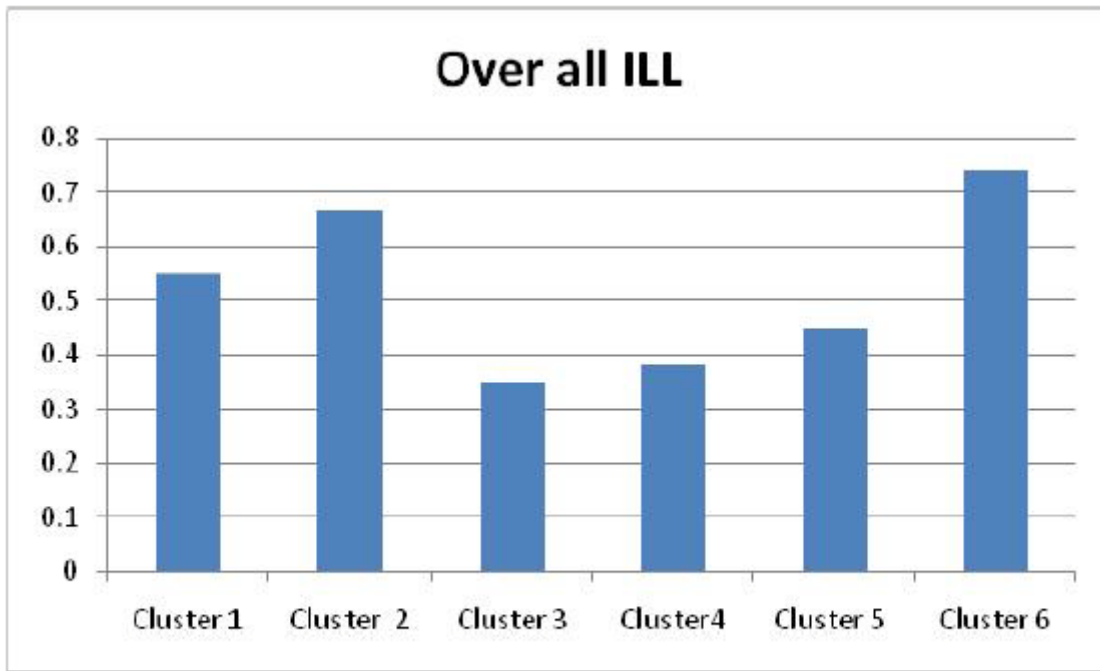


Figure 2 - Overall ILL indices of each cluster

The result of the statistical test are seen in the table 1 below (taken from SPSS software output).

Table 1: Correlations between Domestic and Export Performances

	E5	D7
Export Performance Pearson Correlation	1	.601*
Sig. (2-tailed)		.033
N	6	6
Domestic Performance Pearson Correlation	.601*	1
Sig. (2-tailed)	.033	
N	6	6

Based on the Pearson correlation coefficient ($r = 0.601$; Significance = 0.033) we conclude that for the six companies (the centroids) there is a significant positive linear relation between their domestic and export performance, which means that better domestic performance will result in better export performance and vice versa.

Discussion

The research questions outlined in the course of study were the following:

Q1: How can the export involvement/performance of the Iranian pharmaceutical companies be assessed?

Q2: How can domestic performance of Iranian pharmaceutical companies be assessed?
Q3: How can the relationship between export involvement/performance and domestic market performance be examined?

For measurement of the companies' export performance (Q1) the EXPERF model was used as the analytical framework. A questionnaire approach (Appendix A) was used to collect data from all 90 pharmaceutical companies.

For measurement of the companies' domestic performance (Q2), the EFQM model and Dahlgaard & Dahlgaard-Park's ILL indices were used. The results of the analyses together with the expert panel's view confirm that the EFQM model together with Dahlgaard & Dahlgaard-Park's ILL index constitute a proper framework for evaluation of domestic performance of the pharmaceutical companies.

After clustering the 90 Iranian pharmaceutical companies, Pearson's correlation coefficient was used to measure the strength of relationship (Q3) between export performance and domestic performance. The analysis showed that the two performance measures are positively and strongly related to each other. The export performance (involvement) of Iranian pharmaceutical companies positively affects their domestic performance and vice versa. The presentation will further try to elaborate on understanding the potential and most important cause-effect relations.

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Appendix A

Dear participant;

The questionnaire below is designed to measure export performance of your company please kindly answer each question based the exact information. The information gathered by this questionnaire will be use for only scientific purposes, k= 1000\$ M=1000,000\$”

<i>Financial export performance</i>	1	2	3	4	5	6	7
F1 - How much is your export profit?	1-5%	5-10%	10-15%	15-20%	20-25%	25-30%	30-35%
F2 - How much is your export sales?	100k-500k	500k-1m	1m-5m	5m-10m	10m-20m	20m-25m	25m-Over
F3- How much is your annual export sales growth?	0 – 5%	5 – 10%	10-15%	15-20%	20-25%	25-30%	Over 30%
<i>Strategic export performance</i>							
S1 - How much export venture	Not						Very

contributes to competitiveness of the company?	at all									much
S2- How good is your strategic position in intended markets?	Very bad									Very good
S3 - How much is your markets share in intended target markets?	0-1%	1-2%	2-3%	3-4%	4-5%	5-6%				Over 6%

Satisfaction with the export venture

SE1 – How successful does your venture look?	Not at all									Very much
SE2 – How Satisfied are your customers with your venture?	Not at all									Very much
SE3 – To what degree your venture is meeting overall expectations?	Not at all									Very much

Appendix B

Dear participants;

The questionnaire below is designed to measure the Excellence Level of your company. Please kindly answer each statement based on the group's personal experiences. Please evaluate both Agreement and Importance of each statement on a 7-point scale. The information gathered through this questionnaire is only used for scientific purposes. No commercial goal is pursued in the course of the project."

Leadership - L		<i>Importance</i>							<i>Agreement</i>								
Statements (later translated into English)		Very unimportant	2	3	4	5	6	7	Very important	Completely disagree	2	3	4	5	6	7	Completely Agree
L1 - Organization has interaction with all customers		1	2	3	4	5	6	7		1	2	3	4	5	6	7	
L2 -Organization not only enforces culture of excellence but also it is culture of excellence's role model		1	2	3	4	5	6	7		1	2	3	4	5	6	7	
L3- Organization have individual involvement in assuring continuous improvement of management systems		1	2	3	4	5	6	7		1	2	3	4	5	6	7	
Policy and Strategy - PS		<i>Importance</i>							<i>Agreement</i>								
		Very unimportant	2	3	4	5	6	7	Very important	Completely disagree	2	3	4	5	6	7	Completely Agree
PS1 - Policies and strategies are based on current and future needs of the customers , they are designed based information, performance measurement results		1	2	3	4	5	6	7		1	2	3	4	5	6	7	
PS2 - Policies and strategies are developed, reviewed and updated regularly		1	2	3	4	5	6	7		1	2	3	4	5	6	7	
PS3 - Policies and strategies are communicated, deployed through framework of key processes		1	2	3	4	5	6	7		1	2	3	4	5	6	7	

People - PE		<i>Importance</i>							<i>Agreement</i>								
		Very unimportant							Very important	Completely disagree							Completely Agree
PE1	– people’s knowledge competence are identified, developed and sustained	1	2	3	4	5	6	7	1	2	3	4	5	6	7		
PE2	- people and organization have dialogue	1	2	3	4	5	6	7	1	2	3	4	5	6	7		
PE3	– people are rewarded, recognized and care for	1	2	3	4	5	6	7	1	2	3	4	5	6	7		

Partnership and resources - PR		<i>Importance</i>							<i>Agreement</i>								
		Very unimportant							Very important	Completely disagree							Completely Agree
PR1	-External partnerships are managed	1	2	3	4	5	6	7	1	2	3	4	5	6	7		
PR2	– Financial affairs of the organization are managed properly	1	2	3	4	5	6	7	1	2	3	4	5	6	7		
PR3	– Building, Equipment, material and technology are managed properly	1	2	3	4	5	6	7	1	2	3	4	5	6	7		

Processes - PC		<i>Importance</i>							<i>Agreement</i>								
		Very unimportant							Very important	Completely disagree							Completely Agree
PC 1	- Processes are systematically designed and managed	1	2	3	4	5	6	7	1	2	3	4	5	6	7		
PC 2	– Processes are improved as needed using innovation in order to increase value for stakeholders	1	2	3	4	5	6	7	1	2	3	4	5	6	7		
PC3	– Products and services are produced,	1	2	3	4	5	6	7	1	2	3	4	5	6	7		

delivered, designed
 serviced based on
 customer needs

People results - PER	<i>Importance</i>							<i>Agreement</i>									
	Very unimportant							Very important			Completely disagree				Completely Agree		
PER 1 – people are recognized for their work	1	2	3	4	5	6	7	1	2	3	4	5	6	7			
PER2 – people have job security	1	2	3	4	5	6	7	1	2	3	4	5	6	7			
PER3 – people are paid and benefited properly	1	2	3	4	5	6	7	1	2	3	4	5	6	7			

Customer results - CR	<i>Importance</i>							<i>Agreement</i>									
	Very unimportant							Very important			Completely disagree				Completely Agree		
CR1 - No recalls, Post market studies and clinical trials show ... products quality	1	2	3	4	5	6	7	1	2	3	4	5	6	7			
CR2 – Organization enjoys high popularity and reputation	1	2	3	4	5	6	7	1	2	3	4	5	6	7			
CR3 – Organization have efficient communication channel with customers	1	2	3	4	5	6	7	1	2	3	4	5	6	7			

Society results - SR	<i>Importance</i>							<i>Agreement</i>									
	Very unimportant							Very important			Completely disagree				Completely Agree		
SR1 – organization is involved in education and learning	1	2	3	4	5	6	7	1	2	3	4	5	6	7			
SR2 – Organization creates as much job opportunities as possible	1	2	3	4	5	6	7	1	2	3	4	5	6	7			
SR3 – Organization is science and engineering ambassador	1	2	3	4	5	6	7	1	2	3	4	5	6	7			

Key performance results - KP	<i>Importance</i>							<i>Agreement</i>						
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	Very un impo rtant							Very impo rtant	Compl etely disagr ee							Compl etely Agree
KP1 - Sales	1	2	3	4	5	6	7		1	2	3	4	5	6	7	
KP2 – Investment performance and growth	1	2	3	4	5	6	7		1	2	3	4	5	6	7	
KP3 – Return on Equity	1	2	3	4	5	6	7		1	2	3	4	5	6	7	

Future role of standardization in pulp & paper's sector

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Introduction

In 1987, the International Organization for Standardization (ISO) published the first version of the ISO 9000 family of standards. Subsequently, in 1994, 2000 and 2008 updated the standard with new versions. The original 1987 version introduced some standards, applicable to the type of organization, while in the later revisions are intended to simplify and make it easier to apply, content focusing on continuous improvement and process management. ISO standards list the requirements to be followed by an organization to certify its quality management system (QMS), establishing a customer-oriented corporate culture and defining a management model aimed at meeting the needs and expectations of customers. We analyze what's the current situation in order to make a diagnostic. Initially, data from the world (International Standard Organization, 2010), reviewed the developments from 2004 to 2009, latest available year. According to the ISO survey conducted annually, the spread of global standard has increased (Table I), an increase in the total of certifications and the number of countries.

ISO 9000 \ year	2004	2005	2006	2007	2008	2009
world certificates	660.132	773.867	896.929	951.486	982.832	1.064.785
annual increase %	33%	17%	16%	6%	3%	8%
number of countries	154	161	170	175	176	178

Table I. ISO 9000 certified worldwide in 2004-2009. Source (International Standard Organization, 2010)

It can be seen as the growth rate of global certifications decreases from 2006 to 2008 and in 2009 was recovered. This rise was achieved despite the existence of these factors tend to reduce the total of ISO 9001: (i) the overall economic growth and (ii) the tendency of organizations to replace multi-site certificates a certificate covering all sites. This article analyzes the evolution of the ISO 9000 certification in recent years, trying to look for causes of the phenomenon of decertification. The phenomenon of decertification is not homogeneous geographical or sector level. In some countries a clear decertification is detected, while in other areas of growth is observed. Overall all indications are that the rate of growth in certifications will remain positive but lower rates than in the past.

The analysis focuses in Europe, the total number increases slightly, from a total of 455,332 in 2008 to 500,319 in 2009, which means an increase of 9.8%. The data analyzed again by countries and comparing the evolution of the last two years can be separated into two groups. One group, which is still in a growth phase with significant increases and a second group phase of decline (Table II).

Increase	Decreases
Russia (+230%)	Belgium (-19%)
Romania (+47%)	Greece (-25%),
Ukraine (+33%)	Slovenia & Spain (-13%)
Czech Republic (+39%)	The Netherlands (-10%)
Croatia (+21%)	Germany (-2,5%)
	France (-3.3%).

Table II. Countries with the highest increase and decrease in number of ISO9000 certificates between 2008 and 2009 in Europe. Source (International Standard Organization, 2010)

Globally, in 2008 there were 33,338 decertifications, while in 2009 a total of 110,791. It is another symptom, which represents an increase of 232% in relative terms, while the increase between 2007 and 2008 was 1.5%.

ISO 14000, is an internationally accepted standard that says how to establish an effective environmental Management System (EMS). According to the latest data published by the same ISO, the number of ISO 14000 certification worldwide at the end of 2009 was 188,815 (International Standard Organization, 2010). There is no doubt that the growth is spectacular, considering that just 10 years ago, the number of certifications worldwide was 7,887 (ISO, 1998).

ISO 14000 \ year	2004	2005	2006	2007	2008	2009
world certificates	90.554	111.163	128.211	154.572	188.815	223.149
annual increase %	39%	23%	15%	21%	22%	18%
number of countries	127	138	140	148	155	159

Table III. ISO 14000 certified worldwide in 2004-2009. (International Standard Organization, 2010)

The analysis focuses in Europe, the total number increases slightly, from a total of 78,118 in 2008 to 89,237 in 2009, which means an increase of 14.2%. The data analyzed again by countries and comparing the evolution of the last two years can be separated into two groups. One group, which is still in a growth phase with significant increases and a second group phase of decline (Table IV).

Increase	Decreases
Russia (+108%)	Slovenia (-12%)
Romania & Bulgaria (+76%)	Hungary (-9,5%),
Serbia (+69%)	Sweden(-6,3%)
Cyprus (+59%)	Poland (-2,9%)
Bosnia & Czech Republic (+40%)	
Croatia & France (+35%)	

Table IV. Countries with the highest increase and decrease in number of ISO14000 certificates between 2008 and 2009 in Europe. (International Standard Organization, 2010)

As a difference between table IV and II, there aren't as decreases in ISO 14000 as ISO 9000, it probably means that in this case still is in increase process. The doubt appear during the process we analyze the numbers of withdraws between 2008, 4,324 withdraws and in 2009, 22,607.

At the European level has been extended another management model, also entirely voluntary for organizations: EMAS (Eco-Management and Audit Scheme, or Community Regulation of Eco-Management and Audit-scheme). It is a more demanding than ISO 14000 in terms of content, but also voluntary. Indeed, EMAS is a voluntary regulation of the European Union recognizes organizations that have implemented an EMS and have acquired a commitment to continuous improvement, verified by independent audits. The EMAS recognized organizations-whether industrial companies, small and medium businesses, nonprofit organizations, government and international organizations, have a defined environmental policy, make use of environmental management systems and report periodically the operation of the system through an environmental statement verified by independent bodies. At European level, the number of certified organizations in 2010 was 4,460, located mostly in Germany, Italy and Spain.

The pressure created to preserve the environment has grown and has led to the SGMAS' proliferation and diffusion of these. Anyway, it begins to sense that in some sectors is slowing growth. Even in some countries there is a clear slowdown in the number of certifications (Casadesús, M. et al 2003),(Casadesús, M. et al 2005), (Marimon, F., et al 2006) It is good time to analyze what happens to these EMS based on ISO 14000. What are the causes for this reduction? Why are some companies that have made the effort to get certified in the past does not renew the certification? Which is the cost of continuing certification? Obviously, the reason why organizations decide not to renew the certification is because the costs associated with keeping outweigh the benefits they find.

Organizations are seeking through policies, procedures and tools make it possible to manage effectively and efficiently to achieve quality objectives. Among other areas that have a company to achieve this commitment to quality is the quality assurance which engages the whole organization. Therefore, the organization, planning and control of all activities and functions aimed at obtaining a quality according to predetermined requirements. To keep control of quality management according to quality assurance will be necessary to introduce a Quality Management System (QMS). Among the management systems for quality assurance system with more global acceptance is one that is based on ISO 9000. The ISO 9000 standards are a set of international standards are intended for the management and quality assurance companies.

Something similar has happened in the ISO 9000 evolution. It is a previously published standard ISO 14000 and has been successfully disseminated. According to ISO survey of certifications 2009, at the end of the year, there were 1,064,785 ISO 9000 certified worldwide. Meanwhile, ISO 14000 with 223,149 is five times more certifications. However, there are clear signs of decay in the rate of diffusion of this standard. In some countries, detects a clear setback: Companies are being descertified. In any case, other countries in which the number of certificates continues to grow and make notice that the world level increase growth. The literature has studied the recession that is taking place in this standard (Albuquerque, et al, 2007), (Casadesús, M. et al 2005), (Casadesús, M.

et al 2005c), (Franceschini, F., et al 2010), (International Standard Organization, 2010), (Stanislav K. et al 2010). Precisely this literature can show light to provide a possible similar behavior in spreading the ISO 14000 standard. There are no studies to determine reasons for decertification, (Marimon, F., et al 2009) claim that the main reasons for the decertification organizations for the standard ISO 9001 is the excessive paperwork generated and do not survive the process of re-certification. These are also possible reasons for the hypothetical recession in ISO 14000.

Figure 1, shows the comparative evolution of both standards worldwide. In the figure, both series have been scaled according to the maximum saturation level expected using the logistic curve as a yardstick to predict the future trend. The previous literature on the diffusion of these standards confirms that the logistic curve well describes this phenomenon. The figure shows that although ISO 14000 is more recent, in 2009 both reached the same level on their respective saturations. This makes ISO 14000 is at this time a growth rates higher.

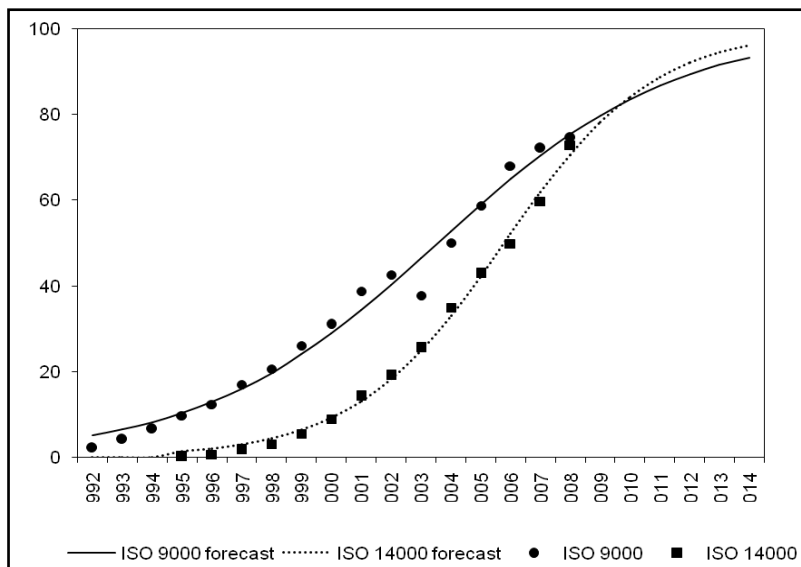


Figure 1 - Evolution compared to both standards and its projected trend to 2014.

ISO 9000 and 14000 CERTIFICATION IN PULP AND PAPER INDUSTRY

Dominant nature paper's industry activity is one of the most impacts on the environment. It is well known to all agents involved and each one has its own role to regulate these impacts. On one hand, governments and state or local authorities and in some cases others are supranational regulations to mitigate the potential harmful effects on the environment. These regulations are mandatory in some cases and in others are only recommendatory. Companies themselves are also developing their own strategies in this field. In general, society and in particular direct customers are also sensitive to environmental performance of their suppliers. Indeed, from different scopes is influencing paper companies. From a more general level, the Kyoto agreement marks required emission limits to be met by countries and enterprises (Lansbergen, P. 2004). Also at the international level, ISO (International Standards Organization) released its first version of an environmental management system (EMS) in the early 80s. This rule has been updated over time and currently valid ISO 14001:2005 version. No doubt that

is one of the standards that have enjoyed growing popularity and success has spread throughout the world (Marimon, F., et al 2009).

The dissemination of the EMS, as well as dissemination of management systems for quality (QMS) has been analyzed in depth, both from the point of view of the explanatory diffusion's causes (Marimon, F., et al 2009) and from the dynamic point of view (Ruihua Joy J., 2003). Anyway, all these items are analyzed aggregate data by country, but there are still few studies focusing on the analysis of a sector industry. Data are available about the certification of ISO 14000 by sector since 1998, by the reports published annually by ISO. In fact, since that year, includes a section in which the certifications are structured in both ISO 14000 and ISO 9000 in 39 sectors. One of them is the paper: "Pulp, paper and paper products."

Figure 2, shows the development of paper industry certifications. Adjustment explains a large percentage of the variance ($R^2 = 0.925$) and the two coefficients are robust at the level of significance 0.05. The series shows an annual growth of 133 certificates, representing high growth rates. In fact, between 2001 and 2006 there was an average annual growth of 16.31%. The first two years and the last two are more irregular. In any case, there is a strong growth rate. There is no doubt that the standard has a strong acceptance in the sector.

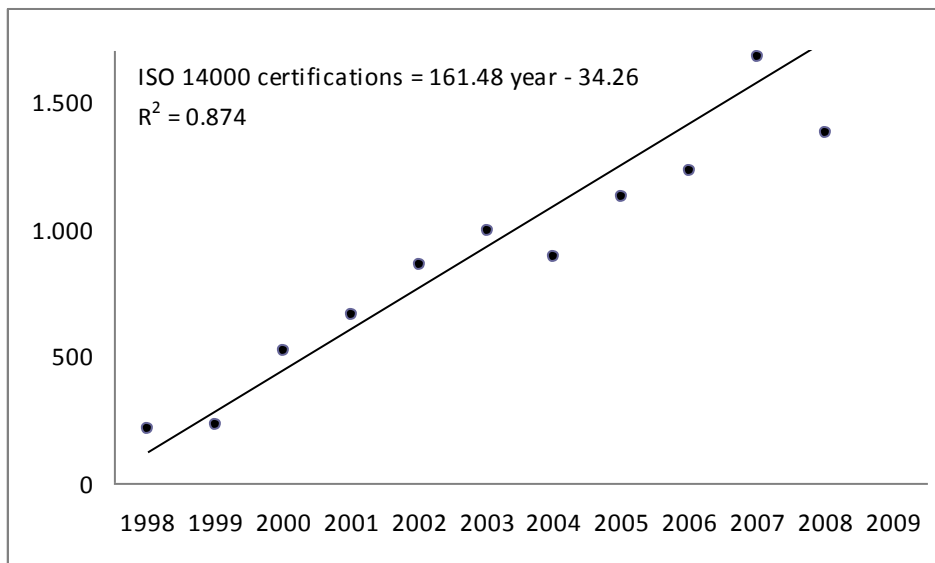


Figure 2- Linear regression ISO 14000 certification in the paper sector

Enclosed is a similar graph (Figure 3) shows the evolution of ISO 9000 certifications in the same period. It also notes that the first two years and the last two show a somewhat different pattern to the years from 2000 or 2006. During these middle years, the linear regression fits perfectly. The number of new annual certification of 235 (one hundred more than in the standard ISO 14000), however a relative level represents an average annual growth of 4.46% between 2001 and 2006.

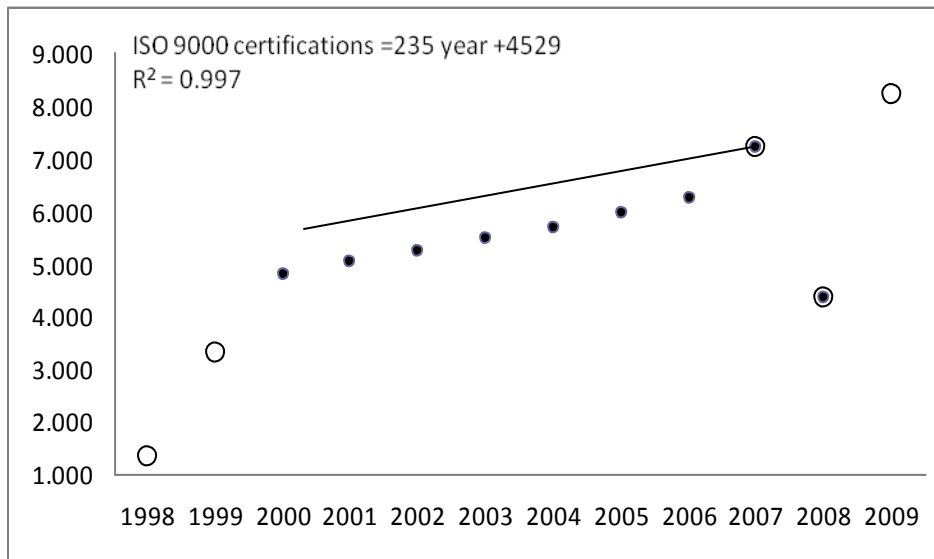


Figure 3- Linear regression of ISO 9000 in the paper sector

Another interesting aspect to analyze is the sector evolution's ranking within the list of 39 sectors in the ISO annual report. Figure 4, shows this evolution for the two standards: ISO 14000 and ISO 9000 certifications ranking of pulp and paper sector.

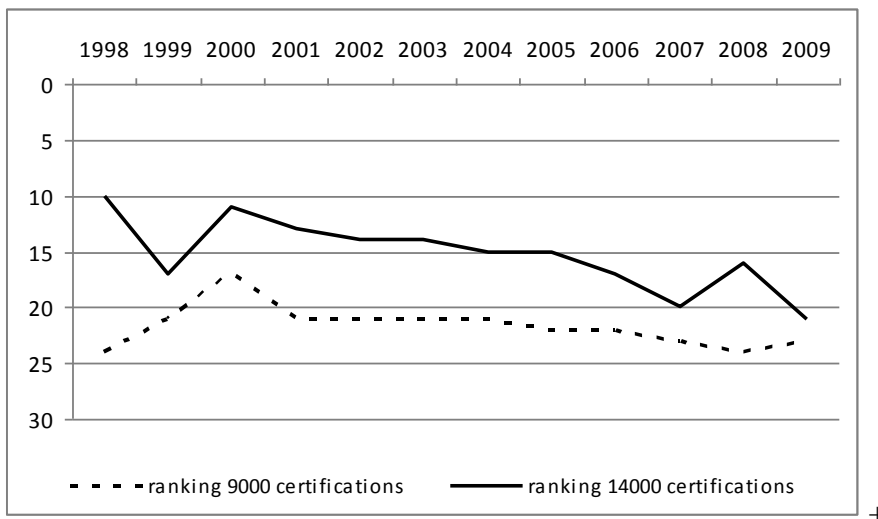


Figure 4 – Pulp & paper industry's ranking certifications by sector (in ISO 14000 and ISO 9000)

It is notice, that the sector has always been on the half top of ISO 14000 rankings (the contribution of this sector in the GDP (gross domestic product) of each country would provide a lower position in the ranking of ISO 14000). It is also noted that the position referred to the ISO 14000 certification has always been higher than ISO 9000. Indeed, the sensitivity for the environment sector has always been above their concern to maintain certifications in the field of quality management. Another phenomenon observed is a slight gradual decline in both rankings. This makes us wonder if there really is a widespread disinterest in the industry for this type (Philippe B., 2007) certification, especially the one in question in this work: the ISO 14000.

Figure 5 has a similar profile, show the percentage of the sector in total certifications. It is also noted that the share of the sector to analyze the ISO 14000 certification is always higher than the share of ISO 9000.

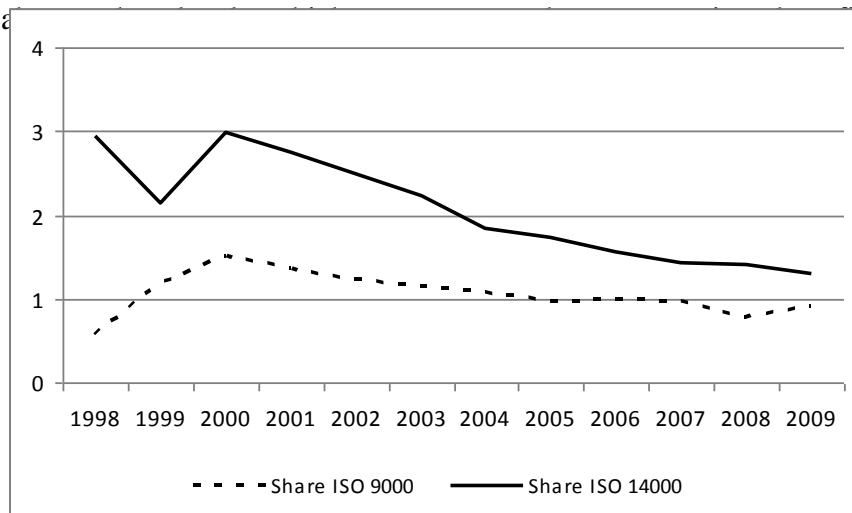


Figure 5 – Evolution of Pulp & paper industry certification's in percentage (ISO 14000 and ISO 9000)

Yet, another important aspect to be analyzed (Corbett, J.C. et al 2001) in parallel with the development of ISO 14000 certifications. As defined in the various ISO 14002,3,4,5,6 ... (Stanislav K. et al 2009), and the long journey that allows the standard itself.

FSC CERTIFICATION. In fact, new standards are emerging to ensure a good relationship between business and environmental organizations. One of the most important in this sector that is gaining strength over the past decade is the certifications from Forest Stewardship Council (FSC). FSC is an independent, non-Governmental, not-for-profit organization Established to promote the responsible management of the world's forests. Established in 1993 as a response to global Concerns over deforestation, FSC is widely regarded as one of the most important of the last decade Initiatives to promote responsible forest management worldwide. FSC is a certification system that provides internationally recognized standard-setting, trademark assurance and accreditation services to companies, organizations, and communities interested in responsible forestry.

The FSC label provides a credible link between responsible production and consumption of forest products, enabling consumers and businesses to make purchasing decisions that benefit people and the environment as well as providing ongoing business value. Over 16.000 certificates (March 2010), the number of companies along the forest product supply chain to FSC certification Committing Peaked at 50% in 2008 (FSC, 2010). The country that leads the ranking in this type of certification is the United States of America, 3,645 certifications, following the UK with 2,030 certifications, Germany 1,213 and China 1,142 certification. Then several countries under the 1000 certifications: Japan, Canada and Holland. In the Spanish sector, we have the breakdown by sector Table V, where, including the group of pulp and paper products along with printing, we've got 50% of this certificates are in pulp and paper industry.

PRODUCT	number	%
pulp and paper	49	26
comerce	1	1
printing	46	24
furniture, decoration, doors, windows	43	23
boards, panels	31	16
others	18	10
total	188	

Table V: FSC Spain certifications (2009). Source FSC Spain.

The paper sector is therefore a very important and is particularly interested in evidence to clients that they're an industry-friendly forestry. The analysis made in the previous section show that the paper industry is still active in the demand for new ISO 14000 and other standards which demonstrate an appropriate relationship with the environment. Superior sensitivity is perceived in this respect than the other sectors. Indeed, it appears that the industry's position in the ranking of ISO 14000 certifications has always been higher than the ranking of ISO 9000. Moreover it is observed that sector participation in the global certificates is decreasing in both types of certifications. It is noted therefore that a number of companies are certified and continues to grow the number of certifications, but at a slower pace than expected. This all leads to find the reasons for this imbalance occur in the evolution of certifications in both standards. Lot of printing customers of pulp a paper companies, consider that FSC certification is the highest available standard, if they are unable to use it in the short term they universally apply other standards to ensure that paper sourcing does not run contrary to environmental principles. The Program for the Endorsement of Forest Certification Schemes (PEFC) provides a framework for the mutual recognition of different national and regional certification schemes. It is their preference to use paper mills, printers and other suppliers who have gained or who have applied for EMS ISO 14001 accreditation. ISO 14001 is an internationally accepted standard that sets out effective Environmental Management Systems recognizing a commitment to effective management of waste, careful use of energy and ensuring recycling processes are in line with government standards.

Pulp and paper case

To investigate what will be the trend in 9000 and ISO 14000 certifications in the paper industry, an interview be conducted in depth to QMS and EMS responsible for in five companies of this sector.

The spread of SGC is a phenomenon that has been studied in depth (Marimon, F., et al 2009). Most studies work with aggregate data by country. There are still few studies focusing on the analysis of a sector of the industry. ISO provides data about the certification of ISO 9000 and ISO 14000 by sector since 1998 (International Standard Organization, 2010). In fact, since then, including a section in which the certificates are grouped in 39 industrial sectors for both ISO 14000 certification and ISO 9000. One of the sectors analyzed the role: "The pulp and paper products." To analyze the phenomenon of decertification we studied through interviews with companies in the role of nine companies, four large and five medium. Most companies interviewed were certified in late 90's and early 2000. According to interviews, the main impact of its implementation was the restructuring and management of the organization, thanks to the

incorporation of new procedures and tools, especially the improvement groups. On the other hand, was a major effort to obtain documentation of the certificate. The ISO 9000 compliance offers competitive advantages to companies that are not certified with respect to international markets.

The companies interviewed showed a clear desire to maintain the standard, but at this time do not appreciate that the rule gives the same intensity of competitive advantage offered in the early years. Maintaining certification because they do not behave a great exertion, they share a certain degree of integration with the ISO 14000 management standard. If in the future, the maintenance of the rule requiring a special effort, most likely abandon the certification.

Add some thoughts of different quality managers or managers of paper companies that allow us to set a trend for the future:

A-This company is certified under ISO 9001, while another in ISO 14001. The manager himself thought: "ISO 9000 certification was a fad in recent years and no benefit for my company. ISO 14000 on the other hand, provides improved image, improved competitiveness and facilitate better environmental management is also valued by the administration.

B- A company with close involvement of all staff. Is first certified under ISO 9000 and ISO 14000 later, prompting a major structural change and performance has ceased to be certified this year for the cessation of industrial activity.

C-In the company attaches great importance to ISO 14000. The quality manager commented "a few years ago, the ISO 9000 certification was requested by most countries and companies, while ISO 14000 does not, now the roles have been reversed."

D-The sector tends to be more environmentally friendly. According to the manager: "The reasons for the certification of quality were mainly commercial. The introduction helped to bring order, procedures, but it is too bureaucratic. The trend in our industry is to find the specialty through certification in environmental standards such as FSC, ... eco ...".

F-ISO 9000 certified company in 1998, something they helped a lot in his day. At present, does not provide a competitive advantage The key is differentiation, with greener products. The quality manager says: "... market demands force us to differentiate ourselves from competitors. This differentiation may come through the forest policy, respect the environment, etc ..."

These reflections show that companies see the ISO9000 as an advantage uncompetitive and unattractive. Interviewed companies place more importance on environmental standards such as ISO 14000 or the Eco-Management and Audit Scheme (EMAS). These allow certified companies in the chain of custody, understanding the process that permits monitoring and control of products throughout its supply chain transformation and Forest Stewardship Council (FSC).

FSC certification was born in early 90's to promote forest management and

environmentally responsible, socially beneficial and economically viable in the forests around the world, being supported by NGOs such as the World Wildlife Fund (WWF).

The recognition program certification Forest Certification System (PEFC) is a forest certification system was created in 1998 as an initiative of private forest. Another certificate on the rise and in order to differentiate the product or service, is the Carbon Neutral Certification, which certifies that the company manages the emissions of CO₂ to the atmosphere seeking compensation for carbon emissions. On the other hand, there are some laws on protection of forests promote forest certification systems, emphasizing the need to promote trade and responsible consumption.

Conclusions

We note that the rate of diffusion of ISO 9000 is in the process of slowing down. This is consistent with an increase in the number of decertifications. Some countries still in the process of industrialization can continue to enjoy a period of growth in certifications. Overall we are reaching saturation point described by various authors (Albuquerque, et al, 2007), (Casadesús, M. et al 2005a), (Casadesús, M. et al 2003), (Corbett, J.C. et al 2001), (Franceschini, F., et al 2010), (Marimon, F., et al 2009), (Marimon, F., et al 2006) (Stanislav K. et al 2010).

The main reason for maintaining the ISO 9000 certification by the companies interviewed is that there is great difficulty in maintaining it, except for your own cost and bureaucracy. Most companies concluded that it provides no added value and contributed about ten years ago, keep the certificate not to damage the image that would override it. Think of migrating towards an integration of standards and thus maintain the ISO 9000 with a small marginal effort.

Obviously, another reason that explains the decertification in 2009 is the cessation of activity of companies. Asking for reasons that will lead to decertification, the overwhelming response was: (i) no added value, (ii) bureaucratic effort required to update data and (iii) is not required by the market. The cost is not cause in these companies.

In the paper industry is estimated that in the future will demand more environmentally friendly certification (EMAS, FSC, PEFC, Carbon Neutral, etc ...) Moreover, the ISO 9000 certification will be integrated into an integrated management system standards.

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Advance Mathematical model to study and analysis the effect of Total Quality Management (TQM) and Operational Flexibility on Hospital Performance

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Keywords: Mathematical model, ANN, Total Quality Management, Operational Flexibility, Hospital Performance.

Introduction and Literature Review

Quality has occupied a prominent place in the Japanese industries in the late twentieth century; which was affected by complex changes such as industrial change and marketing competition. These changes came as a result of political and economic variable and intensifying of economic competition in the local, regional and global developments. These changes were followed by the technological revolution in the fields of human knowledge, information systems technology and others. The significance of quality impacts such as the emergence of the phenomenon of the total quality management (TQM) in the early twentieth century was of great importance in achieving the goals of humanitarian organizations in the production and the service organizations.

This paper comprises of three parts aiming to provide four things: the first part is about TQM in health care services and its principles. The second part is about its operational flexibility. The third part is about the performance in hospitals, and the fourth is the artificial neural networks and results.

The literature of total quality management justifies the principles and methods that are the basis of the development of performance and productivity to its first pioneers such as (Deming), (Ishikawa), (Juran, (Crosby), and (Oakland). The method of total quality management is based on the ongoing performance philosophy and excellent production by that improve goods and services with higher abundance, at lower cost with the freedom from defects and imperfections "from the first time and every time," and customer satisfaction within and outside the organization. Total quality management (TQM) plays an important role in all health sectors. TQM is used to improve patients' satisfaction, reduce cost and reduce medical errors. In recent years, attention to TQM in the healthcare industry started to rise as a major concern to achieve the overall quality. TQM depends on continuous commitment in the organization to improve the operation of the organization. It also depends on the excellence of the highest level of management to the lowest level of employee; also raw materials supplier through the

supply chain to the end consumer. The requirements for the application of total quality management within the healthcare organizations depends on the organization manager to make some changes in the structure, process, system of work, and the employee for achieving the objectives of TQM. To impose all the principles of the program in all aspects of the health organization there must be a very strong commitment from the senior management (Smith and Offodile, 2008).

Artificial neural network

Basically, the artificial neural network (ANN) is numerical structures inspired by the learning process in the human brain. They are constructed and used as alternative mathematical tools to solve a diversity of problems in the fields of system identification, forecasting, pattern recognition, classification, financial systems and many others (Baker & Richards, 2002; Joaquim & Dente, 1997; Shaw et al., 1997). The interest in ANN as a mathematical modeling tool resulted in the consolidation of its theoretical background and the development of its underlying learning and optimization algorithms (Ang et al., 1998; Huang et al., 1993; 1997; Shaw et al., 1997). Modeling and simulation of chemical processes is one of those research areas of interest that made use of ANN modeling techniques but in education field the ANN is very rare in this field and represents the first time to be used. Neural network-based modeling can be used confidently as a substitute for such situations. This is due to the favorable features entailed in their use. Among these features are: simplicity, fault and noise tolerance, robustness and ability for modeling nonlinear systems. The ANNs can be categorized in terms of their topology such as the multi-layer feed forward networks (FFNN), feedback networks (FBNN), recurrent networks (RNN) and self-organized networks. In addition, they can be further categorized in terms of application, connection type and learning methods. FFNNs are the most commonly used type for function approximation. In this topology, the network is composed of one input layer, one output layer and a minimum of one hidden layer. The term feed forward describes the way in which the output of the FFNN is calculated from its input layer-by-layer throughout the network. In this case, the connections between network neurons do not form cycles. No matter how complex the network is, its building block utilizes a simple structure using the neurons. It performs a weighted sum of its inputs and calculates an output using certain predefined activation functions.

Sequential Quadratic Programming (SQP)

The SQP method allows us to mimic Newton's method for constrained optimization. At each iteration a method similar to Newton's method is used to generate a quadratic programming sub problem whose answer is used to determine a search direction for the solution as shown in Figure 2.

Neural Network Modeling of Education System

The data used for training the neural network model was generated from the non linear experimental work of the system as given in paragraph 2 for the newly developed improved mathematical model. Step tests data were generated in simulation for the model with change in input values for the leader ship, training, employee management, information and analysis, supplier management, process management, costumer focus, continuous improvement, internal flexibility and internal robustness as shown in Figures

1 to 4.

The input ranges for all inputs factors were formed (10-100). The selected ranges cover the whole spectrum of operating conditions including flooding conditions and outlet hospital performance. Data sets were divided into three subsets; training, validation and testing.

The neural network structure was selected based on testing different network configurations that vary in terms of structure and simulation parameters. The criterion for network structure selection is based on its simplicity, performance, and accuracy of model prediction. The finally selected network contains 1 hidden layer with 7 neurons. The activation function used in the hidden layer is the tanh function because it is more suitable for the highly non linear system, while the output layer contains linear neurons. The inputs and outputs to the network are as shown in Figure 2.

In Figure 3, shows comparison between actual and theoretical results.

So, we can specify the inputs as (leader ship(t,t-1,...,t-n+1)),training(t,t-1,...,t-n+1), employee management (t,t-1,...,t-n+1), information and analysis (t, t-1,...,t-n+1), supplier management (t, t-1,...,t-n+1), process management (t, t-1,...,t-n+1), customer focus(t, t-1,...,t-n+1) continuous improvement (t, t-1,...,t-n+1) internal flexibility(t, t-1,...,t-n+1), internal robustness (t, t-1,...,t-n+1)) and output hospital performance (t, t-1,...,t-m+1).The neural network predication shown in Figures 3 to 6 is for the training data set.

Simulation and Results

After collecting data from three hospitals in Jordan, which depends on hospitals leaders' perceptions by using convenient sample and a suitable questionnaire, using Likert scale from

Results are represented from Likert scale to percentage by using the following equation:

$$\text{Dimension percentage} = \frac{\text{Dimension Mean}}{7} \times 100\% \dots\dots\dots (A)$$

After that calculate the average (mean) for each item as can be seen in Table (1):

Table one display the result of our survey after we diverted from Likert scale to percentage through the previous formula, we did that to have all results suitable for mathematical model and artificial neural net work (ANN).

The neural network models obtained for training in the previous section were utilized in the model predictive schemes as described in Section 3.

Comparison of both modeled of network-predicted outputs with actual results are shown in the form of the error profiles in Figures 3 and 4. These Figures indicate low errors even under severe process excitations. Figures 3 and 4 are representing square error of training, comparison between actual and theoretical data, training performance and accuracy respectively for King Abdullah University hospital.

Conclusion

Advance mathematical model produced depends on the results of the first hospital King Abdullah University Hospital (KAUH). To reach high accuracy, more than 99% for the first time Artificial Neural Network technique is being used in the education field. This is because this technique was derived from human behavior that is similar to my system. And it also depends on the answer of human beings that allows the model to have a high accuracy of more than 99%.

The comparison results from the modified model and actual data for three samples which gave a very good indication about the accuracy of this model.

From the results above and after verifying the mathematical model, we can say that there is a need to make system identification definition. This is in order reach to the interaction between each inputs variables and output variable performance. Work is going to be done to improve these relations.

After that we can determine the weakness point which affect on hospital performance and improve it. This will lead to decrease the cost of performance improvement, and deliver medical services with high quality and safety.

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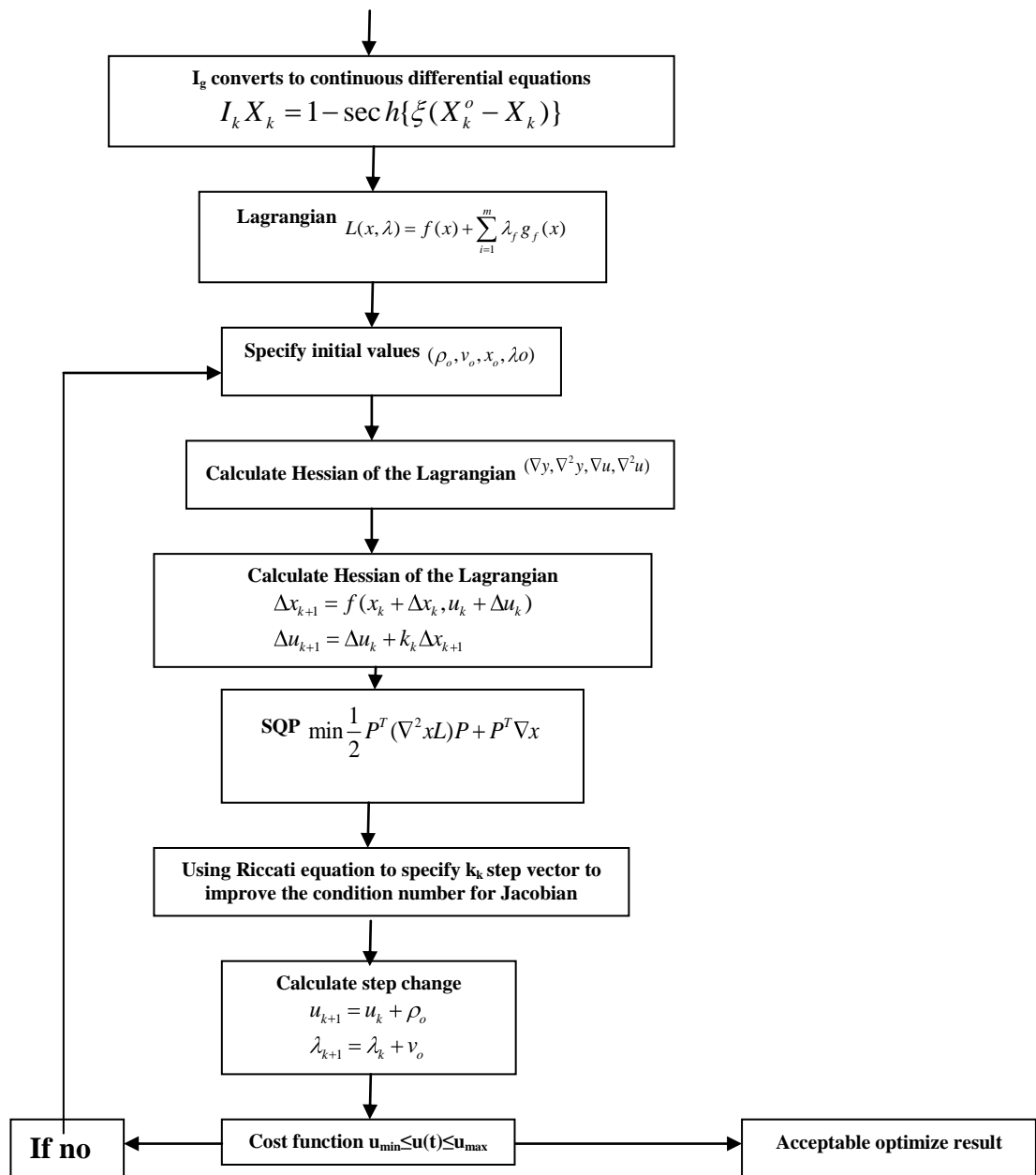


Figure 1: Represents all optimize steps.

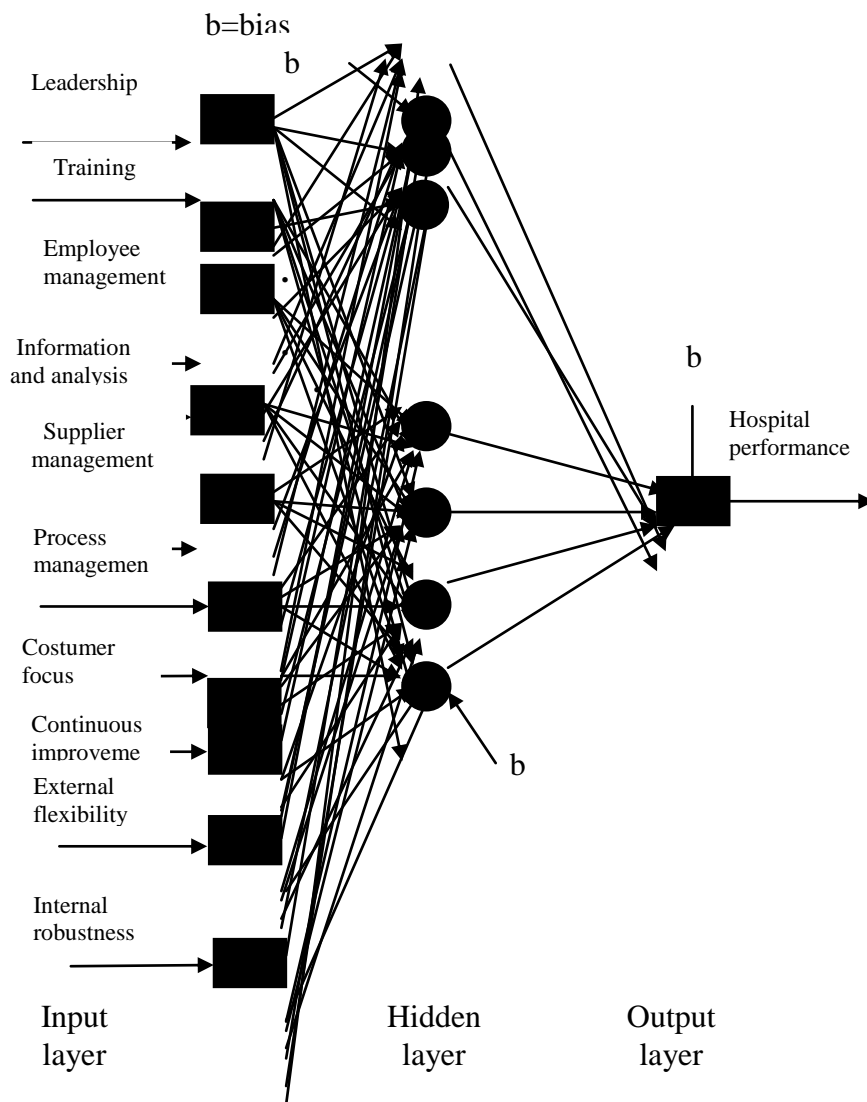


Figure 2: Three layer feed forward neural network.

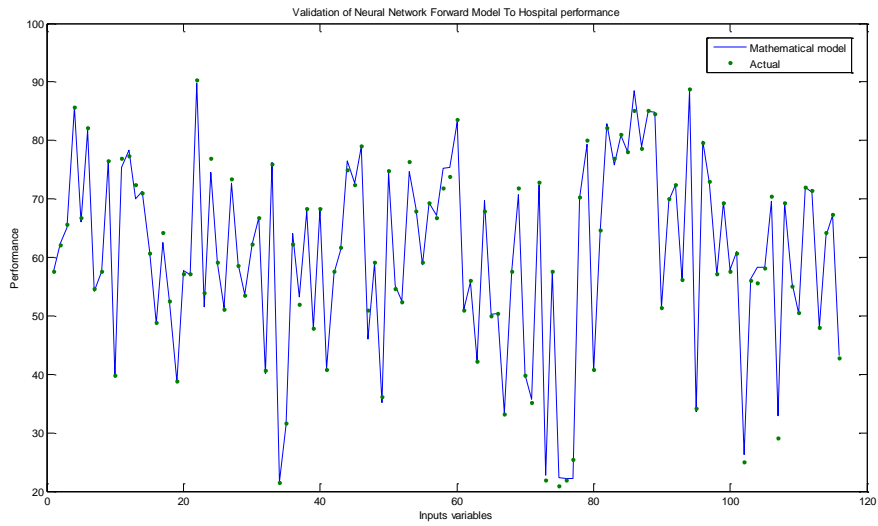


Figure 4: Shows validation of Neural Network model against actual results of King Abdullah University hospital performance

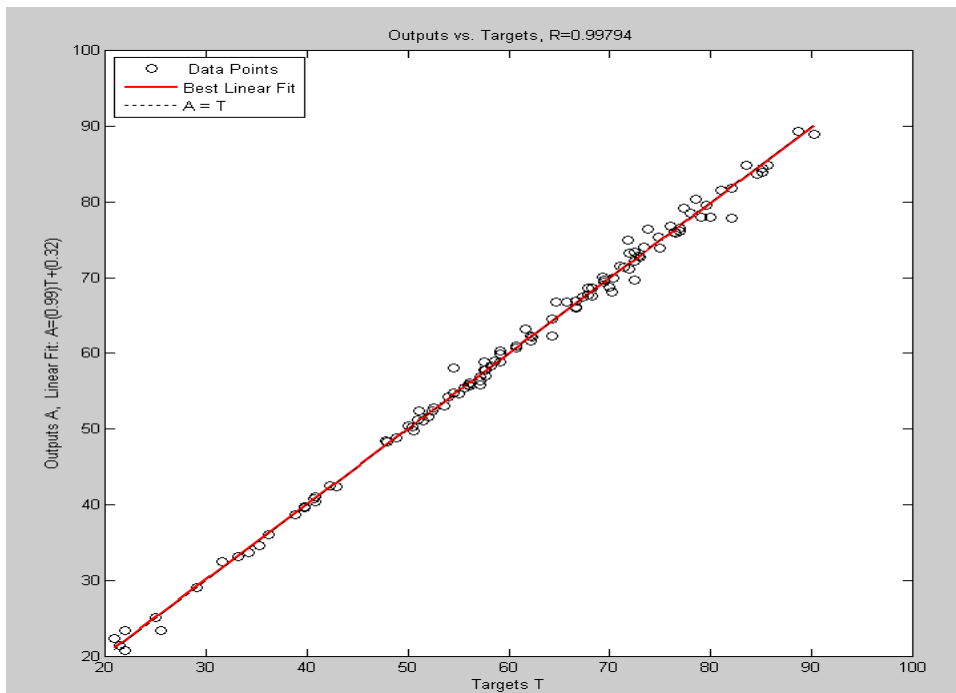


Figure 6: Shows the accuracy of linear fitting on King Abdullah University hospital.

Lessons Learned from Quality Management Systems Diffusion in Hospitality Sector in Spain

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Introduction

Last decade has changed radically the market conditions regarding travelling industry. Price competition, emerging tourist destinations, globalisation, a range of volatile political, economic, and technological factors; a greater environmental awareness, a growing concern about climate change and changes in consumer habits are main characteristics of this named *new market* (Macleod, 2004; Nicholls, 2004; Hall & Higham, 2005).

As a consequence of these developments, businesses in the tourism sector have recognised the need to adopt quality strategies (Casadesus et al. 2010). There has been a proliferation of standardised management systems in accordance with various national and international standards in recent years. These standards attempt to systematise various business functions, including: (i) quality management (e.g., ISO standards 9001:2008, ISO TS 16949:2009, ISO 10002:2004 among others); (ii) environmental management (e.g., ISO standards 14001:2004, EMAS III, ISO 50001 for energy management); (iii) workplace safety (e.g., OSHAS 18001:2007, PEOPLE), and (iv) ethical issues (eg., SA 8000, AA 1000, Global Reporting Initiative). All of these standards have a certain methodology, structure, implementation process, and testing procedure by a third party (Casadesus et al., 2010). In particular, two prominent families of standards issued by the International Standardization Organisation have become widely diffused in a variety of industries: (i) standards related to Quality Management Systems (QMSs) such as the ISO 9000 family of standards, and (ii) standards related to environmental management systems (EMSs), such as the ISO 14000 family of standards (Marimon et al., 2006).

According to the latest ISO Survey (ISO, 2010), up to the end of December 2009 there had been 1,064,785 ISO 9001 certificates issued to organisations in 178 countries, and 223,149 ISO 14001 registrations in 159 countries. Due to worldwide adoption, previous research has focused on these standards diffusion (eg., Franceschini et al., 2004; Marimon et al., 2006; Marimon et al., 2008; Casadesus et al., 2008; Marimon et al., 2010; Llach et al., 2011).

Moreover, little research attention has been paid to other QMS standards, apart from those published by ISO, that companies might have implemented. In view of these gap in the literature, the aim of the present study is to compare the diffusion of two QMSs within the Spanish tourism sector. The two QMSs for examination are ISO 9001 and 'Q', which is a specific certification standard developed for tourism in Spain.

The application of these two families of quality standards in the tourism industry in Spain is of interest for at least two reasons. First, Spain has emerged as one of the leading worldwide tourist destinations, with 52.6 million incoming tourists in 2010 (Frontur, 2011). The tourist sector in Spain has felt the impact of the above-mentioned changes in tourism in the past two decades, and there is a widespread acceptance in the Spanish tourist sector of the need to focus on improving the quality of their services. Secondly, in the tourist sector, Spain was the first country in the world to define specific quality standards for each sub-sector and a certification system by an independent third party (Casadesus et al, 2010).

This exploratory study analyses the diffusion of these quality standards in Spanish tourist enterprises, with the aim of gauging their real impact and forecasting their future important in the sector.

Literature Review

Diffusion of QMS standards

Most models of the diffusion of QMS standards have likened the process to the diffusion of technological and organisational innovations in society. According to Rogers (1995), the diffusion of an innovation is a "*process by which an innovation is communicated through certain channels over time among the members of a social system*".

Numerous studies have examined various aspects of such innovation diffusion. Mahajan et al. (1990 and 1995) investigated how an innovation spreads through an economy. Gurbaxani (1990) reported that new product innovations in many industries follow a so-called 'S-curve'. It means that a relatively slow rate of uptake at the beginning, followed by a rapid acceleration, and then a tapering in the rate of adoption as saturation is approached). Other studies have also supported this view, such as Teece (1980), Stoneman (1995) and Kumar et al. (2009).

Spanish tourist quality systems

Alonso-Almeida et al., (2009) and Casadesus et al., (2010) explained which is the situation in Spain with regard to tourist quality systems.

According to these authors due to the aforementioned situation and the need to provide tourism businesses with a tool for quality management adapted to their needs, the Spanish government launched the Spanish Touristic Quality System Project (STQS) in 1996 with the support of the State Tourist Administration.

Through this project, the Ministry of Tourism of the Spanish government has provided technical assistance in developing quality systems appropriate to the different tourist

sub-sectors (such as hotels, restaurants, travel agencies, and other fourteen systems more).

The STQS thus aimed to provide Spanish tourist enterprises with a methodological tool to enhance their competitive positions by improving the quality of their products and services. Institutional backing was provided in the form of the Spanish Tourist Quality Trademark (known as ‘Q’). The Instituto para la Calidad Turística Española ICTE (Spanish Touristic Quality Institute) is the main responsible to develop these systems.

The ICTE describes itself as ‘. . . a certification organization of quality systems created especially for tourist companies’; it also regards itself as ‘. . . a private, Spanish, independent, non-profit organization, recognized worldwide’.

Its basic functions are the following:

- Standardisation: the creation, development, updating, and reviewing of tourist quality standards in collaboration with all interested parties.
- Implementation: the provision of training courses, technical assistance, and publications to support tourist enterprises in their efforts to adapt traditional management systems to quality assurance systems.
- Certification: recognition of the implementation of quality systems by the awarding of the Spanish Tourist Quality Trademark.
- Promotion: promotion of the Spanish Tourist Quality Trademark (and the companies that hold it) through publicity campaigns, publications, representations in trade fairs, and press releases.

The Spanish ‘Q’ standard covers four main aspects: (i) facilities; (ii) the final service delivered to the client; (iii) organisational processes of client services; and (iv) functions and management tools for customer satisfaction. As such, the ‘Q’ standard is a self-regulated standardisation system that establishes quality standards compatible with the ISO 9000 and ISO 14000 series of standards (Alonso-Almeida et al., 2009; Casadesus et al., 2010).

Methodology

Data sources

Data on the diffusion of ISO 9001 was obtained from ISO annual reports (“ISO Survey”) and from annual reports provided by Fom Calidad (with regard to diffusion in Spain). Data on the ‘Q’ standard data were obtained from ICTE databases.

Data analysis

The model of the logistic curve has been applied in this research. According to this model, growth rate is at a maximum at the start, when there are very few individuals in the species that scarcely have to compete for limited resources, and it becomes zero once a certain size is reached. This is the size of saturation that the available resources permit. The model responds to the following expression:

$$N = \frac{N_0 K}{K - N_0 e^{-r_0 t} + N_0}$$

in which N represents the number of certificates, a function of time. N_0 represents the number of certificates at the starting point. K is the maximum level that may be reached: the saturation level. The initial growth rate is determined by r_0 . The independent variable time is represented by t .

This model has been successfully used by academics explaining the diffusion of the ISO 9001 and ISO 14001 standard. A number of authors as Franceschini et al. (2004), Marimon et al. (2006, 2009 and 2010), Casadesus et al. (2008), Llach et al. (2011) and Sampaio et al. (2011) have established that the logistic curve explains well the dissemination of these standards. It has been applied to other quality management standards; e.g. “Q” for the tourism sector in Spain (Casadesus et al. 2010). On the basis of the aforementioned work, Marimon et al. (2006, 2009 and 2010) perceive how the logistic model in question is also applicable to the diffusion of environmental management systems, particularly the ISO 14000 standard.

Analysis and Results

Comparison of diffusion of ISO 9001 and Spanish ‘Q’ standard

Figure 1 compares the evolution between ISO 9001 certifications in the ‘hotels and restaurants’ sector in Spain and the Spanish ‘Q’ standard using the logistic curve.

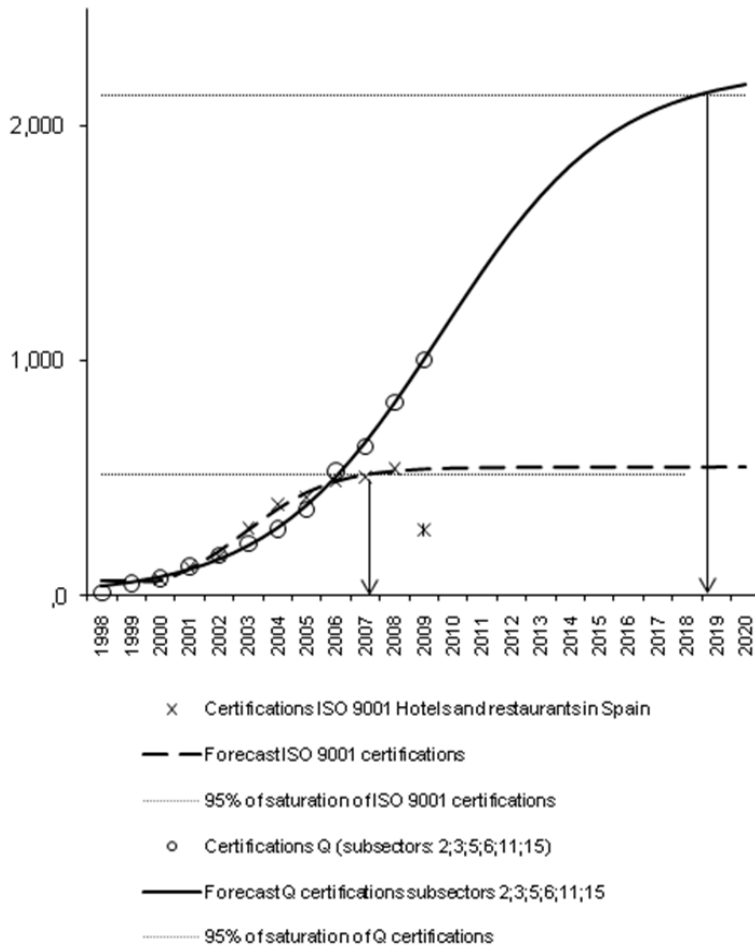
As it can be seen there has been considerable divergence in the graphs in the past years. Whereas the number of certifications under the ‘Q’ standard is growing, the number of certifications under ISO 9001 in this sector in Spain is decreasing.

These findings suggested that ISO 9001 standard has reached saturation in this sector in Spain in 2008, followed by a smaller number of certifications of this standard in 2009 (see Figure 1). In addition, it would seem that there is evidence of a phenomenon of ‘de-certification’ in 2009 as hotels and restaurants in Spain have not renewed their ISO 9001 certificate. However, the data for the latter phenomenon are not conclusive. It will be necessary to see what happens in the future to confirm this trend.

It suggested that the two standards are at different stages on the logistic curve. Whereas ISO 9001 (‘hotels and restaurants’ sector in Spain) is saturated, the ‘Q’ standard is still growing. Indeed, it would seem that the latter will not reach saturation until 2019. In seeking to explain why saturation has occurred so early in the case of ISO 9001 and why the Q’ standard continues to grow; qualitative data on the diffusion of the two standards in Spanish tourism were obtained from a selection of case studies.

Following two of these cases are presented.

Figure 1. Comparison between diffusion models of “hotels and restaurants” sector of ISO 9001 and Spanish Q standard



	Spanish Q standard		ISO 9001 (Hotels and restaurants in Spain)	
	Sum Sq	DF	Sum Sq	DF
Regression	2.68 E6	3	1,237,615	3
Residual	2,839	6	1,738	9
Uncorrect Total	2.68 E6	8	1,239,354	12
(Corrected total)	1.14 E6	8	249,992	11
R squared	.998		.993	
	Value	Standard error	Value	Standard error
N_0	42.12	9.368	65.76	5.24
K	2,237.15	17.658	546.20	421.60
r_0	.34	.062	.68	.02

Source: Compiled from ISO (2010) and ICTE (2010)

Case 1 QMS in hotel chain

“H CHAIN” is a large hotel chain located in Spain. The first hotel in the chain was quality certified in 1999, and by 2006 all hotels had been certified.

In the decision to implement the 'Q' system of quality, internal factors had been especially influential, especially a desire to improve internal processes and the work of functional areas.

With regard to the main benefits that had been obtained from certification, the respondents nominated the improved services provided to guests and the enhanced image of the chain, not only by internal improvement but with foreigner customers due to the efforts of ICTE to advertise the "Q".

Given that hotel is 88 years old, this had made it necessary to adapt older installations and furniture to the specific requirements of quality certification. The hotel chain has created a quality department to centralize the quality documentation, internal audits and coordination with external audits.

Some comments of operations manager are:

*This quality system has strong both ownership and institutional support.
It is easy to implement because processes are familiar to us, we don't have to invent nothing only, we are focus on improvement.
This quality system is adapted to our business and these processes are well known for us.
Our employees have not presented any resistance given that their daily tasks do not really change too much.
ISO 9001 is very general for our business. We had had to create all without guide.*

These comments noted that Q standard is useful for hotels to improve all their departments and processes without resistance of the employees. This point is very relevant for companies because majority of internal projects fail in implementation due to it. These comments also suggested that the costs of implementation are lower given that it is faster and the benefits could flourish soon.

Case 2 QMS in restaurant chain

"R CHAIN" is a large restaurant chain located in Spain with more than 400 restaurants. All of them have been certified in 2010, The management team says that "*the company is compromised for the quality is included in all aspect: product, service, stakeholder and environment.*"

The Q standard regulates facilities, equipment, kitchen, cleanliness, customers' service and training and this situation assures "*the restaurants in working order*".

Conclusions

The present study has focused on the impact of two standards in the Spanish tourism sector. An analysis of these standardised management systems has enabled using a model verified in the literature (Marimon et al., 2006; Casadesus et al., 2008 and 2010). These findings allow making a reliable forecast of the future diffusion of these systems in the hospitality and restoration sector. Although the data are specific to Spain, the results do indicate future developments in other countries in which similar standards are being developed or in which the emerging ISO tourist standards are applied.

It is apparent that standardisation of quality management in tourism will increase in coming years (Casadesus et al., 2010). The worldwide diffusion of ISO 9001 in many service sectors (Marimon et al., 2006) and the findings of the present study with respect to the Spanish standards provide an indication of what is likely to happen in the service sector as a whole in most countries.

A definite tendency is growing, and the model does clearly demonstrate the importance of quality management standards in the tourist sector. As the number of issued certificates inevitably increases, more reliable forecasts will be facilitated as valid adjustments are made to the predictive model.

The findings also suggested that specific standards are very important for the industries; even they could help small companies to change and improve their business.

Finally, although the recent history of certification of tourist management systems has enabled general sectoral analyses and forecasts to be made, the relatively small number of standards in each sub-sector limits detailed analysis of each sub-sector individually. This represents an acknowledged limitation of early studies conducted in this field.

Acknowledgment.

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Adapting a survey to evaluate quality improvements following the Breakthrough methodology in Swedish healthcare

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Key words: Breakthrough Series Collaborative methodology, Quality Improvement, Healthcare settings, survey evaluation

Category: Research paper

Introduction

Quality improvement initiatives have increased within the Swedish healthcare sector in recent decades. These efforts to improve quality can be seen as a response to demands for more cost-effectiveness and better medical results. However, studies have shown that less than 40% of these initiatives are successful (Olsson et al. 2007). The reason why specific improvement initiatives in healthcare fail or succeed is, therefore, a central question in studies of change. The need for more evidence about how to organize and manage new quality initiatives is therefore identified as an important task within studies of healthcare improvement (Walshe 2009, Olsson et al. 2007) Many improvement initiatives in Swedish healthcare uses the Breakthrough Series Collaborative methodology, developed by the Institute for Healthcare Improvement in Boston (IHI webpage). The methodology was introduced in Swedish healthcare by the Swedish Association of local Authorities and Regions (SALAR). This approach is based on a structure in which healthcare teams from various organizations create a joint learning experience. Despite the fact that the method has been practiced for a while and that it seem to be applied extensively in many healthcare systems, critical examinations of its use and application are very rare.

A frequently used measurement tool in healthcare settings is surveys (Streiner & Norman 2008). Surveys for assessment of innovation climate and innovation cultures have been developed. One of those is the Creative Climate Questionnaire (CCQ) aiming to measure the climate in an organization regarding creativity and innovations (Ekvall 1996). This survey was recently used in a study of implementation of new tools in primary health care centres (Carlfjord et al. 2010). Staff and management were shown to differ in their assessment of the organizational climate at the unit, with managers scoring higher. Olsson et al. (2003) developed a model (the Swedish OCM) connected

with a survey to predict outcomes of organizational change. Their model is directed towards predicting success or failure within a change project. A European project (MARQuIS) developed a web-based survey to measure quality improvement strategies in acute care hospitals in the European Union (Lombarts et al. 2009). The survey consisted of four sections, one at an overall hospital quality improvement level, the other three on quality management for medical conditions (acute myocardial infarctions, acute appendicitis and deliveries). Most broadly used strategies were related to external assessments, as ISO, and less implemented were activities related to patient involvement.

To the best of our knowledge, there are no surveys today in a Swedish context that can answer questions about how quality develops and improves over time within Swedish healthcare. Wanting to contribute to the understanding of development of quality improvements in Swedish healthcare by conducting longitudinal studies on innovation development, we needed a measurement mechanism. The Minnesota Innovation Survey (MIS) was found to be a comprehensive survey including different dimensions of innovations and at the same time was developed to measure over time (Van de Ven et al. 2000). It has a broad focus on change processes as well as antecedents and motivations/motors of change. Therefore the MIS survey, with its focus on several dimensions, could be used to investigate more aspects of change.

Minnesota Innovation Survey

The Minnesota Innovation Survey (MIS) was developed to measure how innovations emerge, develop, grow or terminate over time (Van de Ven et al. 2000). MIS is a comprehensive instrument consisting of 102 items including partial and open-ended questions, divided into two parts, the second concerning cooperation with others. In addition there are ten issues of demographic data. It has been used in different contexts, both in manufacturing and service firms, such as medical business, public schools, data processing technology and hospital organizations. The survey is built on a theory (process theory) of innovation management that encompasses five basic concepts: ideas, people, transactions, context, and outcomes. These concepts are seen as central factors concerning managers who direct innovation processes. The conceptual base framework consists of dimensions grouped into the four clusters: Internal dimensions, Situational/contingency factors, External innovation dimensions and Outcomes (Figure 1). Different psychometric tests showed evidences for convergent validity as well as discriminant validity (ibid.).

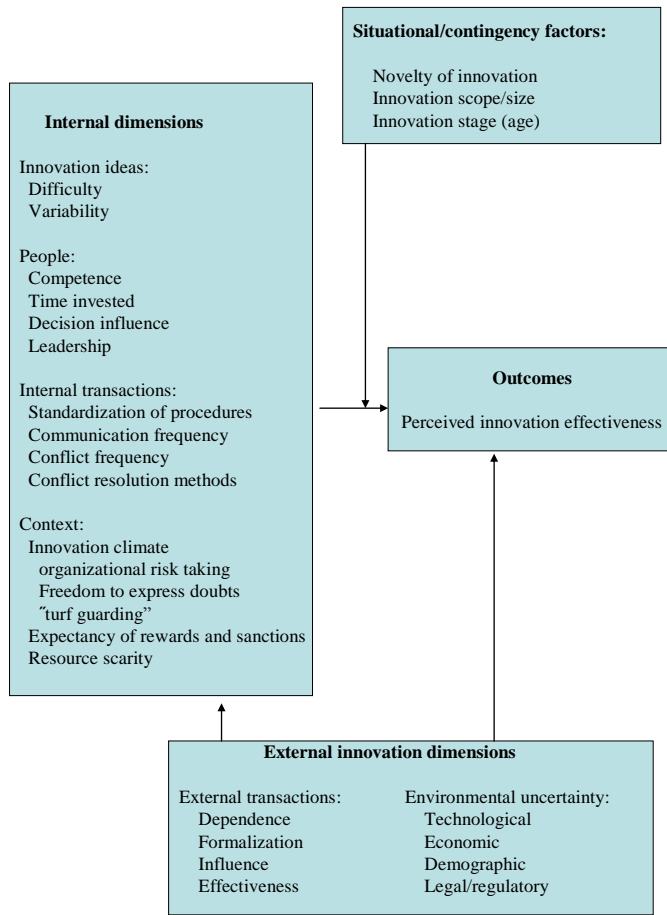


Figure 1, Dimensions in Measurement Model of Minnesota Innovation Survey
 Source: Van de Ven et al. (2000), p. 56

The Breakthrough Series Collaborative methodology

The Breakthrough Series Collaborative methodology was developed 1995 by the Institute for Healthcare Improvement (IHI) in Boston, United states (IHI webpage). The founders reasons were, amongst others, that there was a gap between knowledge and practice, and that we can learn more from collaborating than from working alone. The quality improvement methodology uses small-scale rapid tests of change, and there are eight key concepts that define the Breakthrough Series Collaborative. Those are; 1) Plan-Do-Study-Act cycles are used to test and implement changes; 2) Anyone can have and test ideas; 3) Consensus is not needed to test an idea; 4) Changes happen at all levels (not at or from the top); 5) All teams are required to address all of the Framework components simultaneously; 6) Ideas are stolen shamelessly; 7) Successes are spread quickly; 8) Measurement is for improvement, not research (from a presentation at a web conference 2004). The framework means to identify key components of an ideal system based on existing best practice and evidence, breaking the system down into manageable parts and allow focus on specific aspects within the system. There is also an emphasis on identifying key measures to monitor the progress. Other impotent part are sharing success and to steal shamelessly (ibid.).

The county council improvement program – the empirical context

The quality improvement program started in 2007 and was a political investment with the vision and aim to become a learning organization with welfare of patients in focus. The programme is implemented both from the top management level and at individual departments/clinics/primary health care centres. The program is described on the county council homepage (Kvalitetswebben).

There are several initiatives going on; one is the methodological guided improvement program inviting staff teams to work with an innovation idea in a program using the Breakthrough Series Collaborative methodology and supervisors/facilitators (IHI webpage). The county council has made some local adjustments, but generally they have followed the concept. As of autumn 2010 six of those programs have been started, involving about 130 teams and 610 staff members, the latest including staff and teams from some of the municipalities within the county council. To evaluate this improvement program initiative there was a need for a mechanism to show whether this is a good way of working with improvements in healthcare settings. Therefore, the aim of the present study was twofold; first to translate, revise and test the MIS survey, and then to use the survey to empirically evaluate the use of the Breakthrough Series Collaborative improvement methodology in a Swedish healthcare context over time, comparing the results from the first measurement at the beginning of the improvement program with the second measurement six month later.

Method and material

The Swedish version of MIS - adapting process

The original MIS was used with permission from its creators. Adaption and modification of the survey was done in several steps. Research team meetings were held between the different steps and during this process different ways to validate the survey were performed. The original survey in English was translated into Swedish by a

professional translator. Literally translated words and/or sentences were edited into more idiomatic Swedish and words were adapted to fit the Swedish healthcare and county council organization.

A focus group discussion was conducted with five former participants from earlier improvement programs. The focus group interview was tape recorded and notes were taken. Following the focus group's suggestions, some questions were paraphrased and others reworded. The answers and answer scales were revised and sometimes changed. Individual interviews were held with three support staff from the improvement program support. Their views and ideas were considered in a new revision, some questions were merged and some changed places. An alternative ("Do not know") was added to some questions. Background data questions were adapted, some were removed and some added.

An expert in quality management was then asked to review the revised survey. After his suggestions a revision was made, items were removed and merged, and the survey was shortened. A back translation was conducted by another translator and compared to the original. Some answering scales were further modified, some of which differed in the translation, for example "Very much" has been retranslated as "A lot". Although the overall agreement was good, changes between the original and final survey were, for example, "How big of an undertaking does this innovation represent?" versus "How much commitment do you feel toward the improvement idea?"

The change from using innovation as a construct towards improvement gives a more precise articulation of the content we aim to study. This also meant that the dimension Perceived Innovation Effectiveness was changed into Perceived Improvement Effectiveness. The introduction text was adopted to suit the study and fit the web layout. The survey was entered into the web-based survey program esMaker NX2. An answer was required to all items with fixed scales, otherwise it was not possible to proceed with the survey.

Participants and data collection

The present study contains data from two improvement programs, ongoing from September 2009 until November 2010. Employees within the county council (n=171) and the municipalities (n=39), a total of 210 participants, received the survey. In this paper data from the first measurement and a second measurement six month later are used. The participants received written and verbal information by the first author at the regular improvement program meetings. The survey was sent by e-mail and the informants consented by answering the web-based questionnaire. After one week and two weeks reminders was sent automatically to those who had not answered. The survey study was conducted according to general ethical standards and approved by the Regional Ethical Review board in Linköping, Sweden (Dnr 179-09).

Data analysis

Data was analyzed using Statistica version 8.0 (StatSoft, Tulsa, OK, USA). The results are presented in three answer alternatives, such as "Not at all/A little", "Some" and "Quite a bit/A lot". Descriptive statistics are presented as percentages, range, mean and standard deviation (SD). The repeated measurements are presented as total numbers as

well as percentages. Differences are analysed using Wilcoxon Match Pairs test and correlations between the two dimensions Perceived Improvement Effectiveness and Internal dimensions were made.

Drop out analysis

Drop outs were analysed by comparing the answers from those who only answered the first measurement (n=51) with those who answered both measurements (n=41) using Mann-Witney U test. No significant differences were found between the two groups. Background data were analysed and compared between the two groups, using t-test and chi2 test (Table 1).

Results

In this section the results from developing and testing the survey and the following empirical evaluation of the use of the Breakthrough Series Collaborative Improvement methodology are presented.

Revised version of MIS

The revised survey consisted of 72 items in the dimensions, Perceived Improvement Effectiveness (n=3), Internal dimensions (n=24), External Improvement dimensions (n=18) and Other Indices (n=27). The items consisted of both questions and statements, and were answered in a verbal five-point scale, the majority from “Very little” to “Very much” or “Not at all” to “A lot”. There were items with different scales such as, “Absolutely do not agree” to “Absolutely agree”. In the revised version the answer alternative “Do not know” was added. Likewise there were possibilities added to make comments. Completing the web-based survey took approximately twenty minutes. In the present study the results from the dimensions “Perceived Improvement Effectiveness” and “Internal dimension” are reported (Table 2).

Participants

Demographic data about the participants is presented in table 1. In the first measurement the response rate from county council employees was 45% (n=77) and from the municipal employees 38% (n=15). Seven of the twelve municipalities within the county council were represented. A total of 44% (n=92) participants answered the first survey measurement. The age of the participants ranged from 24-63 with the mean age of 46.3 (SD 10.0). The majority, 86% (n=79), of the participants were women and 14% (n=13) were men. The participant experiences in profession ranged from 0.5-41 years, with the mean of 19.2 (SD 12.0) years. The largest group participating were nurses (n=50), also showing the highest response rate 54%. In the second measurement the response rate from county council employees was 22% (n=42) and from the municipal employees 7% (n=14), a total of 29%. The differences between the participants answering only first measurement and those answering both first and second measurement are shown in table 1. The most striking difference is between the numbers of nurses; it has decreased to almost half as many in the second measurement. There was also a significant difference in working years. Those who answered only the first measurement had a mean working time experience of 21.8 years while the mean time was 15.9 years in the second measurement.

Table 1, Participant background characteristics and drop out analyse (differences between participants answering only first measurement and those answering both first and second measurement)

	Only first (n=51) n (%)	Both first and second (n=41) n (%)	p value
Professions			
Physician	4 (8)	5 (12)	n.s. †
Nurse (including midwife/ other specialities)	30 (59)	16 (39)	.05 (df2) †
Assistant nurse	6 (12)	3 (7)	n.s. †
Other *	11 (21)	17 (42)	n.s. †
Gender			
Men	7 (14)	8 (20)	n.s. †
Women	44 (86)	33 (80)	n.s. †
Age: mean range, (SD)			
	48 28-63 (9,1)	44 24-63 (10,8)	n.s. ^
Professional experience (year): mean, range, (SD)			
	21,8 2-41 (11,2)	15,9 0,5-41 (12,3)	0,0173 ^

* Others, e.g. medical secretaries, physiotherapists, occupational therapists, dieticians, psychologists and audiologists

† chi2 test

^ t-test

Survey results first measurement

The total of 27 items in the two dimensions “Perceived Improvement Effectiveness” and “Internal dimension” had a Cronbach’s alpha coefficient of 0.77. The overall item “How much commitment do you feel toward the improvement idea?” showed a large engagement in the improvement work: 90% answered “Much/Very much”, 9% “Moderate” and 1% of the participants answered “Very little/Little”. The time spent on working with the improvement idea during the last month ranged from 0 to 80 hours and on average the participants spent 12 (SD 10.6) hours on this work. Most of the time was spent on the participant's own education, mean 3.2 (SD 4.6) hours, followed by time for planning and administration, mean 2.9 (SD 3.3) hours. Least time was spent on acquiring economic funds and resources, mean 0.2 (SD 0.6) hours.

Having prior experience working with improvements was stated as “Quite a bit/A lot” 29% and “Some” 30%, while 41% were answered “None/A little. At the same time 50% of the respondents stated having “No education” in improvement work on beforehand, 35% answered “Participated in courses/training”, 10% “University/college-level education” and 5% “Other”. Those answering “Other” were mostly participating in earlier improvement programs.

The “Internal dimensions” consist of eight sub-dimensions with a total of 24 items (Table 2). The five items in *Recourse Scarcity* (item 35a-e) affects the work with the improvement idea differently. A majority of the respondents stated that they had to compete for time (item 35e) to work with the improvement idea (“Quit a bit/A lot” 52%, “Some” 26% and “Not at all/A little 22%), while competition for economic resources (item 35a) were stated “Quit a bit/A lot”12%, “Some” 17% and “Not at all/A

little” 71%. Least competition was about materiel, space and equipment (item 35b) 8% answered “Quit a bit/A lot”, 17% “Some” and 75% “Not at all/A little”. Regarding the item if the methods used supported the work (item 3) answered 44% “Much/Very much”, 46% “Moderate” and 10% “Very little/Little”. The item about receiving feedback from the support personnel (item 21) were answered by 51% “Quit a bit/A lot”, 34% “Some” and 15% “Not at all/A little”.

The dimension “Perceived Improvement Effectiveness” showed that the majority of the respondents were satisfied with their work and what they had accomplished, 76% answering “Quite a bit/A lot”, 17% “Some” and 7% “Not at all/A little” (item 22). That the improvement idea contributed to improving the work at the unit (item 24) were considered of 56% answering “Quite a bit/A lot”, 35% “Some” and 9% “Not at all/A little”. That the progress was above their expectations (item 23) were stated “Somewhat/Fare above” 42%, “As expected” 49% and “Far/Somewhat below” 9%.

The most common comments were about time; not getting enough time to work with the improvement idea and that it was hard to find time because of regular tasks. There were also comments about manager support, such as wanting help from the manager to plan time for the team to meet. Other comments were about methods of measurements and how to show results. Need for evaluations and assessments to show improvements and distribute achieved results to other colleagues not involved were commented on. Suggestions on improving the work were about getting more knowledge and using unit development days to work with improvements.

Survey results repeated measurements, first and second measurement

Results from the repeated measurements are shown in table 2. The significant differences between the “Decision Influence” items 6a ($p=0.0008$) and 6b ($p=0.0372$) due to the high amount of “No decision made” answers. Problems were stated to arise more often later during the work (item 7), and feedback decreased dramatically (item 21). The improvement program was finished when answering the second measurement. The item if the methodology supporting the work (item 3) is mostly answered “Moderate” in both measurements, 46% respectively. In the first measurement more respondents were answering “Much/Very much” (41%) than in the second measurement (34%). “Very little/Little” were stated by 12% respectively 19%. There were no significances between the measurements in this item, as well as most differences were not significant (Table 2).

The time spent on working with the improvement idea during the last month ranged from 0 to 50 hours and on average the participants spent 6.6 (SD 9.5) hours on this work. Comparing to all answers in the first measurement this is a decrease of about half time. Most time were spent on own education, mean 2.9 (SD 6.0) hours, followed by planning and administration, mean 2.4 (SD 2.8) hours. Least time was still spent on acquiring economic funds and resources, mean 0.1 (SD 0.4) hours.

Table 2, Items and results from the dimensions Perceived Improvement Effectiveness and Internal dimensions, n (%), participants (n=41) answering both measurements

Perceived Improvement Effectiveness	Not at all/A little		Some		Quit a bit/A lot		p value *
	First	Second	First	Second	First	Second	
22. Overall, how satisfied are you with the progress that has been made in the work to develop the improvement idea during the past month?	3 (7)	6 (15)	4 (10)	8 (19)	34 (83)	27 (66)	
24. How much does the improvement idea contribute to improving the work at your unit?	4 (10)	5 (12)	15 (36)	9 (22)	22 (54)	27 (66)	
23. To what extent is your progress with the improvement idea below or above your original expectations?	Far/Somewhat below		As expected		Somewhat/Far above		
	4 (10)	5 (12)	18 (44)	12 (29)	19 (46)	24 (59)	
Internal dimensions							
<i>Innovation Uncertainty</i>							
2. How easy is it for you to know ahead of time what steps are necessary to develop the improvement idea?	Very/Quite easy		Moderate		Quite/Very difficult		
	4 (10)	5 (12)	20 (49)	19 (46)	17 (41)	17 (41)	
7. How often in the past month did problems arise during development of the improvement idea?	Not at all/Once		Every other week		Every week/Every day		0.0344
	3 (7)	1 (2)	5 (12)	3 (7)	33 (80)	37 (90)	
<i>Resource Scarcity</i>							
35. How much must your improvement idea compete with other activities within your unit, when it comes to:	Not at all/Little		Some		Quite a bit/A lot		
a. Economic resources?	4 (10)	5 (12)	7 (17)	3 (7)	30 (73)	33 (80)	
b. Material, space, and equipment?	2 (5)	3 (7)	5 (12)	6 (15)	34 (83)	32 (78)	
c. Attention from the executive level?	7 (17)	9 (22)	8 (19)	7 (17)	26 (63)	25 (61)	
d. Personnel?	10 (24)	7 (17)	11 (27)	12 (29)	20 (49)	22 (54)	
e. Time to work with the improvement idea?	18 (44)	22 (54)	12 (29)	8 (19)	11 (27)	11 (27)	
<i>Standardization of Procedures</i>							
3. To what extent is your work on the improvement idea supported by the methods used in the improvement program?	Very little/Little		Moderate		Much/Very much		
	5 (12)	8 (19)	19 (46)	19 (46)	17 (41)	14 (34)	

	First	Second	First	Second	First	Second	p value *
<i>Expectations of Rewards and Sanctions</i>							
15. How likely is it that the following will occur if the goals of the improvement idea have been achieved:	Not/Hardly likely		Likely		Very/Totally likely		
a. Everyone involved, as a group, will be rewarded or recognized for their collective efforts	16 (39)	16 (39)	17 (41)	15 (36)	8 (22)	10 (24)	
b. Only some participants will be rewarded or recognized for their individual efforts	1 (2)	2 (5)	3 (7)	1 (2)	37 (90)	38 (93)	
16. How likely is it that the following will occur if the goals of the improvement idea have not been achieved:							
a. Everyone involved, as a group, will be reprimanded or told to “shape up” to improve their efforts.	7 (17)	6 (15)	7 (17)	7 (17)	27 (66)	28 (68)	
b. Only some participants will be reprimanded or told to “shape up” to improve their efforts	0	0	2 (5)	2 (5)	39 (95)	39 (95)	
	Absolutely/Mostly do not agree		Neutral		Mostly/Absolutely agree		
<i>Innovation Group Leadership</i>							
10. The project leader of the improvement idea encourages the participants to take initiative.	2 (5)	4 (10)	10 (24)	17 (41)	29 (70)	20 (49)	
11. The participants involved in the improvement idea are aware of their individual responsibilities.	0	2 (5)	2 (5)	3 (7)	39 (95)	36 (88)	
12. The project leader for the improvement idea places great emphasis on getting the work done.	1 (2)	3 (7)	9 (22)	9 (22)	31 (76)	29 (70)	
13. The project leader has great confidence in the participants involved in the improvement idea	0	0	5 (12)	7 (17)	36 (88)	34 (83)	
	Not at all/Little		Some		Quite a bit/A lot		
21. Do those involved in working with the improvement idea receive feedback from “improvement support”/their supervisor on how they can improve their work?	7 (17)	24 (59)	14 (34)	11 (27)	20 (49)	6 (15)	0.0000
	Absolutely/Mostly do not agree		Neutral		Mostly/Absolutely agree		
<i>Freedom to Express Doubts</i>							
14. To avoid causing disorder I often feel I cannot say what I think about the work on the improvement idea.	3 (7)	5 (12)	2 (5)	5 (12)	36 (88)	31 (76)	
	Absolutely/Mostly does not apply		Neutral		Mostly/Absolutely applies		
<i>Learning Encouragement</i>							
33. If a colleague tries something new and fails, this is viewed as something that could harm her/his future career in the county council.	1 (2)	0	14 (34)	6 (15)	26 (63)	35 (85)	0.0438
34. The county council prioritizes experimenting with new ideas.	10 (24)	17 (41)	24 (59)	17 (41)	7 (17)	7 (17)	
	First	Second	First	Second	First	Second	

Decision Influence

6. How much influence have you had on each of the following decisions that might have been made during the past month?	None/Little		Some		Quite a bit/A lot		No decision made		p p value *
a. Preparing goals and measures for the improvement idea?	1 (2)	2 (5)	3 (7)	4 (10)	37 (90)	23 (56)	0	12 (29)	0.0008
b. Deciding which activities should be carried out within the improvement idea?	0	4 (10)	4 (10)	4 (10)	37 (90)	27 (66)	0	6 (15)	0.0372
c. Deciding on economic funds and resources for the improvement idea?	21 (51)	17 (41)	4 (10)	3 (7)	2 (5)	6 (15)	14 (34)	15 (36)	
d. Recruiting colleagues to work with the improvement idea?	13 (32)	11 (27)	3 (7)	1 (2)	13 (32)	13 (32)	12 (29)	16 (39)	

* only significant differences are shown (p <0.05), Wilcoxon Match Pair test

Correlations

Correlations were calculated between the item “*overall how satisfied are you with the progress that has been made in the work to develop the improvement idea during the past month?*” (item 22) in the dimension Perceived Improvement Effectiveness and all items in the Internal Dimensions. Only three significant item correlations were found, all in the first measurement. “*How much must your improvement idea compete with other activities within your unit, when it comes to: Time to work with the improvement idea?*” (item 35e) ($r=0.34$, $p=0.029$), “*The participants involved in the improvement idea are aware of their individual responsibilities*” (item 11) ($r=0.35$, $p=0.024$) and “*To avoid causing disorder I often feel I cannot say what I think about the work on the improvement idea*” (item 14) ($r=0.53$, $p=0.000$).

Discussion

The aim of this paper was twofold, first to translate, revise and test the MIS survey to be used in a Swedish healthcare context, second to evaluate and follow an improvement program using the Breakthrough Series Collaborative methodology using the survey over time. In our revision we have shortened the survey. Many of the earlier participants in the focus group and consulted experts agreed that the survey was too comprehensive. The different innovation dimensions in the original model (Figure 1) are still there, although some only have a few items left. Our choice to use improvement instead of innovation as a construct suits the work in Swedish healthcare better. The phrase innovation is seldom used; instead almost all organisations working with quality improvements are using that term (SALAR webpage). At the same time it gives a more precise articulation of the content we aim to study, an improvement program built on the Breakthrough Series Collaborative methodology.

First the survey was translated. There are considerations about translating such an instrument into another language, but if the cultures are similar, there can be an assumed agreement that concepts mean the same thing (Strainer & Norman 2008). To test the conceptual agreement we used a focus group interview (Kruger 2009) with participants from earlier improvement programs. Based on their statements wording was simplified. The focus group participants thought the language in the survey was difficult and not suitable in the healthcare context. After the quality management expert was consulted about item relevance, additional changes were made. We shortened the survey and sentences were rewritten in an attempt to clarify. Scales were kept close to the original, with only small adjustments, which has meant that there are different wordings in the answer scales, perhaps confusing the participants. A number of comments refer to this. The overall Cronbachs alpha was consider sufficient and the survey was sent out to participants following a Breakthrough Series Collaborative methodology program.

The sub-dimensions in “Internal dimension” are quite different, as items in “Standardization of Procedures”, “Expectations of Rewards and Sanctions” and “Learning Encouragement”. Therefore this study shows the results item for item and has not made any total scores.

The response rate was 44% in the first measurement and 29% in the second measurement. The comparison between the participants showed that nurses were the largest group not answering the second time (Table 1). There are different reasons for

not participating in a survey. Responses from participants indicated that there are a lot of surveys circulating in healthcare, which could be one reason why some of the respondents chose not to fill in the questionnaire. Perhaps healthcare professionals sometimes become survey-fatigued? The most common comments however were about lack of time. Perhaps another reason is that there is not time enough in healthcare both to work with improvements and answer a survey about the work. The respondents thought that they needed scheduled time so the whole team could meet and work together. The ordinary daily work always intruded. The time issue is supported by the fact that 52% (first measurement) stated that they had to compete for time to work with the improvement idea. But at the same time, most respondents were satisfied with what they had accomplished, and thought their work was useful to the unit and to the healthcare organization.

Through the application of the revised MIS survey, our empirical study in the county council reveals what it means to work in project teams within the context of Breakthrough Collaborative Series arrangements. The section below are highlighting and discussing the most significant findings.

There were not many significant correlations, but some interesting findings are that the overall satisfaction with the improvement work correlates positively to the awareness of the individual responsibilities and the feeling of openness, to express what you think about the work. Ekvall (1996) describes this in words of the organisations climate, implying a certain degree of openness, commitment, motivation and risk taking mentality. The more positive climate the more innovative organisation and more satisfied employees. He also claims that risk taking, dynamism and freedom play a roll to create an innovative organisation. In our study the items concerning decision influence were not showing this. But the awareness of the individual responsibility as well as the item about commitment (even if no correlations were found) can be factors having influence on the satisfaction.

The results showed variation on how Breakthrough Collaborative Series team members experience competition for resources. Respondents stated that they had to compete for time, which applies to the comments about lack of time. The least competition was mentioned with respect to economic resources. The fact that 62% (first measurement) stated that they did not have to compete for attention from management (executive level) is interesting. At the same time a recurring comment was about wanting more attention and support from management. Surprisingly there was a positive correlation between the overall satisfaction and the time competition with other activities (item 35e).

The items directly affecting the Breakthrough Collaborative Series methodology are quite interesting. The item if the methodology are supporting the work (item 3) values below the middle was reported, and quite a high amount have answered that they do not receive feedback from the improvement support staff (item 21). Discussing this with the support staff, they claimed that at the second measurement six month later the methodology program was ended. At the same time, there is a support organisation built up at local (administration) levels to be able to support improvement work going on at different levels in the organisation. One can assume that the respondents' answerers only concern the support during the program, and then this result will be understandably and corresponds to the explanation of the support staff. The answers that the

methodology does not support the work are more problematic. Are the instruments too complicated, not introduced properly or just not regarded as sufficient? There are a lot of healthcare organisations in Sweden using the Breakthrough Series Collaborative. There are only one evaluation made, that we are aware of (Øvretveit 2003). This report stated that the most important factor for those programmes to succeed in long-term are that the organisations after the program has ended can make use of the knowledge that the teams have accomplished. If this is the case, this study can not answer, more studies within this county council improvement program are to be accomplished.

This paper was the first evaluation of the revised survey. It is also the first analyze of data following an improvement program using the Breakthrough Series Collaborative. There is a need to do more testing to get the survey to apply better to the Swedish healthcare context. More data will be collected in this county council improvement program, and more analysis of the use of the Breakthrough Series Collaborative is forthcoming.

Conclusions

The survey methodology can be used to study and evaluate improvement initiatives in Swedish healthcare settings. Although the survey would benefit from some more development regarding the extent, language and uniformed standardized measurement scales.

Regarding the improvement program and Breakthrough Series Collaborative methodology the most striking results are that almost half of the respondents (46% in both measurements) stated that the methods only support the improvement work at a moderate level.

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The Post Crisis Sustainable Management Vision for Excellence: Implications for Business Education

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Introduction and Paper Objectives

“There was a rich man whose manager was accused of wasting his possessions. So the rich man called the manager in and asked him, “What is this I hear about you? Give an account of your management, because you cannot be manager any longer.” ... Whoever can be trusted with very little can also be trusted with much, and whoever is dishonest with very little will also be dishonest with much. So, if you have not been trustworthy in handling worldly wealth, who will give you true riches? And, if you have not been trustworthy with someone else’s property, who will give you property of your own? Nobody.

Jesus in the Gospel of Luke 16:10-12

The recent global multifaceted crisis is a direct consequence of the dominant paradigm of economic growth that followed the industrialization era, an argument highlighted by Marschall et al. (2010) in the recent Academy of Management Learning and Education special issue on sustainability in business education. This paradigm has been focusing on the self referent corporate unit that neglected its impact in the wider context and the right of future generations to meet their own needs by utilizing natural, social and human resources. The scientific over-fragmentation and relevant technocratic education, the centralized power structures and the unilateral economic growth mentality were responsible for the development of a consciousness trap that determined to a great extent the course of global and corporate action for many years. This means that managers’ perception was constrained into a discipline specific, organizational and cultural self referent mental framework that led them to specific behaviours and thus not allowing them to think differently, as Kuhn (1962) and Senge (1990) would agree.

Facts like a) the recent corporate scandals which shocked both the practical and the conceptual/theoretical constituents of management (eg Enron, Worldcom, Lehman Brothers), b) the financial crisis (credit crunch), c) the corporate greed, inertia and short-sightedness (according to America’s Union Movement in 2010, i) the gap between a CEO’s and an employee’s pay rose by 343 times in comparison to 42 times during the eighties, ii) the average US CEO pay for 2010 amounted to \$11.36 million and a pay cut of 30 % could assure the job of 33,000 employees that most of the times are thrown into unemployment, iii) there is \$ 1.93 trillion in corporate cash not invested, leaving 14 million people unemployed in the US, d) the percentage of hungry people that reached 13.1% of global population-1.35 billion of people live with almost \$1.25 per day (World Hunger report 2011) and e) the environmental disasters of Chernobyl, Fukushima and the massive oil spill in the Mexican Gulf and f) the human rights violations by major corporations could be described as human hubris for which the

global community and its corporations (to a variable extent) share responsibilities. It is truly a paradox, on the one hand spending billions of Euros to understand the fundamentals of universal creation (eg CERN experiment) or to advance our knowledge on the mystery of life and on the other still behaving with total disrespect to the preservation of life. What is the purpose of conquering Mars, of discovering the mysterious Higgs particle or even maximizing financial results, if humanity has lost its ability to understand its own nature and lives in a state of civilized barbarism, in which the teachings and values of the ancient world, enlightenment, renaissance seem to be fading away?

These are indications of multiple failures in various fields, namely not meeting the desirable or predefined objectives. However, it would be truly unwise, culturally inferior and scientifically incorrect to simply rely on a sheer and inexpensive criticism of these failures. Failure is indeed possible and sometimes beyond our control. However, mankind can choose to penalize it or understand it, learn and recover from it (Edmondson, 2011). Indeed, recovering is still possible. Gandhi used to urge people to “become the change they wish to see in the world”.

There is a clear need for a paradigm shift of the global growth model. Thomas Kuhn (1962) in his book “The structure of scientific revolutions” is describing the preconditions for that, when he talks about the anomalies that cannot be resolved by the prevailing paradigm. Scientists, practitioners and states are exchanging arguments and views on the realization of the sustainable management vision as specific factors like a) the increase of world population to 9 billion people until 2050, b) the diminishing natural resources, their cost increase and the easy attraction of financial resources for businesses which are socially and environmentally responsible, due to balanced long term performance prospects, c) the volatility of energy prices, d) the global preferences of human resources to be employed in socially responsible corporations, e) the corporate legislation which is becoming stricter and requires disclosure of all relevant information by companies and f) the consumers` demand and expectations for eco friendly products from companies that are accountable to them, g) the increase in waste and disposal cost, h) the opportunity for gaining competitive advantage, set the boundaries for future development (EFMD, 2010; WBCSD, 2010), which has no alternative than being sustainable.

According to the trends on sustainability published by CERES (2010), investors have a positive attitude to companies that implement sustainability strategies. In addition, structural changes inside companies are reported as well as an increase in the time devoted to the discussion of sustainability issues. Increased stakeholders awareness and engagement is also reported, while many companies proceed in the disclosure of sustainability data. There is also a high percentage of companies (from the Fortune 500, 2006 list) reporting that they have human rights practices (93%) and a respective high percentage (75%) of companies that provide information on human rights issues. While these facts are quite encouraging, a great number of global corporations have fallen into serious environmental and human rights violations (eg. ILRF,2008; UNEP Finance Initiative, 2010).

As Professor Stuart Hart from Cornell University states, sustainability should not be left solely to the state (Hart, 1997). Sustainability has entered the field of business education, where conferences and special issues by prestigious journals (Harvard Business Review, Academy of Management Learning and Education etc) focus on the

areas that need to be transformed so that future managers are educated to produce business solutions scientifically and ethically correct. This trend is strengthened by the criticism exercised on the effectiveness of business education and its contribution to excellence. Therefore, despite inherent ambiguities in defining sustainability, it is an issue of growing significance for business schools, which are expected not to confront this issue with negligence or approach it as a new fad or “a just business issue”. The sustainability imperative impacts all educational and managerial processes of business schools and in literature there are both information regarding the progress made so far and examples of how it can be approached (eg International Journal of Sustainability in Higher Education). However, even if sustainability is seen through the lenses of institutional strategy, teaching methods such as experiential learning, new and /or multidisciplinary courses and new research frontiers, success and the linkage to excellence can be achieved through a sincere amplified awareness and understanding of the world and its subsystems that results in “knowing thyself” (the ultimate aim of education that has been described by Thales of Miletus -one of the seven sages of Ancient Hellas). Only then, excellence becomes action not because of laws or some business model requirements but as a logical consequence of conscience. The sustainable management vision presupposes a fundamental paradigm shift in management, as a scientific corpus or a well respected profession. In addition, national initiatives, investments and legal frameworks along with the supporting market trends constitute important empowering pillars for the sustainable management vision for excellence.

Therefore, the aim of this paper is a) to analyze the meaning of sustainability and its relation to excellence, b) to present the global challenges for sustainable management of the future and finally c) to examine how sustainability should be approached by business schools.

Sustainability and the challenges for sustainable management

“A human being is a part of a whole, called by us “universe”, a part limited in time and space. He experiences himself, his thoughts and feelings as something separated from the rest... a kind of optical delusion of his consciousness. This delusion is a kind of prison for us, restricting us to our personal desires and to affection for a few persons nearest to us. Our task must be to free ourselves from this prison by widening our circle of compassion to embrace all living creatures and the whole of nature in its beauty.”

Albert Einstein , Quotes

During the last years, there is a continuing awareness of the need for simultaneous development of the economy, society and environment, a practice called “sustainable development”. Sustainable development is based on the concept of sustainability (from the Latin “sustinere” which means to persist, endure and last). In natural sciences, the term sustainability refers to the ability of biological systems to remain healthy and productive for a long time while in the social field it is associated with the multidimensional long term maintenance of prosperity/wellbeing. The environmental dimension focuses on the reduction of human impact and the improvement of ecosystems through environmental management and the management and use of natural resources. The economic dimension refers to those practices and actions that will be undertaken by present generations so that future generations can enjoy the same level of wealth and prosperity (Durlauf and Blume, 2008). The social dimension of sustainability is related to human rights, global poverty, peace, security, corporate power and citizen action (Blewitt, 2008). While the issue of sustainability is brought at

the global forefront rather recently, the preservation of harmony in human societies has been a major priority in the ancient times. Harmony (the core of the sustainability concept, expressing the interrelations of non contrasting laws) is an omnipresent value found both in the micro and the macro level. From the smallest material particle (atoms or quarks), to the cells and the human body, to the galaxy and the universe, harmony assures existence and the continuation of life.

Sustainable development (a concept that became popular in the 1980s) aimed to underline the significance of development that meets the needs of the present without jeopardizing the ability of future generations to meet their own needs (Brundtland,1987). Some years after, in 1992, the World Summit for Environment and Development convened in Rio de Janeiro and adopted Agenda 21 (a programme for motivating society towards sustainable development). Sustainable development is recognised as a main axis also in European policy level which has led to the adoption of the European Strategy for Sustainable development in Göteborg. In 2005, the United Nations world summit put the interdependence and mutual reinforcement of the three dimensions of sustainability at the core of economic development. Cultural diversity has also been suggested as the fourth dimension for sustainable development (UNESCO, 2001).

Sustainability is a rather broad, evolving and dynamic concept. Collins and Kearins (2010) describe it as *“a “glocal” system`s level concept that transcends entity or national boundaries to embrace notions of equity, equality and futurity in relation, but not limited to economic, social and environmental conditions that support life for all”*. Sustainability places the corporation at the heart of interrelated environmental, economic and social systems (Bradbury, 2003). At the individual level, a cultural transformation is necessary against the traditional short term orientation and rapid personal enrichment towards self awareness and the sincere willingness of managers to be truly constructive in society.

The teachings and practice of quality management have led to an extended view of the enterprise, emphasizing on the issue of balanced corporate performance. There is a continuing ambition and attempt made by many organizations to achieve excellence. Excellence, according to business related literature may be seen as a) a corporate value, b) a purpose, c) a mindset of doing business and d) balanced performance in predefined dimensions. In the managerial / organizational context, excellence can be described as a framework that offers systemic view, presupposes high engagement of people, enables self improvement and evolution and thus it contributes to constant change and conformance to new situations through quality monitoring at each stage and every process of the organization (Anninos,2007). Nevertheless, excellence cannot be restrained strictly into the frontiers of an organization, but it relates to a great extent with the organizational impact on society (i.e it is not possible for an enterprise to be excellent and neglect corporate responsibility issues and/or business ethics). So, there seems to be an interaction between the concepts of excellence and sustainability. There can be no excellence without sustainability and there can be no sustainability without excellence. The inclusion of social and environmental parameters in some organizational models for excellence (eg EFQM) should be combined with a sincere change in management motives that would ensure commitment and excellence itself, in the long term. These two interrelated concepts (excellence and sustainability) have contributed in shifting the national, corporate and sometimes individual mentality to include the world and the society.

As suggested earlier, it is impossible to deny that global scale problems deserve attention and they should not be left only to the states or supranational actors. Researchers like Kaplan, (2003), Bello, (2004), Schroyer and Golodik, (2006) and Banner (2007) among others suggest a necessary transformation of social operation in order to re determine the relationship of mankind with nature. Being in accordance with United Nations relevant resolutions (2005), organizations should develop and execute strategies for sustainable development.

Managers are sometimes confused by the blurred boundaries of corporate sustainability and corporate social responsibility proliferated definitions and thus they are not able to understand what their company is doing and to what direction (Montiel, 2008). Corporate sustainability is a wider term referring to both voluntary and compulsory environmental and social action through transformative leadership for re-shaping business mentality and processes, markets and developing sustainable innovations through an integrated business model that puts ethics (towards man, environment and society) at its core. To achieve that, different sustainability models have been suggested (such as the EFMD 7P model, the CERES roadmap etc). Regardless of the model used, the sustainability vision should be aiming at raising a company-wide awareness and spreading to all business functions, providing opportunities to human resources to be involved in sustainability experience, integrating sustainability to the corporate learning strategy and the company knowledge system (Haugh and Talwar, 2010).

The sustainability concept is being integrated in the corporate DNA through for example environmental friendly facilities and equipment, product design and production methods minimizing energy consumption and lowering emissions, ethics orientation, participation in social and humanitarian actions (Haugh and Talwar, 2010). Even though there are costs involved in such attempts (see for example Jaffe et. al, 1995), a number of researchers such as Porter and Van der Linde (1995); Ellen et al.,(2000); Orlitsky et al., (2003); Porter and Kramer,(2006); McWilliams and Siegel, (2001); Peterson, (2004); Aguilera et al.,(2007) and Brønn and Vidaver-Cohen, (2009) underline the benefits that a company can achieve through the sustainable management orientation.

Corporations will have to deal with challenges like a) the incorporation of externalities, the improvement in the use of resources and waste while lowering environmental aggravation and increasing their active initiative undertaking towards workforce and social well being, the design and production of innovative products that qualitatively transform the standard way of living, b) the structural and operational reengineering and the relevant corporate behaviors that should not only be confined to an on the surface rhetoric of sustainability. Corporations should proceed to a vigorous revision of organizational culture and operation, thus replacing the dogma of resource sufficiency (that promoted the sheer exploitation of nature), social negligence and self orientation along with its intellectual framework, c) the formulation of a sustainable management vision which requires a novel, broad in scope, perspective of corporations and management that would truly understand and utilize the natural, social, economic, technological and corporate system with respect to cultural and historical dynamics. This means that there may be different sustainability visions and certainly not a dominant one, as was the western till recently. In any case, corporations will have to satisfy both shareholders and stakeholders.

It is interesting to note at this point that CEO's business education impacts positively on the corporate environmental performance due to improved profit prospects (Slate and Dixon-Fowler, 2010). However, being responsible just for profits is different from being responsible due to transformed consciousness, values and altered world views and this is where the significance of a proper business education lies.

Sustainability in business education

"There's only one corner of the universe you can be certain of improving, and that's your own self. So you have to begin there, not outside, not on other people. That comes afterward, when you've worked on your own corner"
Aldous Huxley

It is without doubt to say that business education adds value a) to people (as individuals) and b) to organizations, as Longenecker and Ariss (2002) suggest, since it helps them achieve competitive advantage through i) exposing managers to new ideas and business practices which are needed in a changing environment, ii) motivating managers to improve performance and help them develop their skills, iii) providing opportunities for reflection, introspection and self appraisal, iv) increasing managers' confidence, reducing stress level and challenge them think in a different way and v) encouraging managers think about their career development and be the example for their subordinates, and finally c) to society by emphasizing on the development of mature and capable citizens to lead fulfilling lives and help sustain democratic and learned culture and on the provision of knowledge and skills to students to sustain a corporate economy.

A basic element for successful managerial activity is business education whose quality has a major impact on what managers perceive and understand regarding business activity, on their ability to analyze, evaluate and bring together management theory, experience and practice, on using management techniques and making decisions by taking into account hard and soft issues in order to produce wealth. The essence of business education, for more than a century, is perceived by managers and global academic leaders as being synonymous to the provision of a certain knowledge corpus that will enable individuals to acquire a global mindset and act to achieve high self and corporate performance levels.

Despite the fact that the business education model has incorporated all the major changes regarding structure and curriculum that were considered necessary during the 80s and 90s (such as emphasizing international dimension, training in soft skills and converging educational content with real business situation) (Pauca-Caceres, 2008), a significant number of researchers and renowned management gurus point out the need for restructuring and improving business education (e.g Mintzberg and Gossling, 2002; Pfeffer and Fong 2002; Ghoshal 2003, 2005; Bennis and O' Toole 2005; Holstein 2005; Tsurumi 2005; Ferrano et al. 2005).

While there is no empirical evidence to support the view that business schools should undertake fully responsibility for the current crisis (Neubaum et al. 2009), (as education is not the only enabler of human behavior), business schools must see this crisis as an opportunity to provide their students with an alternative perspective on management (by encouraging their students understand and think upon corporate responsibility and business ethics issues, equipping them with all necessary knowledge and skills to understand and critically approach management practice, managing problems of ethics

and involving them at the individual level in learning ethics through the analysis of actual cases (Anninos and Chytiris, 2012).

Sustainability (in management practice), innovation (in all business school processes) and integrated management approach (science, theory and ethics) are presented as key factors for excellence in the future. In the last 3-4 years the issue of sustainability is gaining momentum in the field of education (Holliday, 2010) due to the intensification of the aforementioned sustainability forces (Charan, 2009; Friedman, 2008). Business education is in a state of necessary transformation in order to meet the needs of a sustainable management vision of the future, something that as Marschall et al.,(2010) report, seems to be progressing at a slow pace. To avoid losing ground in competitiveness and become marginalized and outdated, business schools should quickly adjust the curricula and operation model to prepare graduates to respond to the new emerging sustainability paradigm. The development of the Principles for Responsible Education in 2007 by leading business schools and institutions is helping towards that direction. The leading MBA programs that have incorporated the social and environmental perspective into their curricula are ranked by the Beyond Grey Pinstripes survey (Kurland et al.,2010).

Sustainability should be integrated at the conceptual, theoretical and practical level of business education. In the case of the conceptual level, future managers must be able to understand the connection and interaction of basic principles and acquire a broad perspective of management through the study of philosophy, logic, ethics, metaphorical literature works and arts. This contributes to the development of meddlesome and inquisitive minds and personalities that critically approach and creatively doubt management models and theories. At the theoretical level, students participate and learn the scientific foundation of management and develop technocratic abilities through the study of the traditional business education curriculum from a multidisciplinary perspective. Finally, at the practical level, students engage in business-academia hybrid experiential learning activities and knowledge exchange systems and become aware of the interactions between the economic, social and environmental parameters and business decisions.

Between the two approaches of incorporating sustainability into the curriculum, namely the one suggesting that sustainability should be a distinct course (Gruenewald, 2004; Carrithers and Peterson, 2006) and the other suggesting that it should be diffused in all courses (Ghoshal, 2005; Stubbs and Cocklin, 2008; Audenrand, 2010), the second is most suitable as it allows for broadening and challenging students worldviews, better opportunities for knowing thyself and seeing the sustainability dimensions in every area of business activity.

There are certain literature findings that document an increasing trend in business schools regarding the incorporation of sustainability courses into their curricula, the use of experiential learning and immersion techniques and the integration of the sustainability logic in business thinking (Matten and Moon, 2004; Christensen et al.,2007; Wu et.al, 2010). However, Benn and Martin (2010) and Gray and Collison (2002) refer to a serious obstacle, namely the tendency of faculty to teach and research sustainability from their own discipline specific perspective. This is further complicated by the inherent obscurity of the meaning and content of sustainability in the business world. Thomas and Benn (2009) also refer to the issue of institutionalization of change

and the management of complexities both inside institutions and among universities and communities. To effectively overcome the above barriers, sustainability should be approached as a strategic issue for business schools, embedded initially in the institutional organizational model, something that was noted in a relevant issue of the Journal of Management Education (Rusinko and Sama, 2009). Deans and faculty should show commitment to the sustainable management vision and practice. Transformative leadership, cultural web, use of resources, emphasis on satisfying the stakeholders demand as well as institutional accountability constitute organizational parameters that display the sustainability orientation of a business school.

With regard to the educational functions, namely teaching, research and social contribution, business schools should become cells of extended physical and web based networks for facilitating knowledge, experience and best practice exchange in which private, social and state actors participate. This is also highlighted in the works of Bartunek, (2007) and Brydon et al.,(2003). Teaching and research should be multidisciplinary, interdisciplinary and multithematic since business education is primarily university/higher education. It is based on (at least at the university level) mental, methodological and scientific processes that should help students acquire a holistic perspective of the world. The more holistic approach is implemented in business education, the more possible it is for future managers to proceed towards knowing themselves which leads to the revision of personal goals, the acquisition of empathy, the undertaking of company-wide sustainability initiatives, the rejection of the ego/corporate centered mentality and the conscious and influential practice of ethics for the sake of ethics and not due to deceptive stimuli that wear out the foundations of a corporate economy. As Stubbs and Cocklin (2008) admit, the presentation of sustainability issues from a business education perspective is a challenge. The following table presents an example of how different fields could contribute to the setting of foundations for the sustainable management vision (Table I).

Table I: The contribution of different fields to sustainability

Fields	Examples of future managers` critical abilities for sustainability
Business core areas: Management - Human Resources Management/Organizational Behavior – Marketing – Production/Operations Management -Economics- Finance and Accounting and relevant quantitative courses	Ability to efficiently and effectively manage resources, train and develop HR, incorporate externalities, develop and execute a sustainable strategy and policy, understand and utilize challenges for competitiveness, evaluate multidimensional performance, deal with corporate governance issues, build innovative products and services, understand how theories and models of macro and micro economics affect human prosperity and corporate actions, understand limitations, ability to maximize shareholders (and stakeholders) wealth, ability to design and operate efficient and effective business processes and procedures for products and services, knowledge of production techniques, use of technological potential for sustainable competitive advantage
Environmental Sciences	Interdisciplinary approach of the environment and environmental problems through the study of fundamentals of natural and biological sciences, ability to understand how environmental problems impact the organization and vice versa
Information technology – Knowledge management	Abilities to use modern technology to create, share and diffuse knowledge and ideas related to sustainability challenges and relevant corporate actions
Sociology	Ability to understand human social activities, the interaction of micro and macro systems and social structures
Politics	Ability to perceive and understand how politics can affect management decisions and act to deal with sustainable management problems
Urban Studies	Ability to understand how economy, planning, architecture, ecology, transportation, social relations in urban areas affect organizational issues and decision making

Ethics and Philosophy	Analysis and study of morality, critical and systematic approach, rational argumentation and constant inquiry and dialogue relevant to existence, mind, knowledge, ideas and values, reason and language
Psychology	Ability to understand the human mind and behaviour, the mental processes that determine the what and how of human behaviour
Culture	Abilities to understand and utilize a diversified workforce, understand how cultural issues affect management decisions, how cultural factors co develop the way of living, thinking and behaving
Literature and arts	Abilities for self awareness, for reflecting and discovering changes of cultural values, for discovering new frontiers of scientific endeavours

Scientific collaboration in research as well as in teaching should also be encouraged and recognized. Creative thinking, experiential learning and critical abilities to investigate the potential impacts of management decisions in various fields should also be emphasized through co curricular activities and social contribution (eg opportunities for recycling, participating in waste and energy management joint business academia projects and undertaking of socially supportive actions).

Conclusions

The greatest challenge for the 21st century manager is walking on the path of self awareness. The awareness of this reality is enough to reshuffle the human mind, engage it to mental processes that contribute to the higher understanding of life through the perception of mankind in relation to the whole universal structure.

The intensity and the rapid enlargement of environmental and social consequences of the dominant global growth model push towards a revision of our scientific and mental way of thinking and living on a national, corporate and even personal level. As basic institutions of modern culture, corporations should reconfigure their business models and their underlying values and beliefs of their mission to respond the aforementioned sustainability challenges and maintain their competitiveness through excellence. Some positive steps have been reported, however working towards a sustainability vision requires greater attempts in scale. It is to be reminded that as excellence may take different expressions, there are many ways of progressing towards sustainability that can be generated through the combination of culture specific elements and management knowledge corpus.

A basic precondition for moving to a new kind of management practice is refining the mental software of managers, which is their education. Progress –even if it is slow- is indeed noted regarding the integration of the sustainability concept in business education and practice. Bearing in mind that education is only one parameter that defines human behaviour, multi and inter disciplinary and inter-thematic approach of management is needed to help future managers develop sounder hypotheses in their understanding of the world and their own selves, thus conquering knowledge which is attained through stronger foundations of approaching the mind, something that Plato considers as the ultimate goal of man. This will lead to the integration of sustainability at the conceptual, theoretical and practical level of business education, impacting on the values, purpose and methods used by corporations to serve mankind.

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Budget Ratcheting and the production function

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Introduction

Target setting is at the core of the planning processes in organizations. Targets define an expected level of performance and converge into planning documents such as the budget. Coordination, resource allocation, and performance evaluation are organizational activities intimately associated with planning and target setting. Managers use a diverse set of information sources to set targets and weight these different sources depending on a myriad of factors particular to the organizational unit (Fisher et al. 2002).

While traditional researchers investigating target setting have assumed fixed targets (Holthausen et al. 1995; Gaver et al. 1995), some theoretical as well as empirical studies (Alison et al. 1991; Leone and Rock 2002) suggest that past performance may be optimally used to set targets. The use of past performance, known as the ratchet principle (Weitzman, 1980) happens when targets for the current year are influenced by the difference between last year's performance and its target. In particular, a favorable variance last year is associated with an increase in the target for the current year, while an unfavorable variance is associated with a decrease in next year's target (Lee and Plummer 2007; Ettredge et al. 2008).¹

Past performance may provide relevant information to set targets if variances (actual versus expected performance) are associated with permanent (versus transitory) changes in performance. If so, unbiased expectations about future performance will incorporate the magnitude of these variances leading to ratcheting. In contrast, if variances capture transitory changes, then unbiased expectations will not incorporate these variances. The challenge is, therefore, to separate permanent from transitory components of performance improvements. To do so, it is necessary to understand the ultimate source of variance and to explore its expected change in the future.

¹ We use a broad definition of ratcheting without constraining it to be symmetrical (Weitzman, 1980) or asymmetrical responses (Leone and Rock 2002) to favorable and unfavorable variances. Our empirical findings indicate that the asymmetry of these response coefficients vary with the information environment of the manager setting targets. Symmetrical as well as asymmetrical responses are observed with varying information environments.

Permanent innovations (e.g. improvements in efficiency) can be sustained without posterior increases in effort, whereas transitory innovations require agents to continue increasing their effort in subsequent periods. Thus, investigating the relation between effort exerted and performance achieved, as the economic theory does in the production curve, will be of help in separating the two types of improvements. Although the production curve is a significant part of the economy applied to various circumstances and situations, it that has generally been ignored in the budgeting literature. Prior budget research assumes that the relation between effort (the input) and performance (the output) is linear and unbounded, in contrast to the assumption made in the production curve theory that this relation changes across the production curve. As effort levels increase and maximum capacity is approached, more effort is required to achieve the same improvement in performance, and consequently, the improvement potential will depend on the current position on the production curve or the current level of effort.

In this paper we incorporate the productive capacity as a source of information in the target setting process. We study how the level of effort implied in the current target affects the revision in subsequent periods. That is, how the level of current targets in relation to the productive capacity affects targets' revision. We investigate both a direct effect together with an indirect effect that comes from the change in the informational content of past performance (interaction effect with budget ratcheting). In so doing, we use the budgeted and actual performance of 376 branches of a travel agency between 2002 and 2006 (for a total of 1,105 branch-year observations). Though these branches vary in terms of the local market, their size, and individual talent, they are similar in that they sell comparable products with pretty homogeneous marketing and operating practices. Therefore, targets and performance of other branches may have information content relevant to decisions making. Specifically, the performance in relation to comparable branches (relative performance evaluation -RPE) can be used analyze current variances, and targets in relation to comparable branches (relative target setting -RTS) can be used to revise targets. Hence, actual performances (targets) can be a good proxy of the position on the production function at which the branch operates (is asked to operate).

Consistent with prior results, we first find evidence of the ratcheting phenomenon in revising sales yearly targets. We also find that relative target setting (RTS) is associated with next year's target. In particular, branches whose targets for the previous year were above the average of comparable branches have their targets for next year reduced and branches bellow the mean have them increased. Branch's location on the production curve affects targets as well as past performance does.

Second, we find that RTS and past performance (ratcheting) interact. The magnitude of ratcheting changes depending on the value of RTS: targets for those branches performing above the mean and having favorable variances are not ratcheted as much as targets of branches performing below the mean and having favorable variances. Conversely, targets for those branches performing above the mean and having unfavorable variances are reduced more than targets of branches performing below the mean and having unfavorable variances.

Moreover, while previous works have provided empirical evidence of ratcheting being asymmetric, i.e., there is an asymmetric response to favorable and unfavorable variances with the effect being more pronounced for favorable variances (Leone and

Rock 2002), we found that this results is only a particular case that applies for branches located on the left side of the production curve. For those branches around the middle of the curve the ratcheting coefficients are symmetric, and finally, for branches on the right side of the production curve the ratcheting coefficient for unfavorable variances is higher than that for the favorable variances.

The paper contributes to our knowledge of target setting within the context of the budgeting process and control in decentralized organizations. The evidence is consistent with past performance and economic information about productive capacity being relevant to form expectations about future performance. The results also indicate that these two sources of information interact. The paper reinforces the presence of ratcheting in organizations. Yet, it highlights that the significance of the ratcheting and its shape across favorable and unfavorable variances (symmetric versus asymmetric response) is not fixed but rather responds to the position on the production function of the target against to which the performance is measured. The paper identifies relative target setting as good proxy for the branch's location on the production curve and then as relevant variable to the budgeting process.

The research setting is limited to one company and the results cannot be generalized to other settings. Rather they are intended to provide evidence consistent with theoretical predictions associated with managers' use of information. Future research may extend the findings in the paper to other settings and investigate how alternative characteristics of the target setting process may affect the relevance of past performance and relative target setting on future targets.

The rest of the paper is organized as follows. Next section presents theoretical arguments leading to the prediction of ratcheting and production function influence and develops the hypotheses empirically tested. Section 3 describes the research setting and the research design. Section 4 presents and discusses the results. Section 5 concludes.

Theory and hypotheses

In a dynamic setting firms tend to revise targets over time. Managers are uncertain about the performance potential of employees for the information is by no means complete and precise. Yet the firm presumably learns over time and uses information on current target deviation to identify what is feasible in future periods and how to set subsequent targets. This tendency to base target adjustment in the subsequent period according to reported performance relative to budgeted performance in the current period, coined the "ratchet principle"² (Weitzman, 1980), has later been documented in empirical studies such as Leone and Rock (2002), Leone et. al. (2006) or Bouwens and Kross (2011).

Current target deviations are certainly relevant when setting future targets. However its information content about employee performance potential will surely depend on the type of innovation that caused the favorable (unfavorable) deviations. In this regard,

² Also designated with the term target ratcheting. Though Weitzman (1980) describes a symmetric response to positive or negative departures from budget, Leone and Rock (1992) interpret it in an asymmetric manner. That is, positive variances in performance from budget lead to greater absolute changes in the following period's budget than do changes associated with negative budget variances of the same magnitude.

Leone and Rock (2002) distinguish between permanent innovations and transitory innovations. Permanent innovations (e.g., improvements in efficiency) have a permanent effect on performance and can be sustained without posterior increases in effort. On the opposite extreme, transitory innovations refer to positive performance effects that can only be sustained by agents continuing to increase their effort in subsequent periods (Bowens and Kross). The two types of innovation have radically divergent implications in terms of future effort. Consequently, when revising targets, managers should account for the type of the innovation that caused the current target deviation. This is theoretically the spirit of the ratchet principle. In practice, there is likely to be a combination of transitory, permanent, and partially permanent innovations and it is improbable that firms will be able to discern the persistence of a given innovation. The consequence of this grouping is that each improvement in performance will most probably require an increase in effort: the raising of targets is always more demanding in terms of effort.

The question is how much the effort of the agent (a branch in our empirical analysis) should increase to reach the more exigent target. In the short run, where technology is fixed, the production function theory suggests that it is likely that output will increase with the level of input, but it does so at a decreasing rate (see, for instance, Varian). Using effort as input and performance as output, economic theory predicts a concave relationship between effort and performance: as effort levels increase and maximum capacity is approached, more effort is required to achieve the same improvement in performance. Alternatively, the performance improvement potential is conditioned to the current position on the production curve or to the current level of effort.

If the production function is a significant part of economic theory, why has it generally been ignored in the budgeting literature? In our own judgment, the reason lies in the fact that effort is an extremely difficult construct to quantify in each different setting. Testing our predictions necessarily requires the development of a quantitative variable able to capture the position of an agent on the production function with effort as input.

Conceptually, how hard a person works (effort) is different from job performance. Rather, it is necessary to search for a suitable point of reference. In other disciplines such as finance, it is common to look for a benchmark against which to compare the performance or the returns of a financial asset (for instance the Capital asset pricing model). Relative performance is a coined term that refers to the performance of a security compared to that of a relevant index.

In compensation theory, if the shocks to firm performance are correlated across firms in an industry (i.e., under common underlying uncertainty), then the optimal incentive scheme compensates a firm's manager on the performance of her firm relative to those of other firms (see Holmström (1982)). Relative performance evaluation (RPE) has often been identified as an effective way of eliminating noise in performance evaluation and enhancing its effectiveness (Holmstrom 1982; Holmstrom and Milgrom 1987). At the top management level, relative performance evaluation is associated with external criteria such as the level of performance of comparable companies ("peer group") (Aggarwal and Samwick 1999; Garvey and Milbourn 2003). Comparable companies relevant to RPE have been shown to be companies not only within the same industry but also similar in size, technology, and complexity (Albuquerque 2009). At a

responsibility center level, centers are more comparable the closer they are in size, operational structure and market environment.

H1: There is a decreasing relation between expected changes in performance and current relative performance with respect to peers.

Diminishing returns to effort (i.e., the performance-effort concavity shape) have important implications on target setting. First, the increase in targets that can be rationally requested from agents should be linked to their current position on the production curve, determined by the current level of effort. Second, when targets ratchet, “agents make a trade-off between the current rewards derived from favorable performance and the future losses derived from the assignment of higher targets. If an agent becomes convinced that manipulating future targets—for example, by reducing their current performance—will increase the total wealth they stand to gain from current and (expected) future performance, they will do so.” (Bowens et al. 2011, p 6).” The strength of this pervasive incentive effect, referred to in the literature as the “ratchet effect” (see, e.g., Murphy (2000), Bowens et al. 2011.), is expected to increase with the current level of effort. Those agents already near their maximum capacity will tend to hold back effort to avoid any over-fulfillment of targets (positive deviation from targets) that would result in even more difficult future targets. However, the moral hazard problem will not be as severe for easier current targets. Equal deviations from targets, and equal target revisions, will trigger different reactions in terms of effort on the part of the agents. Aware of this phenomenon, senior managers would react rationally by conditioning the strength of target ratcheting to the position on the production curve.

As far as we know, prior budgeting literature has overlooked these two implications: the dependence of the target revision process, and the incentive problems that come along, on the production curve. Both in the theoretical work of Weitzman (80) and in the empirical tests of Leone and Rock (2002), the change in targets is modeled as an independent increment, which represents how much the target would change if it were exactly met, plus a linear function of the deviation in performance from target -- strength of the ratchet principle (equation 3 in both authors).

The independent increment is the same for all observations (business units from the North American division of a large multinational corporation in the case of Leone). For example, if business-units A and B exactly met the profit target before interest and taxes in period t (there was no deviation), both would see their target increased by the same amount, even if the target in period t was \$1.911M for unit A and \$7.641M³ for business-unit B. The difference in the level of targets between units, A and B, would also imply differences in the relative degree of effort. This, leveraging on the diminishing returns to effort, we claim that the revision in targets for each observation in the sample (business-units or branches in our empirical analysis) should adjust for the level of effort implied in its current target. That is, when revising targets, senior managers should complement past performance information (i.e., ratcheting) with an additional source of information that captures the relation between effort and performance, as the performance levels increase. In other words, we predict a direct effect of effort on the revision target process. In the comparison of each agent’s performance to that of their peers, targeted performance is considered instead of actual,

³ Figures are from Leone and Rock’s Table 3, Q1 and Q3.

we will measure the relative degree of difficulty -- effort – implied in the given target. In this case, we will refer to relative performance with the term relative target setting (hereafter RTS). Then

H2: Relative Target setting is negatively associated with performance targets.

In relation to the modelization of the ratchet principle, the budgeting literature (Leone and Rock, 2002,...) has used a linear equation. The coefficient represents the change in targets associated to a change in the variance from the previous year's target. For example, in Exhibit 4 of Leone and Rock (2002) the estimated coefficient is 0.868⁴. The target for the next period will increase in this amount per dollar of positive variance. The fact that this coefficient is modeled as a constant implies the same target revision per unit of variance.

However, the improvement potential upon a certain positive deviation from current targets, and the strength of the moral hazard problem, depend considerably on the current level of effort. As effort level increases and agents move to the right on the production curve, any further improvement in performance is more costly in terms of effort. Similarly, agents confront higher moral hazard problems. For both reasons, the informational content of past performance varies with the position on the production curve, and, [consequently, the coefficient that captures and incorporates this source of information into the target revision process should also vary: equal positive deviations from targets (i.e. ratcheting of the same magnitude) will have to trigger different changes in targets. That is, senior managers will increase targets to a lower extent as agents move to the right on the production curve. We predict a negative sign for the interaction effect.

H3: Higher relative target setting (RTS) reduces the impact of target ratcheting on performance targets.

Research Design

Description of the research site

This study uses quantitative and qualitative field data from a large European travel company together with official government data for the industry. The company has operations in all of the stages of the industry's value chain including: travel agencies, tour operators, airlines, receiving agencies, and hotel chains. The travel agency has four business units: (1) vacation (individual), (2) business travel, (3) conventions and incentive trips and, (4) conference organizing. The research site for this study is the vacation division within the travel agency division that had a revenue of €444 million in 2006, about 60% of the travel agency's revenues.

The vacation division had between 244 (2003) and 361 (2006) branches located in a European country and structured around 13 geographic areas, each one managed by a regional director. These branches, treated as a separate responsibility centers, sell only vacation products; the other three business units use different distribution channels for their products with a heavy emphasis on a direct sales force. Each year branch managers

⁴ The modelization of the ratchet principle is asymmetric in Leone and Rock (2002). For a negative variance, the next year's target decreases in \$ 0.521 (0.868 -0.347).

have a revenue target for their branches linked to economic compensation. This target is set for what the company calls “guided sales.” These are sales of products from other divisions in the company (tour operator, airline, receiving agencies, and hotels) and specific suppliers considered as strategic for the company. The ratio of “guided sales” to total branch sales (which has been increasing throughout the years) is decided at the division level. Therefore, once a target “guided sales” is defined, overall sales are also set through this ratio. The target profit for the branch is also set through expense ratios (such as representation expenses over sales, discounts over sales, etc) in a similar way as total target sales are determined. Thus, once the target “guided sales” is decided, the rest of the branch’s income statement is created mechanically through mathematical calculations.

The “guided sales” budgeting process starts with a negotiation between the branch manager and the regional director. This negotiation takes into account last year’s performance, expected changes in the industry, changes specific to the particular geographic area of the branch, and any relevant unique issues that the branch may face. Once “guided sales” targets have been set for all branches, regional directors review the overall target with the general manager of the division to insure that branches’ targets reach the financial objectives set for the division. Regional directors then inform branch managers about their final “guided sales” and associated profit target.

The incentive system works at the branch level and the bonus for the branch is assigned to the employees of the branch according to their professional rank. Table I describes the incentive system. The bonus accounts for 10 to 20% of a branch employee’s salary. Half of the bonus is associated to “guided sales.” This part of the bonus is paid bimonthly and kicks in from the first euro sold (much like a commission). The other half of the bonus is determined at the end of the year and is based on profits. This part of the bonus has a floor at 70% of the targeted profit below which this half of the bonus is not paid. Between 70% and 130% of the targeted profit there is a linear relationship between target achievement and the bonus; if the branch reaches 70% of the profit target it receives 70% of this part of the bonus, at 100% the branch gets the full payment associated with this piece of the bonus, and at 130% it gets 130%. Beyond this threshold, the bonus does not increase. For example, a branch that precisely meets its “guided sales” and its profit targets, would get 100% of the bonus. A branch that sells 10% above its target “guided sales” would receive a sales-related bonus of 55% of the expected total bonus ($110\% * 50\%$); if this branch’s profit was 20% above the targeted profit it would receive an additional 60% ($50\% * 120\%$) of the expected total bonus. The total bonus would be 115% of the expected total bonus.

Table I
Incentive System for Branches

Estimation period: One year

Performance measures	Weight	Thresholds and caps
“Guided sales”	50%	None
Profit	50%	Less than 70% of the target: 0% of the bonus Between 70% and 100% of the target: linear; full bonus payout if it reaches 100%

		Between 100% and 130% of the target: linear up to 130% of full bonus payout Beyond 130% of the target: 130% of the full bonus payout
Non-financial performance measures Internal audit Database management Discounts Bad debt	Associated with prizes and/or penalties	Based on scales Based on scales Proportional Based on scales

In addition to this two-piece bonus, branches have rewards (and penalties) associated with the outcome of internal audits, quality of the customer database, level of discounts given, and bad debt expense. A subjective bonus may be added to this incentive scheme to account for exceptional events at a particular branch.

Data collection and variable description

The study is based on a total population of 376 branches of the vacation business unit during the period between 2002 and 2006. For a branch-year to be included in the analysis, we require performance information actual (A_{t-1}) and budgeted “guided sales” (B_{t-1}) for year $t-1$, budgeted “guided sales” (B_t) for year t , and other relevant variables for year t (all of them available if B_t is available). Thus, our first year of analysis is 2003 (using budgeted “guided sales” for 2003 and actual performance in 2002) and our last year is 2006 (using budgeted “guided sales” for 2006 and actual performance in 2005). The total number of branch-year observations is 1,105. Table II describes how the final sample is determined. For a certain year only offices that worked the previous year and were not closed during the current year (for which there is no budget for the year as the decision to close is made before the year starts) are eligible. For instance, to build the 2005 sample, we start with the 294 branches that worked in 2004 and thus their actual versus budgeted performance is available ($A_{t-1} - B_{t-1}$). We subtract the 11 branches that were closed during 2005 for a 2005 final sample of 283. In addition, 78 branches were opened during 2005 (for which we have B_t but not $A_{t-1} - B_{t-1}$) giving a starting number of branches for 2006 of 361.

Table II
Sample Construction

	Years				Total
	2003	2004	2005	2006	
Number of offices with information available from the previous year: $A_{t-1} - B_{t-1}$	244	238	294	361	
Number of offices closed for which there is no information on the current year: B_t	7	4	11	9	
# Observations for the year	237	234	283	352	1,106

Number of offices opened during the year for which there is no information from the previous year: $A_{t-1} - B_{t-1}$	1	60	78	38
Missing data				<u>1</u>
Final sample				<u>1,105</u>

Table III, Panel A provides descriptive statistics from 2002 to 2006 on budgeted and actual average branch “guided sales” and total sales and the relationship between these two variables. During this period, target “guided sales” grew from €647,596 to €929,385 and the percentage of target “guided sales” to total sales also grew from 67.6% in 2002 to 76.8% in 2006. The budget increase for “guided sales” varied from 15.5% (2003) to -0.54% (2006). Actual “guided sales” growth varied between 15.9% (2003) and 3.6% (2005). Finally, Panel A, Table 3 indicates that the percentage of branches that exceeded the “guided sales” budget varied between 25.2% (2005) and 50.7% (2004) (the average percentage of year-branches that exceeded this target was 42.3%).

Table III, Panel B provides additional descriptive statistics on the previous variables. The average “guided sales” are €766,615 compared with an average target of €840,329. The average percentage of actual “guided sales” over total sales is 75.7% while the average target is 73.9%. Finally mean branches’ “guided sales” were €28,932 below their targets.

Table III
Mean Performance Standard and Variances
Panel A: Descriptive Statistics Over Time

(in €)		ACTUAL				BUDGET					$(A_t - B_t) > 0$	
Years	# of obs.	Average sales per branch	Average "Guided sales" per branch	Percentage "Guided sales" to total sales per branch	Average Increase in "guided sales"	# of obs.	Average Sales per branch	Average "Guided sales" per branch	Percentage "Guided sales" to total sales per branch	Average increase in "guided sales"	Percentage branches that exceeded "total sales" budget	Percentage branches that exceeded "guided sales" budget
2002	270	829,442	615,641	74.20%		244	962,010	647,596	67.61%		21.72%	46.72%
2003	267	959,849	713,427	74.19%	15.88%	238	1,048,802	748,013	71.65%	15.51%	36.97%	46.22%
2004	378	1,027,247	766,525	75.55%	7.44%	294	1,139,253	839,818	74.39%	12.27%	37.07%	50.68%
2005	403	1,055,075	794,078	75.95%	3.59%	361	1,242,436	934,474	76.06%	11.27%	24.93%	25.21%
2006	390	1,138,557	879,257	78.02%	10.73%	390	1,224,299	929,385	76.80%	-0.54%	38.46%	42.56%

Panel B: Descriptive Statistics of the Sample

Variable	Mean	Std. dev.	Q1	Median	Q3
A_t	766,615	406,855	494,597	689,608	956,919
B_t	840,329	406,005	580,131	754,141	1,024,311
A_t/AS_t	0.757	0.101	0.703	0.773	0.826
B_t/BS_t	0.739	0.086	0.690	0.748	0.801
$(A_t - B_t)$	-28,932	154,660	-120,145	-28,486	58,288
$(A_t - B_t) > 0$	104,934	116,572	33,539	75,935	135,577
$(A_t - B_t) < 0$	-122,951	-98,739	-51,141	-100,072	-173,937

A_t is actual "guided sales," B_t is budgeted "guided sales," AS_t is actual total sales, and BS_t is budgeted total sales.

Our variable of interest is the change in budgeted “guided sales” defined as $(B_{i,t} - B_{i,t-1})$. The ratcheting effect predicts a relationship between this change in budgeted “guided sales” and last year’s actual “guided sales” relative to their target defined as $(A_{i,t-1} - B_{i,t-1})$. We further define a dummy variable to capture the possibility of an asymmetric impact of the ratcheting effect depending on whether the variance is favorable or unfavorable. $U_{i,t-1}$ is equal to 1 for unfavorable variances ($A_{i,t-1} < B_{i,t-1}$) and zero otherwise (see Leone and Rock, 2002).

Supervisors can incorporate information from comparable branches to remove noise from the target and to make evaluation more effective. In our setting, branches meet the necessary requirements to be considered as comparable for they sell similar products with pretty homogeneous marketing and operation practices. In addition, once targets are set for all branches, these have negligible influence over accounting decisions (e.g. discretionary accruals), pricing policies or investment expenditures. To increase performance, branches have few options other than expending more effort (much in line with the argumentation elaborated by Bouwens and Kross (forthcoming JAE). Sales activity in this setting could be considered as an effort-intensive task, and according to our arguments, the actual performance of a branch relative to those of its peers will capture the relative level of effort, and therefore, will signal the location on the production curve. Relative performance per branch (RP) is measured comparing its actual “guided sales” per employee (to consider size effects) to the average actual “guided sales” per employee for the branches in its region. In particular we define it as:⁵

$$RP = A_{i,t-1} / employees_{i,t-1} - (\sum_{j=1}^n A_{j,t-1} / employees_{j,t-1}) / n$$

Where n is the number of branches in the region. A positive RP indicates a current relative level of effort higher the average level of effort for the branches in the same region. The larger is the value of RP, the further to the right on the production curve is a branch. RP is the measure used in testing hypothesis 1.

Hypotheses 2 and 3 examine the interplay of the factors that influence the target setting process. Targeted “guided sales” is the variable of interest, and therefore we develop a measure of the relative degree of difficulty of targets: relative target setting (RTS). RTS conveys the same idea as RP, and also has the same definition but substituting budgeting “guided sales” for actual “guided sales”. The definition then is:

$$RTS = B_{i,t-1} / employees_{i,t-1} - (\sum_{j=1}^n B_{j,t-1} / employees_{j,t-1}) / n$$

As in the above formula, a positive relative target setting indicates a challenging target in that it is higher than that of the branches in the same region. A negative RTS indicates the opposite.

In addition to the main variables in the model, we control for variables that may affect changes in targets over time. Branches that have additional resources to their disposal are likely to see their targets increase. Our research site has a service orientation and its main resource is the employees who perform the commercial transactions. The main

⁵ We use last year’s targeted performance to avoid transitory components that may affect actual performance. We also ran all our tests using the same variable definition but replacing budget with actual performance. The results reported are robust to using last year’s actual performance instead of targeted performance unless reported otherwise. The correlation between RTS using budget and actual performance is 61%. We also ran tests incorporating both variables together to explore whether relative difficulty (budgets) has a different effect from relative performance (actual).

resource is the number of people working at the branch. We measure the “additional branch resources” variable as the change in the number of employees in the branch from the previous to the current year. This definition considers the fact that most decisions about the size of a branch (in terms of number of employees) are made during the planning period. Because at certain periods during the year temporary personnel is hired, we define number of employees as total number of hours worked divided by the working hours of a full-time employee. To control for size we include number of employees.

We control for changes in the level of competition as an increase in the number of competitors will affect the expected level of sales. We capture the change in competition as the change in the number of travel agencies’ branches (our research site as well as its competitors) per thousand inhabitants. This data comes from the government statistical office. We compare the current to the previous year. We measure this variable at the regional level.

Because the uncertainty around the performance potential may vary among branches, we separate new and mature branches using a dummy that identifies those branches older than four years.

We also control for changing economic conditions across time using dummy variables for each year. Targets may vary year to year depending on expectations for the coming year and whether the economic situation will improve or deteriorate.

Finally, we include a dummy for each region to control for the potential effect associated with the supervisor. Because the target setting process is negotiated between the branches and the regional supervisor, this person’s approach to the target setting process may affect the final targets.

Table 4 presents descriptive statistics on these variables. The average increase in “guided sales” target is €71,101.84 with more than 25% of the branches having their target reduced from one year to the next. Relative target setting (RTS) has a value of -€37,337 in its first quartile (25%) and €38,877 in its third quartile (75%) indicating significant variation of effort across branches. Half of the branch-year observations do not see changes in their number of employees consistent with most branches working at a steady state regime. Finally, branch density shows a high dispersion across regions and increases during this period at about a 4.6% yearly rate.

Table IV
Descriptive Statistics for the Sample

Variable	Mean	Std. Dev.	Q1	Median	Q3
$(\mathbf{B}_t - \mathbf{B}_{t-1})$	71,101.84	166,795.5	-19,561	73,951	156,575
RTS_{t-1}	0.000	68,264.81	-37,337	475	38,877
Emp_{t-1}	2.614	1.010	2.000	2.5	3.000
ΔEmp_t	0.171	0.608	-0.080	0.060	0.450
$Comp_{t-1}$	340.97	140.65	245.89	325.92	392.58
$\Delta Comp_t$	12.811	14.172	4.030	12.770	24.090

\mathbf{B}_t is the “guided sales” target for the current year, \mathbf{B}_{t-1} is the “guided sales” target for the previous year

RTS_{t-1} is the relative target setting defined as $B_{i,t-1} / employees_{i,t-1} - (\sum_{j=1}^n B_{j,t-1} / employees_{j,t-1}) / n$, Emp_{t-1} is employees in the previous year, ΔEmp_t is defined as $(employees_t - employees_{t-1})$, $Comp_{t-1}$ is the density of travel agencies' branches (number of branches divided per thousand inhabitants) in a region in the previous year and $\Delta Comp_t$ is the change in the density of agencies from the previous to the current year.

Results

Test of hypothesis 1

Hypothesis 1 proposes the relative performance (RP) of a branch as a proxy for its position on the production curve. Relative performance actually captures changes in the relation between effort and performance as performance levels increase. Intuitively, as effort levels increase and maximum capacity is approached, more effort is required to achieve the same improvement in performance. For instance, suppose that the maximum sales capacity for an employee is 1. Increasing sales in one period from .90 to .92 requires significantly more effort than moving from .50 to .52.

To empirically test if a branch's changes in performance depend on its current relative performance, and if these changes exhibit diminishing returns to scale, we apply two approaches. In the first one, for each branch we calculate the change in actual "guided sales" per employee as $(A_{i,t} / employees_{i,t} - A_{i,t-1} / employees_{i,t-1})$ and we regress it against relative performance ($RP_{i,t-1}$). The estimated coefficient (table V, panel A) is negative (-0.33) and statistically significant ($p < 0.05$).

Table V

Test of Hypothesis 1. Decreasing returns to effort

Panel A: linear regression

Model (1)

$$(A_{i,t} / Emp_{i,t}) - (A_{i,t-1} / Emp_{i,t-1}) = RP_{i,t-1} +$$

$$+ \alpha_1 comp_{n,t} + \alpha_2 Emp_{i,t} + \alpha_3 Year_04_i + \alpha_4 Year_05_i + \alpha_5 Year_06_i + \sum \eta_j Z_j + \varepsilon_{i,t}$$

Variable	Coefficient	Predictions	Results
			Model (1)
Intercept	□	?	121,015.8 ** (2.27)
RP _{i,t-1}	□	-	-0.33 *** (-11.98)
Comp _{n,t}	□ ₁	-	-378.65 ** (-2.30)
Emp _{i,t}	□□	-	5,123.4 ** (2.14)
N			1,276
Adjusted R ²			20.29%

For the second approach, we use a probabilistic model. We run a binary logistic model in which the dependent variable equals 1 if performance improves from one year to the

next (i.e., $A_{i,t} / \text{employees}_{i,t} - A_{i,t-1} / \text{employees}_{i,t-1}$ is greater than 0), and otherwise equals 0. We test the significance of the coefficient (table V, Panel B) and conclude that RP has a significant effect on the probability of an increase in the targets (z-statistic=-9.41, $p < 0.01$ for a two tailed test).

To ease the interpretation, we estimate the predicted probability of an increase in the targets for two different values of $RP_{i,t-1}$, with control variables held at their mean: a value in the upper quartile (€112,994.2) and another value in the lower quartile (€753.81). The predicted probabilities are 0.3820 and 0.6513 respectively, and the confidence intervals for these probabilities are [0.3238, 0.4402] and [0.6230, 0.6797]. At these values, we are 95% confident that the probability of an increase in the targets for a current target in the upper quartile of effort is approximately 20% lower than the probability for a current target in the lower quartile⁶.

Table V (continued)
Test of Hypothesis 1. Decreasing returns to effort
Panel B: Logistic regression

Variable	Coefficient	Predictions	Results Model (1)
Intercept	□	?	4.93 ** (2.01)
RTS _{i,t-1}	□	-	-9.85e-06 *** (-9.41)
Comp _{n,t}	□ ₁	-	-0.01 ** (-1.96)
Emp _{i,t}	□□	-	0.09 (1.15)
N			1,280
Pseudo R ²			11.13%

*, **, *** Statistically significant at 10%, 5% and 1% respectively. *t*-statistics are in parentheses.

$A_{i,t-1}$ = Actual performance for year *t*-1 for branch *i*.

Comp_{n,t-1} = #branches/Million of habitants from year *t*-1 to year *t* in geographic area *n*.

Emp_{i,t-1} = number of employees

Year_0x = 1 if observation year corresponds to year 200x. These three variables are included but not reported.

Zx = 1 if branch belongs to region x. These thirteen variables are included but not reported.

RP = Relative performance defined as

$$A_{i,t-1} / \text{employees}_{i,t-1} - \left(\sum_{j=1}^n A_{j,t-1} / \text{employees}_{j,t-1} \right) / n$$

⁶ As robustness check, we have estimated the predicted probabilities for other values in the quartiles, obtaining consistent results.

Empirical evidence for both approaches supports H1, and it is consistent with the interpretation that relative performance of a branch with respect to its peers captures the position of this branch on the production curve.

Basic Ratcheting effect and the direct effect of relative target setting (Hypothesis 2)

Having proven that RP is a good proxy for the position on the production curve, hypotheses 2 and 3 test whether or not, when revising targets, managers consider not only performance variances on previous year target but also the relative position of this target with respect to that of comparable branches (RTS).

As a starting point and to empirically examine the evidence of target ratcheting and to compare it with the work of Leone and Rock (2002), we estimate the following regression model (2):

$$(B_{i,t} - B_{i,t-1}) = \alpha + \beta(A_{i,t-1} - B_{i,t-1}) + \lambda U_{i,t-1} (A_{i,t-1} - B_{i,t-1}) + \varepsilon_{i,t}$$

Where B_t is the current year's budget, B_{t-1} is the budget for the previous year and A_{t-1} is the actual performance for the previous year. β is the ratcheting coefficient for favorable variances and λ is the differential coefficient for unfavorable variances (U_{t-1} is one for unfavorable variance and zero otherwise). We estimate the model controlling for region, year, employee growth, change in local competition, number of employees, and branch maturity. To handle heteroskedasticity, we use Huber-White robust standard errors clustered by store.⁷

We predict both coefficients to be significant and of opposite signs ($\beta > 0$ and $\lambda < 0$), consistent with evidence of asymmetric target ratcheting in prior work, being moreover more pronounced for favorable variances (Leone and Rock 2002; Lee and Plummer 2007; Ettredge et al. 2008). Asymmetric response coefficients are consistent with various arguments. First, empirical evidence indicates that managers are rewarded for events that they do not control but that benefit their performance measures (luck) and are spared from being penalized when these events move against their performance (Bertrand and Mullainathan 2001). Consistent with this argument, targets would not incorporate favorable variances to facilitate managers' meeting these targets but do so when unfavorable variances provide excuses to ease targets. Because targets are associated with future rewards, including unfavorable variances and excluding favorable ones facilitate meeting targets ($\lambda > 0$). Second, if contracts are written on earnings, accounting conservatism leads to earnings increases that are more permanent than earnings decreases. Accordingly, next year's budget will be more responsive to increases than to decreases. Thus, favorable variances will have a higher impact on next year's targets than unfavorable ones ($\lambda < 0$). However, if targets are written on revenues, accounting conservatism becomes less relevant and this reason for asymmetry may disappear. Third, ratcheting parameters may be asymmetric to provide incentives for managers to invest in actions leading to permanent rather than transitory performance

⁷ An alternative solution for heteroskedasticity is to scale all variables as Leone and Rock (2002) did. Excluding the control variables, a natural candidate for the deflator could be either last year's budget or last year's employees. As a robustness check, we also run the scale modifications obtaining results that are comparable to the results reported here when the model is estimated in absolute terms (euro variances). However, if control variables are included, such as competition, their interpretation, once scaled, turns out to be rather difficult. To the extent that a commonly proposed solution for heteroskedasticity in the literature has been to define variable in percentages (see Barth and Clich 2009), we opted for running the regression in percentages as well. Although not reported in the paper for the sake of brevity and clarity, empirical evidence supporting the hypotheses is also obtained.

improvements.⁸ Fourth, managers' incentives often have a call option shape bounded at zero if the minimum performance is not met. Favorable variances are rewarded through the bonus while unfavorable variances are bounded at zero bonus (rather than becoming negative). The magnitude of ratcheting influences the level of reward and punishment to changes in performance.⁹

Table VI reports the results. The R^2 is 64.81% suggesting that there is still a significant amount of variation that ratcheting does not explain.¹⁰ Ratcheting is indeed present, consistent with prior evidence.¹¹ Each euro increase in last year's performance over its target is associated with a 0.57 increase in this year's target compared to last year's. Different from previous studies though, the coefficient of asymmetry (λ) is not significant.

Table VI

Test of Ratcheting and RTS in absolute terms

Model (2)

$$(B_{i,t} - B_{i,t-1}) = \alpha_0 + \beta(A_{i,t-1} - B_{i,t-1}) + \lambda U_{i,t-1}(A_{i,t-1} - B_{i,t-1}) + \alpha_1 \Delta Emp_{i,t} + \alpha_2 \Delta Comp_{n,t} + \alpha_3 Emp_{i,t-1} + \alpha_4 Mature_i + \alpha_5 Year_04_i + \alpha_6 Year_05_i + \alpha_7 Year_06_i + \sum \eta_j Z_j + \alpha_8 U_{i,t-1} + \varepsilon_{i,t}$$

Model (3)

$$(B_{i,t} - B_{i,t-1}) = \alpha_0 + \beta(A_{i,t-1} - B_{i,t-1}) + \lambda U_{i,t-1}(A_{i,t-1} - B_{i,t-1}) + \gamma RTS_{i,t-1} + \alpha_1 \Delta Emp_{i,t} + \alpha_2 \Delta Comp_{n,t} + \alpha_3 Emp_{i,t-1} + \alpha_4 Mature_i + \alpha_5 Year_04_i + \alpha_6 Year_05_i + \alpha_7 Year_06_i + \sum \eta_j Z_j + \alpha_8 U_{i,t-1} + \varepsilon_{i,t}$$

Variable	Coefficient	Predictions	Results Model (2)	Results Model (3)
Intercept	\square	?	128,854.4 *** (9.43)	74,581.7 *** (5.24)
$(A_{i,t-1} - B_{i,t-1})$	\square	+	0.57 *** (6.16)	0.57 *** (7.12)
$U_{i,t-1} * (A_{i,t-1} - B_{i,t-1})$	\square	-	-0.13 (-1.34)	0.08 (0.94)
$RTS_{i,t-1}$	γ	-		-0.62 *** (-6.69)
$\square Emp_{i,t}$	\square_1	+	75,956.4 *** (5.72)	102,682.8 *** (7.17)
$\square Comp_{n,t}$	\square_\square	-	-768.13 ** (-2.26)	-810.44 ** (-2.51)
$Emp_{i,t-1}$	\square_\square	?	86.36 (0.02)	12,468.17 *** (2.68)

⁸ Leone and Rock (2002) provide a numerical example on this argument.

⁹ An expansion of the example in Leone and Rock (2002) that illustrates the implications of this type of bonus structure is available from the authors upon request.

¹⁰ In contrast, Leone and Rock (2002) have an R^2 of about 75%. This difference implies that despite both research settings deal with internally set targets, our research site appears to rely to a much less extent on the previous year performance when setting targets.

¹¹ We also run the model controlling for change in sales in the previous year to include an additional control for growth. This model loses all the observations from the first year. The results were comparable.

Mature	\square_{\square}	?	-43,929.2 *** (-6.60)	18,389.9 *** (-2.76)
Year_04	\square_{\square}	?	41,957.07 *** (3.81)	34,310.8 *** (3.81)
Year_05	\square_{\square}	?	6,542.1 (0.85)	2,855.1 (0.40)
Year_06	\square_{\square}	?	-10,114.2 (-1.01)	-15,378.4 (-1.60)
$U_{i,t-1}$	\square_{\square}	?	-12,713.3 (-1.31)	-8,305.2 (-0.98)
N			1,105	1,105
Adjusted R ²			64.81%	69.21%

*, **, *** Statistically significant at 10%, 5% and 1% respectively. *t*-statistics are in parentheses.

$B_{i,t}$ = Budget performance (performance target) for year *t* for branch *i*.

$B_{i,t-1}$ = Budget performance (performance target) for year *t-1* for branch *i*.

$A_{i,t-1}$ = Actual performance for year *t-1* for branch *i*.

$U_{i,t-1}$ = 1 if $A_{i,t-1} < B_{i,t-1}$, 0 otherwise.

$\Delta Emp_{i,t}$ = Change in number of employees from year *t-1* and year *t*.

$\Delta Comp_{n,t}$ = Change in #branches/Million of habitants from year *t-1* to year *t* in geographic area *n*.

$Emp_{i,t-1}$ = Prior year's number of employees

Mature = 1 if branch *i* at time *t-1* is 5 years old or older, 0 otherwise.

Year_0x = 1 if observation year corresponds to year 200x.

Zx = 1 if branch belongs to region x. These thirteen variables are included but not reported.

RTS = Relative target setting defined as

$$B_{i,t-1} / employees_{i,t-1} - \left(\sum_{j=1}^n B_{j,t-1} / employees_{j,t-1} \right) / n$$

Despite the fact that our results at this point seem to be inconsistent with the results of previous work¹², we will ultimately show how the introduction of the productive capacity into the model helps to reconcile the findings. Once the consequences of productive capacity are discussed, our results will be comparable to those of Leone and Rock (2002), notwithstanding the apparent contradiction.

As a first step in this discussion, we test the direct effect of RTS on the target setting process. Table VI presents the results of testing the predictions of hypothesis 2. Model (3) includes the relative target setting variable as well as the control variables. If the target for the previous year of a branch relative to comparable branches (branches in the same geographic area) affects the target revision process, then the coefficient on RTS is expected to be different from zero. Moreover, if relative performance information captures the branch position on the production curve, then the coefficient will be

¹² Even though empirical studies support asymmetry, theoretically, there are several arguments in favor of symmetry. The symmetric design would be consistent with managers valuing favorable and unfavorable performance similarly. It is also consistent with accounting conservatism not being relevant to the financial measure used for bonuses. Managers may want to set symmetric incentives for permanent performance increases and decreases because both have similar informational content.

negative. This argument is consistent with supervisors increasing the target for branches that had demanding targets the previous year (targets located to the right in the production curve) to a lower extent than those that had easier targets. The model tested is:

$$(B_{i,t} - B_{i,t-1}) = \alpha + \beta(A_{i,t-1} - B_{i,t-1}) + \lambda U_{i,t-1} (A_{i,t-1} - B_{i,t-1}) + \gamma RTS_{i,t-1} + \varepsilon_{i,t}$$

In consistency with the arguments exposed, the coefficient on RTS is negative and significant (-0.62). The coefficient of ratcheting does not change. It is still significant and symmetric, and it has a magnitude comparable to that of the relative target setting. The amount of variance explained increases from 64.8% (Table 5) to 69.2% if RTS is added to the model in Table 6¹³

Test of hypothesis 3: the interaction between budget ratcheting and productive capacity

Model (4) introduces interaction effects to capture the third hypothesis: whether ratcheting might interact with RTS inasmuch as it signals the position on the production curve. Thus, the impact of ratcheting might not be constant but decrease with RTS. The coefficient on this interaction term is expected to be negative as higher values for RTS are associated with more exigent targets that leave less room for further favorable variances. In addition to this, the higher level of effort necessary to meet the more demanding targets will trigger more severe pervasive incentive effects that will also tend to reduce favorable variances from targeted values.

The model (model 4) tested is:

$$B_{i,t} - B_{i,t-1} = \alpha + \beta(A_{i,t-1} - B_{i,t-1}) + \lambda U_{i,t-1} (A_{i,t-1} - B_{i,t-1}) + \gamma RTS_{i,t-1} + \phi_1 RTS_{i,t-1} * (A_{i,t-1} - B_{i,t-1}) + \phi_2 RTS_{i,t-1} * U_{i,t-1} (A_{i,t-1} - B_{i,t-1}) + \varepsilon_{i,t}$$

The coefficient for the interaction term between RTS and favorable variances is \square_1 . Table VII reports the results. In comparison with Table VI, the coefficients on ratcheting remain positive, significant and symmetric. Likewise, the coefficient of the direct effect of RTS remains negative and significant (-0.48). This result indicates that when the previous year's actual was equal to its budgeted level ($A_{t-1}-B_{t-1}=0$), RTS modifies the increase in targets estimated in the intercept (€71,739.2). Targets will increase to a lower extent for branches that were above the region's average, i.e. for positive values of RTS. On the contrary, for branches below the average, RTS amplifies the increase in targets captured by the intercept.

Table VII

Test of interaction between ratcheting and RTS

Model (4)

$$(B_{i,t} - B_{i,t-1}) = \alpha_0 + \beta(A_{i,t-1} - B_{i,t-1}) + \lambda U_{i,t-1} (A_{i,t-1} - B_{i,t-1}) + \gamma RTS_{i,t-1} + \phi_1 RTS_{i,t-1} * (A_{i,t-1} - B_{i,t-1}) + \phi_2 RTS_{i,t-1} * U_{i,t-1} (A_{i,t-1} - B_{i,t-1}) + \alpha_1 \Delta Emp_{i,t} + \alpha_2 \Delta Comp_{n,t} + \alpha_3 Emp_{i,t-1} + \alpha_4 Mature_i + \alpha_5 Year_04_i + \alpha_6 Year_05_i + \alpha_7 Year_06_i + \sum \eta_j Z_j + \alpha_8 U_{i,t-1} + \varepsilon_{i,t}$$

¹³ Defining RTS using actual performance in the previous year instead of targeted performance leads to identical conclusions. The coefficient for RTS is negative and significant (-0.31) as well as the coefficients on the ratcheting effect.

Variable	Coefficient	Predictions	Results Model (4)
Intercept	\square	?	71,739.2 *** (4.95)
$(A_{i,t-1} - B_{i,t-1})$	\square	+	0.63 *** (8.06)
$U_{i,t-1} * (A_{i,t-1} - B_{i,t-1})$	\square	-	0.01 (0.13)
$RTS_{i,t-1}$	γ	-	-0.48 *** (-4.55)
$RTS_{i,t-1} * (A_{i,t-1} - B_{i,t-1})$	\square_1	-	-1.23e-06 *** (-2.71)
$RTS_{i,t-1} * U_{i,t-1} * (A_{i,t-1} - B_{i,t-1})$	\square_{\square}	-	-1.02e-07 (-0.14)
$\square Emp_{i,t}$	\square_1	+	101,077.6 *** (7.04)
$\square Comp_{n,t}$	\square_{\square}	-	-826.4 ** (-2.56)
$Emp_{i,t-1}$	\square_{\square}	?	11,775.7 ** (2.54)
Mature	\square_{\square}	?	-18,559.7 *** (-2.80)
$U_{i,t-1}$	\square_{\square}	?	-5,500.2 (-0.68)
N			1,105
Adjusted R ²			69.55%

*, **, *** Statistically significant at 10%, 5% and 1% respectively. *t*-statistics are in parentheses.

$B_{i,t}$ = Budget performance (performance target) for year *t* for branch *i*.

$B_{i,t-1}$ = Budget performance (performance target) for year *t-1* for branch *i*.

$A_{i,t-1}$ = Actual performance for year *t-1* for branch *i*.

$U_{i,t-1}$ = 1 if $A_{i,t-1} < B_{i,t-1}$, 0 otherwise.

$\Delta Emp_{i,t}$ = Change in number of employees from year *t-1* and year *t*.

$\Delta Comp_{n,t}$ = Change in #branches/Million of habitants from year *t-1* to year *t* in geographic area *n*.

$Emp_{i,t-1}$ = Prior year's number of employees

Mature = 1 if branch *i* at time *t-1* is 5 years old or older, 0 otherwise.

Year_0x = 1 if observation year corresponds to year 200x. These three variables are included but not reported

Zx = 1 if branch belongs to region x. These thirteen variables are included but not reported.

RTS = Relative target setting defined as

$$B_{i,t-1} / employees_{i,t-1} - \left(\sum_{j=1}^n B_{j,t-1} / employees_{j,t-1} \right) / n$$

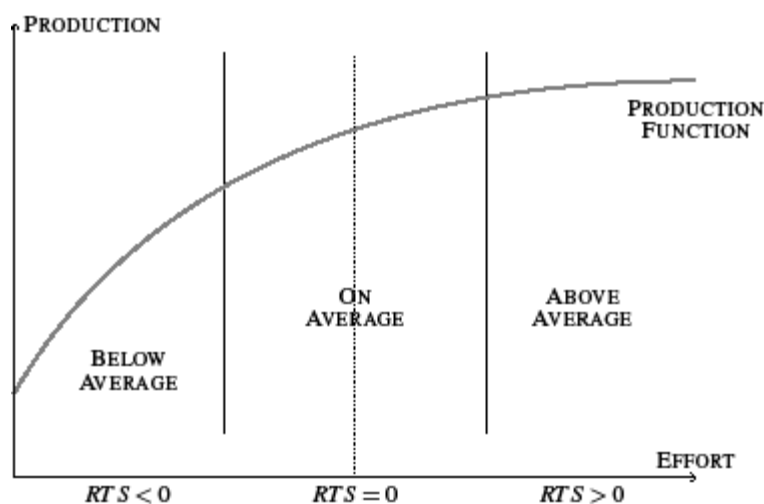
The coefficients of the interaction term for favorable variances, \square_1 , is significant, and in the expected direction. The negative sign indicates that the increase in targets following

a favorable variance is attenuated for those branches having a positive RTS the previous period. Thus, considering the definition of RTS, the negative sign of the coefficient implies a lower ratcheting for those branches which had a challenging target higher than that of the average of branches in the same region. On the other hand, those branches with negative RTS will see their targets increased to a higher extent in this model as a way to incorporate the fact that on the left side of the production curve there is considerably more room for performance improvement.

As an additional test to support the argument that the level of ratcheting depends on the position on the production curve, we grouped the observations into three equal groups according to the magnitude of RTS (see Figure 1) and estimated models 1 and 2 for each zone of the figure. The first group (named below average) included the 33 percent of the bottom branch-year observations for the RTS variable, the medium group (on average) included those with a magnitude of RTS in the range of 33 percent to 66 percent of the sample distribution, and the large RTS group (above average) included the upper 33 percent.¹⁴

Figure1.

Ratcheting effect and regions of the production curve



The region “Below Average” includes the 33 percent of the bottom branch-year observations.

The region “On Average” includes sample data with a magnitude of RTS in the range of 33 percent to 66 percent of the sample distribution.

The region “Above Average” includes the upper 33 percent of the observations.

The main results, shown in Table VIII, can be summarized as follows. First, ratcheting diminishes as we move from the average group to the above average group.

¹⁴ To divide the sample in three equal groups, the exact percentage used was 33.33%.

Branches on the top 33% will see their target increased in €0.47 (or €0.49 in model 2) per dollar of favorable variance, in contrast to an increase of €0.64 for the branches located in the middle zone (i.e., on average). Consistent with our arguments, the increase in the target that follows a favorable variance is smaller the closer the branches get to maximum capacity.

Table 8
Ratcheting and Relative Target setting for each region of the production curve

		BELOW AVERAGE RTS<0 (0%-33%)		ON AVERAGE RTS=0 (33%-66%)		ABOVE AVERAGE RTS>0 (66%-100%)	
Variable		Results Model (1)	Results Model (2)	Results Model (1)	Results Model (2)	Results Model (1)	Results Model (2)
Intercept	□	146,940.1 *** (8.26)	48,010.7 * (1.87)	59,662.5 *** (2.04)	58,371.6 ** (2.00)	72,093.3 *** (3.04)	100,436.6 *** (4.39)
(A _{i,t-1} - B _{i,t-1})	□	0.64 ***, § (8.26)	0.64 ***, § (7.66)	0.64 ***, Δ (3.85)	0.64 ***, Δ (3.89)	0.47 ***, §, (6.51)	0.49 ***, §,Δ (8.44)
U _{i,t-1} * (A _{i,t-1} - B _{i,t-1})	□	-0.30 ***, § (-2.61)	-0.31 ***, § (-2.75)	0.07 (0.42)	0.07 (0.39)	0.34 ***, § (3.08)	0.29 **, § (2.60)
RTS _{i,t-1}	γ		-0.85 *** (-5.50)		-0.46 (-1.28)		-0.65 ** (-2.34)
□ Emp _{i,t}	□	117,348.4 *** (4.78)	128,948.2 *** (5.37)	83,043.8 *** (3.50)	84,482.8 *** (3.53)	86,027.6 *** (4.33)	100,138.5 *** (4.35)
□ Comp _{n,t}	□	-522.8 (-1.18)	-598.0 (-1.42)	-1,229.4 ** (-2.38)	-1,190.4 ** (-2.29)	-734.5 (-1.06)	-822.1 (-1.18)
Emp _{i,t-1}	□	1,167.0 (0.14)	9,340.8 (1.10)	20,334.7 ** (2.01)	20,639.5 ** (2.05)	4,941.6 (0.87)	6,699.5 (1.14)
Mature	□	-38,811.2 *** (-3.83)	-15,835.7 (-1.42)	-18,919.8 * (-1.84)	-17,811.0 * (-1.73)	-11,550.7 (-0.77)	-8,568.8 (-0.56)
U _{i,t-1}	□	-29,566.3 * (-1.94)	-24,252.2 * (-1.70)	-973.5 (-0.07)	-1,392.9 (-0.09)	-19,678.7 (-1.41)	-10,622.2 (-0.75)

N	358	358	365	365	382	382
Adjusted R ²	64.51%	67.76%	69.70%	69.85%	69.99%	72.69%

*, **, *** Statistically significant at 10%, 5% and 1% respectively. § indicates coefficients significantly different from each other at 1%. Δ indicates coefficients significantly different from each other at 1%. *t*-statistics are in parentheses. Dependent variable: $(B_{i,t} - B_{i,t-1})$. Control variables: Year_0x, and Zx included but not reported. Variables defined as in Table 6.

The second important result obtained from the analysis of the three zones is that RTS is not significant in the average target difficulty zone. When targets are exactly fulfilled and variances are null, the budget changes are of the same magnitude for all branches. This is not the case when the values of RTS are in the bottom and in the upper percentiles. For branches here, the position on the production curve is taken into account in the target revision process.

The third result to discuss is related to the asymmetry of ratcheting. To this respect, the three zones clearly exhibit a different behavior. For those branches with a target difficulty value around the average, i.e., small values of RTS located in the average zone of the production curve, the coefficient of asymmetry ($\alpha=0.07$) is not significant. Senior managers do not distinguish between favorable and unfavorable variances when revising targets. Branches are located in an intermediate zone in terms of the effort required to increase performance; there is room for performance improvement as well as for performance worsening. This fact leads to a lack of asymmetry in ratcheting. Very much on the contrary, the asymmetry of ratcheting is significant on the two extremes of the production curve. Not only are the coefficients of asymmetry significant, but also and more importantly, they have opposite signs: negative (-0.30, model 1) in the below average and positive (0.34, model 1) in the above average zone. The negative sign implies that positive variances in performance lead to greater absolute changes in the following period's budget than do changes triggered by negative variances of the same magnitude. The result in this zone is in line with the findings of previous empirical studies such Leone and Rock (2002) and B&k (2010). The positive sign rather means that the decrease in targets undertaken upon an unfavorable variance is greater than the increase that follows a positive variance of the same magnitude. Senior managers perceive an unfavorable variance performance as a sign that branches are about to reach maximum capacity. Targets seem to be too exigent and might trigger the undesired effect of demotivating employees (Fisher, Peffer and Sprinkle 2003, JMAR).

Summarizing, the level and asymmetry of ratcheting is ultimately linked to the production curve. Budget ratcheting and productive capacity interact: the magnitude of the target change, and the degree of asymmetry, resulting from a favorable or unfavorable performance variance will vary with the position of a branch in the production curve. This theory, supported by our empirical analysis, enables us to reconcile and provide an explanation for the difference in the asymmetry of ratcheting between our results and those obtained in previous studies. While for the complete sample we estimate a symmetric ratcheting, Leone and Rock (2002) and B& K (2010) reported an asymmetric coefficient of a greater magnitude for favorable variances. This negative asymmetry is consistent with our results for the below average zone. Ultimately, the asymmetric coefficients would reveal the senior managers' beliefs about the specific position of the majority of branches on the production curve. If managers had the idea that the branches of the firm were generally operating in the bottom part of the production curve, the change in targets would follow this pattern. In light of our results, if managers thought that branches were mainly operating in the middle zone of the production curve (with small values of RTS), we then would observe a symmetric ratcheting coefficient. Similarly, if senior managers would perceive that branches are close to reach maximum capacity, the ratcheting would exhibit a positive asymmetry. In the end, the level and asymmetry of ratcheting will depend on the managers' beliefs about the position on the production curve, and consequently the improvement potential of branches.

Conclusions

This study uses field data from branches of a large European travel company to investigate the extent to which productive capacity in an effort-intensive setting influences the level of subsequent targets. Our results show that the effect of the productive capacity (RTS) on the target revision process is twofold. In addition to the direct effect, we find evidence of an interaction effect between productive capacity and budget ratcheting. The level and asymmetry of ratcheting depend on the managers' beliefs about the position of a branch on the production function.

The results reported are relevant in several aspects. First, they highlight the significance of the productive capacity, RTS, as a source of information in addition to past performance associated to budget ratcheting. The results indicate that RTS is relevant in magnitude as it is budget ratcheting, and therefore future research may want to better understand the role of peer groups in setting targets.

Second, the results indicate that past performance, used as a source of information, is not independent of the performance of comparable responsibility centers. The reason is that this performance signals the relative degree of target difficulty or the relative position on the production curve. Traditionally, empirical tests of budget ratcheting have used linear models and have found evidence consistent with asymmetric ratcheting. The constant targets response coefficients of linear models imply an unbounded relation between effort and performance. Senior managers believe that increases in performance are always attainable and require the exertion of the same increment in effort. Consequent with this reasoning, the process of revising targets would be undertaken irrespective of the degree of difficulty of the current targets. Yet, we find evidence that the coefficients in the lineal equation vary with RTS. For branches located in the upper (bottom) zone of the production function, favorable target variances result in performance target increases that are smaller (larger) than decreases associated with unfavorable variances of the same magnitude. The shape of budget ratcheting reported for the lower zone of the production curve, i.e., negative asymmetry, is consistent with the results of previous studies. The equations estimated in these previous studies could be considered as a particular case of our general model; that in which senior managers believe the majority of observations are located in the bottom part of the production curve and have relatively easily achievable targets. The fact that the asymmetry has a positive sign in certain settings and a negative sign in others indicates that target setting is not a structured process (such as formula based incentive systems), managers form their beliefs and weigh the various sources of information differently depending on the overall information set. Thus, target setting is a subjective process but consistent with an information value framework.

The results offer a more complex picture of the target setting process that reflects the interplay of different sources of information available to managers. This process is interesting because it is highly subjective and managers can readily adapt their decisions (reflected in targets) to the information set at their disposal. The research setting is one division within a company. As such, it allowed a research design that controlled for a significant amount of variables that are common across the division that increases the power of the tests. However, the results and especially the magnitudes of the various effects are particular to this setting and cannot be generalized. The results provide empirical evidence consistent with an information processing framework and therefore

support the importance of understanding the information set available to managers in target setting processes.

The results open new questions for future research. First, the asymmetry of the ratcheting effect appears to vary with the information setting. Previous explanations of this asymmetry were unrelated to information available to the manager setting targets. Second, target setting is a complex process, the paper identifies RTS as an additional dimension but other variables may also be relevant beyond past performance and peer group performance. Third, deviations from targets and relative performance may not only be relevant for setting new targets but may be relevant for resource allocation decisions. Again, resource allocation decisions may not only depend on these two variables but a broader set of variables.

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The Augmented Reality in The Cultural Heritage Sector

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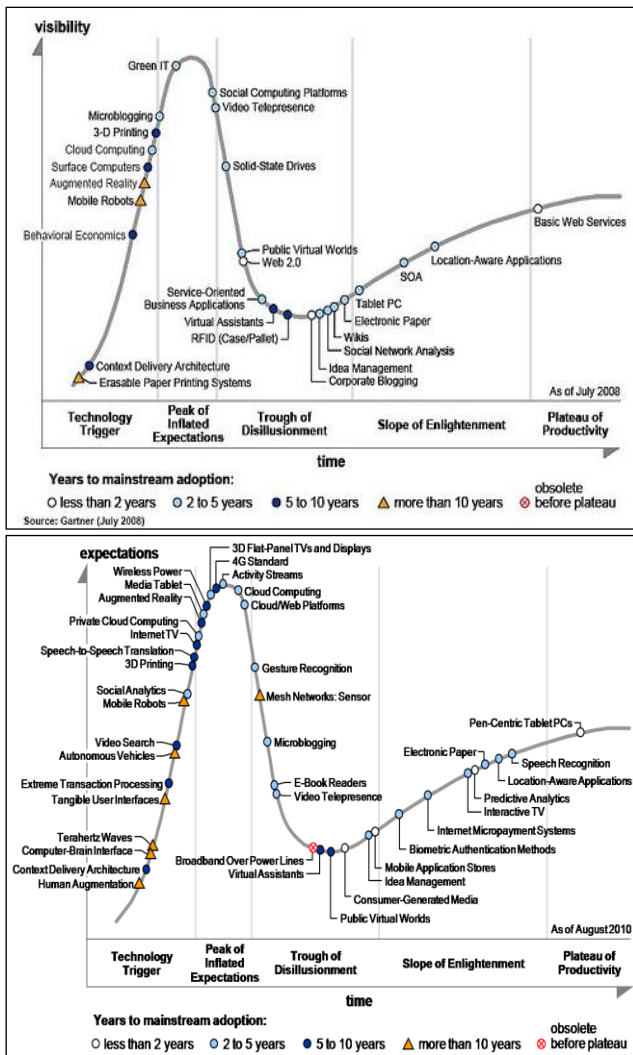
Keywords: Cultural Heritage, Augmented Reality, Smartphone, Application, Cultural visit, SWOT analysis.

Type of paper: General review

Introduction

The technological prediction analysis provides useful indications to guide the investments of market operators belonging to different sectors, with the aim of assuring their competitiveness. The two Garthner's Hype Cycle curves, respectively from 2008 and 2010, show the maturity level of technologies and their development in the market: the x-axis represents the time and the y-axis the visibility. The comparative analysis shows that in only two years, the Augmented Reality changed its position on the curve from a starting phase of the technology to the peak of expectations. This demonstrates that the market operators can consider it as an interesting element of attractiveness.

Figure 1 - Hype Cycle di Garthner, 2008, 2010

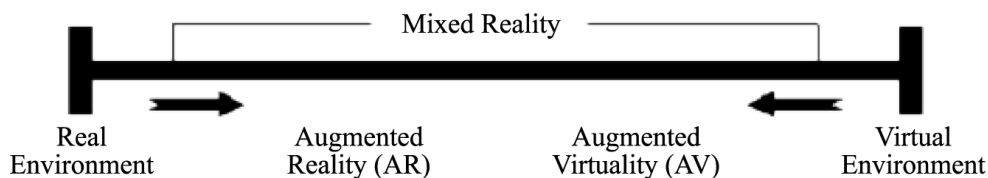


Starting from the considerations made on Garthner's curves, the actual level of diffusion of the Augmented Reality in the Italian Cultural Heritage sector will be verified, analysing strengths and weaknesses, opportunities and threats to its implementation.

But what does Augmented Reality mean? With the technology of Augmented Reality, additional information is added on the real scene and this allows the interaction, in a completely innovative way, with the real situation to which the technology is applied. In literature the Augmented Reality (AR) is constantly considered as an evolution of Virtual Reality (VR). In fact, VR represents a three-dimensional interactive environment generated by an IT technology connected with a computer. The diffusion of VR in the scientific and economic fields contributed to the success of its use as first technology able to provide, in the specific context of application, the interaction in real time between user and artificial environment. The environment, in this case, is completely fictitious and distinguished from the environment surrounding the user. The latter can interact with the artificial environment through equipments such as haptic interfaces. Differently from the VR, which operates through a replacement real world-user not taking into account the surrounding environment, the AR enriches the real environment with information through virtual objects performing complex tasks. The result for the user is the coexisting vision of objects of different nature, both virtual and real, in same scene space, increasing the perception and interaction with the addition of visual information, which would not be possible to detect naturally. In 1990, at Boeing

laboratories, the researchers Tom Caudell and David Minzell, both working on a prototype that would substitute the control instruments of an aircraft, created the prelude technology to the current HMD, wearable by the pilots and able to quickly visualize the route, take off and landing information. The technology created was defined Augmented Reality, as information of different nature was added to the real perspective (Aloisio, De Paolis, 2007). Since then, the international technological scenario was characterized by the development and production of more and more sophisticated systems and mainly by the implementation of the same technology in different contexts. The tight link between the two technologies is easily deducible from the description of the taxonomy, according to which the real world and virtual environment are two extreme conditions, on the inside of which the AR is closer to the real environment, as the data collected refer to the real system and symmetrically the augmented virtuality is closer to the virtual technology highlighting the smaller quantity of real data (Milgram, Kishino, 1994).

Figure 2 - Simplified representation of a "virtuality continuum".



Source: After Milgram *et al.* (1994)

The Augmented Reality consists of the overlapping of different levels of information (virtual, multimedia, data delocalization, etc.) to the real experience that a user can carry out while employing a service. The technologies that enable to “augment” the value of the reality are added through devices using different technologies and mainly through mobile devices, in particular last generation mobile phones (*iPhone* or *Android*), or fixed base supports such as personal computers equipped with dedicated accessories as a webcam, vision devices, VR glasses, headset or handling devices and technical use of technology, adding multimedia information to what is naturally perceived in the real scene. The overlapping of these virtual elements with real elements creates a situation of “mixed reality” generating a new service category.

The innovation of AR is not strictly technological, in fact, by adding virtual contents, interactive graphic systems are created, allowing to overstep the limits of reality in real time. With the support of appropriate rendering or motion-tracking devices, maker recognition through virtual vision and the building up of modified environments containing sensors and electronic actuators, the AR enables to mix a live video with three-dimensional objects and animations in real time and with perfect synchronization. The AR technology category includes all the applications aiming at increasing the visual perception of a physical space. An essential principle for the correct use is the parallel coexistence of the two environments, real and virtual, put side-by-side by the freedom of movement of the user in the scene and by the possibility of interacting with it having the impression that the two environments are indistinguishable. The main developments of this technology are based on the use of videos digitally processed, placed side-by-side with graphic components digitally created.

Application of AR to the Cultural Heritage Sector

The use and application of AR technologies implies many advantages in several sectors such as architecture, building, didactic and vocation, entertainment, manufacturing and design, marketing, medicine and psychology. Nevertheless, perspectives of great interest for the development of the AR are those offered by the Cultural Heritage sector. Starting from the 1990s this sector, particularly complex considering the strong professional difference of the actors working in it and the strongly multi-disciplinary character, is affected by a process of transformation and updating providing for the adaptation of the modality of the offer, with the aim of answering to the new social behaviours of visitors, through the introduction of additional services to museums and State owned archaeological sites (Ronchey's Laws, 1993; Cultural Heritage Italian Codex, 2004). It is interesting to highlight that the process of utilization of a cultural good is characterized not only by objective factors, but also by aesthetic, symbolic, psychological and emotional factors, and is therefore marked by a strong subjective and functional worthiness. In fact a double relation takes place between visitor and work of art/performance, but also between service offered and context of reference. The necessity to involve new users and promote the development of the sector pushed towards the exploitation of the good and of the cultural experience through the introduction of additional services, enriching the traditional offer, and new modality of utilization of the visit, with the use of technological applications (First Report of Nomisma on the Ronchey's Laws application, 2000). In particular, the recent developments of technological convergence amplified the impact of innovation on cultural organizations, creating new opportunities to exploit the cultural heritage through the optimization of internal processes, the development of integrated networks and the definition of modalities of service utilization in multi channel. Also the behaviour of those utilizing the cultural goods evolved as consequence of the new social trends based on the increase of income, instruction level and free time, on the enlargement of the offer of services and alternatives connected to the cultural experience (Grandinetti et al., 2004). The most traditional and common instruments used to inform the visitors during the tours are since always paper guides, maps and information panels along the cultural paths (Vlahakis *et al.*, 2004). Nonetheless, the ability of these traditional instruments to positively influence the visitor perception and his learning capacity are not particularly high. In fact, these instruments, although still extensively used, may transform the visit in always more complex experiences in terms of utilization and involvement. In the light of the socio cultural evolution, the users of this type of services are directed to the continuous research of new modalities to satisfy their senses and this along the years translated into a progressive introduction of more and more sophisticated, and at the same time creative and interactive instruments. The introduction of the first technologies in the cultural heritage sector dates back to the 1980s with the application of the primordial tape audio guides (Vlahakis *et al.*, 2003). These models, although very limited in their functioning, had a positive impact on the visitors' ability to live an experience and easily learn during the visits. Along the years, these first instruments were refined with the purpose and making more pleasant the enjoyment of cultural paths and were progressively replaced with sophisticated hardware devices equipped with an internal memory. In this context the first mechanisms of active participation of the user of the service were introduced, and these automatism were considerably developed with the passage to VR technologies. For instance the diffusion of pen-tablets, or rather e-book like devices, through which it is

possible to reproduce presentations also in VR, simply by orienting the tablet towards specific information points located on purpose along the path. This evolution allows the visitors to live realistic historic scenes, dipping into an interactive static context. Nonetheless, following an analysis of the sector, it is possible to state that the Augmented Reality, still in its experimental phase, shows broad potentiality of development in the Cultural heritage sector. In particular, the main advantages offered by the AR derive from the possibility of exploiting this technology through the use of smartphones, whose request on the market is constantly increasing. According to an OFCOM research (OFCOM, 2010), the British Authority for Telecommunications, in Italy reveals the highest diffusion of smart phones in the world, represented by the 26% of the population above 13 years and 66% of the regular Internet users. It is interesting to highlight that according to the same research, the Italian users are among the first in the world regarding the utilization of the most advanced and sophisticated applications for smartphones, and this is a factor that should be taken into account when defining the potentiality of AR application to this specific context.

Results

With the purpose of evaluating the degree of diffusion of AR in the field of Cultural Heritage, an explorative analysis was carried out, aiming at pointing out the main modalities of application of this technology in the sector, the main realizations in operational environments and possible best practice. What comes out is both a broad potential of the supply and a highly fragmented and heterogeneous picture, characterized by lack of integrated databases. The study highlights that the diffusion of this technology is still in an experimental stage, although the many projects in development and the less isolated cases of application demonstrate that this technology is quickly rising in the sector. The application of AR in the Cultural Heritage sector provides the possibility to superimpose to a monument or to an archaeological site observed in the reality a broad range of additional information (through texts, pictures, links, videos, etc) with the simple sharing of application developed on purpose for smartphones. One of the great advantages offered by those applications is that these can be used “*in mobility*”, showing to the user in movement the updates in real time on what is being visited. This aspect represents the contact point between current AR and the first prototypes based on this technology developed by Caudell and Minzell. What makes them different is the fact that complex and elaborated systems of tracking and overlapping are replaced by light interactive applications that connect the mobile to the web to download information. In the Cultural heritage sector, in the functioning mechanism of AR applications, the user, through the digital photo camera on the device, frames the point of interest as for instance a monument, a picture or a statue. In this way, the GPS system of the device and the integrated compass locate the user with regard to the point of interest (POI), and exploiting the connection (web or Wi-Fi), the application displays on the screen of the device several georeferenced information useful to describe and to talk about the POI. Thus, the data obtained can be classified and visualized by the user according to his needs and can be combined with other information signalling other possible elements of interest (for example restaurants, museums, hotels, etc.). This information can originate from public archives or from archives created on purpose, as for instance by the manager of the POI, but can derive also from *crowdsources* (e.g. *Wikipedia*, *Flickr*, etc.). The above described elements have the strength to contribute to the improvement of the capacity to build an experience going beyond any expectations of the visitor, making him an active user, directly

involved in the personalization of the learning level on the basis of the specific need and personal tastes. This type of technology, allowing the visitors to manipulate and interact in real time with the POI and with the other connected elements, enables to have a certain influence on their overall level of satisfaction. In other words, through the AR it is possible to strengthen the complexity of the experience and emotion of a visit, challenging the visitors to interact with an exhibition or monument (Rothfarb, 2011), in the effort to increase exponentially their level of involvement. Thus it is possible to offer to the clients an additional service with a high competitive value, thanks to the distinctive peculiar competences, highly technological, that characterize it. It is interesting to underline that many international museums approached this technology, attracted by the high potential of development and implementation, but most of all by the possibility to increase the qualitative and experiential level of the services provided.

From a desk analysis it is possible to find some best practices for the AR application i.e. *Powerhouse Museum of Sydney*, *Street App of London Museum*, *Getty Museum of Los Angeles*, *Andy Warhol Museum of Pittsburgh*, the reconstruction of the appearance of Cluny Abbey in France before the destruction due to time. The purpose is that of collecting of works of art and historical pictures in digital format in order to make them usable also outside the museums, or tracking them (applying a tag) in the places they depict. Hence, visiting these cities, the users can utilize a combined visualization *ex ante* and *ex post* of a POI accompanied by suggestive stories on the social and urban changes that took place along the years. Also the *Stedelijk Museum of Amsterdam* developed a project called *ARtours*, made of several programs of different nature based on AR, and aiming at testing all the different forms of interaction between art and users that can be realized through this technology. The mission of the project is that of managing the art in an innovative way, with the purpose of increasing the target of reference of visitors of the museum, trying to involve and make loyal new groups of people (Schavemaker *et al.*, 2011). In 2010, the AR model was also implemented by a dedicated team of DOR (*Departement of Records*) of Philadelphia, with the purpose of making available a huge amount of historical pictures of the city, contained in several historical archives, in order to superimpose them to the observed reality through the use of smartphones (Boyer, Marcus, 2011).

The Italian picture consists of several projects trying to exploit this technology in the field of Cultural Heritage. Two projects already active were developed by the city of Savona and Ferrara. In both cases, the Local Bodies used the application *Layer*, already available on smartphones, building up specific levels (layers) with reference to the two cities. The users, through the free download of *Layer*, can visualize in modality AR information geolocated with reference to point of interest (POI) in the territories of Savona and Ferrara directly on their mobile phones. Once the application is launched the user can chose the level referring to the city of interest, and moving the photo camera of the smartphone, he can visualize on the screen all the POI nearby. The user of the service can therefore get in relation with these data on the basis of his information need: for instance he can visualize the path to reach a POI from the exact point where he is, read the description, listen to the audio guide, visit the official web site and contact the office via telephone or email. Furthermore this application enables the user to visualize the screen in three modalities of scene: *reality*, with the addition of augmented information; *list*, with the list of all the available activities from the closer to the further; and *map*, with the visualization of the same activities overlapped directly on the bi-

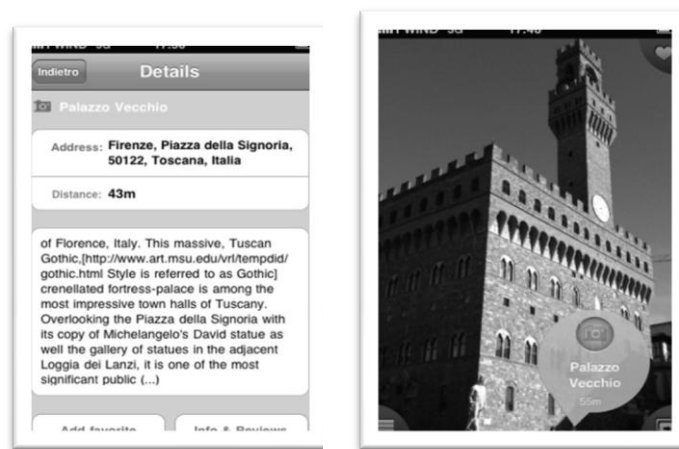
dimensional map of the city territory. In each of these cases, clicking on every POI, a range of additional information is obtained.

Figure 2 - Examples of Layer views on smartphone in Ferrara and Savona.



In a similar way Tuscany Region, created its own free application called *Tuscany Plus*, with the aim of providing to the visitors of Tuscany territory an interactive touristic guide enabling to produce an exponential service from a cultural and technological point of view. In this case a double modality of visualization is offered: *live* and *map*.

Figure 4 - Examples of Tuscany Plus views on smartphone.

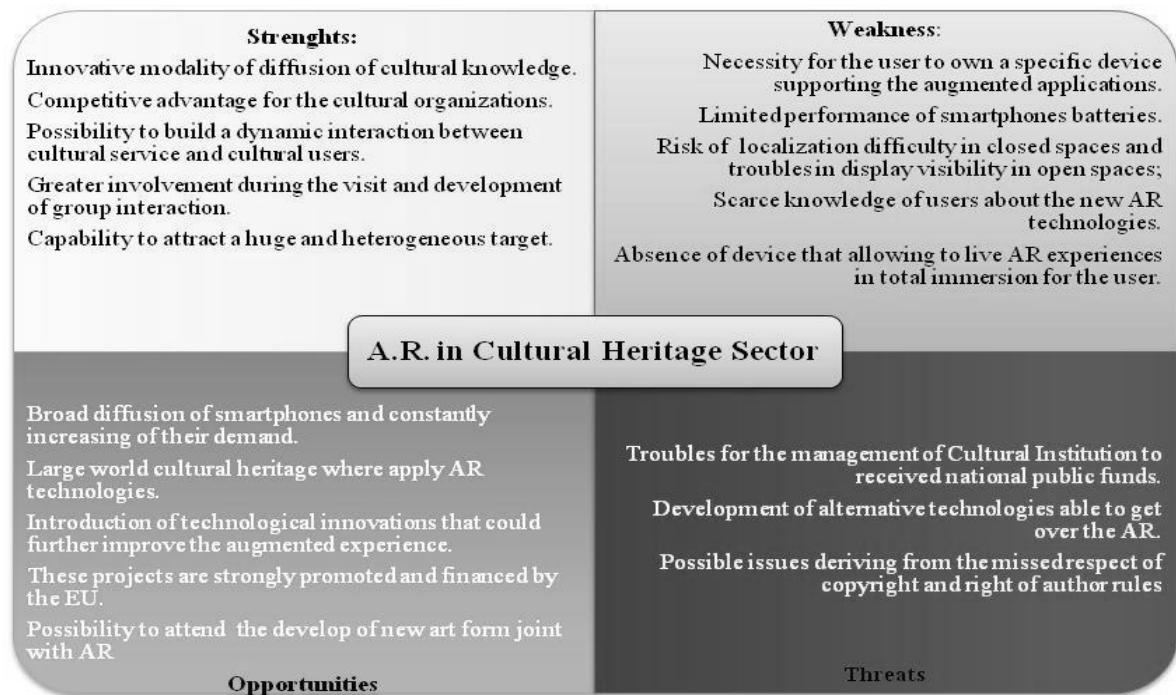


In order to implement these projects according to predefined modalities, during the planning phase, each element of interest in the above mentioned territories was positioned directly on the map, using as parameters latitude and longitude with the aim of guaranteeing the precise localization. Furthermore, for each POI a precise description was created, with the double audio guide Italian and English. The three innovative projects were supported by a dedicated communication activity, especially on the website of the city of Savona, on the touristic website of the city of Ferrara realized by the Province and on the touristic website of Tuscany Region, with the aim of explaining in a simple and direct way the innovative and technological potential of AR to impact on the cultural and touristic experience.

Also the MiBAC has recently manifested its interest for the exploitation of these new technologies, with the aim of capturing new targets and increase the level of cultural

services provided. In the specific case, it introduced on the market the guided application for smart phones called i-MiBAC Voyager, through which, by the means of GPS, compass and accelerometer, it is possible to visualize on the screen of the telephone 3D historical reconstructions (at the moment only for the Fori Romani in Rome) with a georeferenced correspondence 1:1. The i-MiBAC Voyager is indeed able to recognize autonomously the framed monuments providing an audio guide on the POI observed (MiBAC, 2011). Tuscany region carried out one of the most relevant studies on the adoption of AR in the Cultural heritage sector. The study was part of the project Technologies and Cultural Heritage, promoted by the EU and through an analysis carried out at a National level, revealed that the augmented reality, currently experimented by the 20% of the sample and present among the technologies with the higher penetration potential on the market, is perceived by the cultural organizations only with fairly good possibilities of penetration and growth (Report Te.Be., 2009). Following the explorative analysis, an investigation was carried out on the impacts and potentialities linked to the use of AR technologies with regard to users of cultural services and the possible evolution. In the effort to provide a rational answer to this question, through the study of literature, a SWOT analysis was conducted, aiming to detect the point of strength and weakness, opportunity and threats deriving from the use of AR in the Cultural Heritage sector when the service is used through smartphones. The results of the analysis are summarized in the following table:

Figure 5. SWOT Analysis on the application of AR used with smartphone.

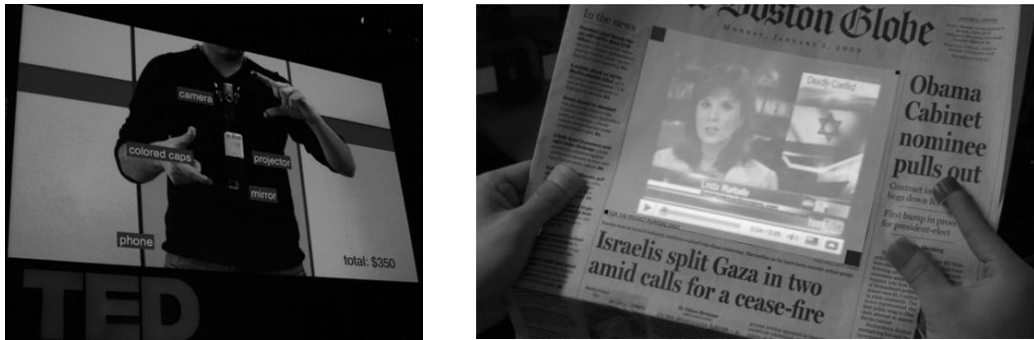


It is possible to detect through the SWOT Analysis that there are several points of strengths and opportunities connected to the exploitation of this technology. There isn't any doubt, in fact, that it represents the innovative modality of diffusion of cultural knowledge, otherwise difficult to transmit to a huge and heterogeneous public. Furthermore, these concepts are shared leaving to the addressees of the message the possibility to interact directly and in presence with the information in an interactive and procreative way. It is necessary to point out that the mechanisms of inclusion and

participation can generate further dynamics of group involvement. In *Stedelijk Museum*, for instance, during the test phase of AR technology, sharing behaviours of the experience were observed, both for the necessity to be confronted with the other users to understand the employment of the application and for the curiosity of the users without the latest generation mobile phones attracted by the originality of the service (Schavemaker, 2011). What was described can only be translated in a competitive advantage for the cultural organizations, until the point of transforming the attractive quality of these services in a distinctive capacity of his own offer. Beside strength elements some opportunities exist, occasions offered by the market and more in general by the perspectives of future development in the environment context. A broad diffusion of smartphones, constantly increasing, can foster a penetrating extension of the studied phenomenon. Let's consider the broadness of the world cultural heritage to which the AR could be applied and the quick introduction of technological innovations that could further improve the augmented experience. In addition, these types of projects are strongly promoted by the EU that is investing into projects aiming at the use and development of AR technologies in the Cultural Heritage sector. The project *Lifepius* in Pompeii, for instance, has the purpose of building up a technological prototype enabling the visitor of the excavations to interact in real time with the ancient environment partially reconstructed. Through a helmet and dedicated devices the user of the service receives information on the elements he is observing, but most importantly he has the possibility to live daily scene from the roman period (Vlahakis *et al.*, 2004). With reference to most critical aspects in the SWOT analysis, it is clear that the main critical point derives from the necessity for the user to own a specific device supporting the augmented applications. This element is a possible barrier for the use of the service and consequently the cultural structures deciding to invest in these technologies could find themselves in the position of excluding part of their public. In reality, it is appropriate to consider this element as an additional service to the traditional visit. To this respect, the demand of smartphones is constantly increasing, mainly in Italy. In addition, some weaknesses are detected in tight connection with the technical characteristics of smartphones. Currently, these devices are limited due to poor performance of batteries while using the AR applications and to the integral visibility of the display in open spaces. In closed spaces, the devices might present network issues, hindering the proper functioning of localizing mechanisms and therefore, more generally, the augmented experience. Another critical point can be that of the scarce knowledge of users about the new AR technologies. In order not to waste all the technology efforts, it is important to transmit in an effective way the initiative with communication campaigns reaching a broad and heterogeneous public. Finally, among the opportunities there is also the possibility to apply technology still at prototype stage and therefore not available (and therefore currently classified in the SWOT analysis as weakness points), allowing to live AR experiences in total immersion for the user, or without the intercession of the display of device. It is quite likely that this limit will be overcome easily thanks to the future development in the R&D field. Some of these prototypes in this direction have been already developed and an example above all is that of "*Sixth Sense*", an innovative technology realized at MIT laboratories and presented at the *TED India Conference* in 2009 by the inventors *Pattie Meas e Pranav Mistry*. This first prototype must be put on the neck and is made by a projector, a video camera, a small *computer/smartphone*, a mirror and several coloured sensors that are placed on the tips of the fingers. Through this device the user can record the reality surrounding him and project on it all the information that he is able to gather through a research on Internet. Thus the user acts directly on the context surrounding him,

augmenting it through simple manual gestures with a series of news he considers useful and interesting.

Figure 6 - Sixth Sense presentation at Ted (www.pranavmistry.com)



At last, the threats detected are those related to the investments necessary to develop these technological applications and the connected investments return for the organizations adopting them, as well as the development of further alternative technologies able to get over the AR and possible issues deriving from the missed respect of copyright and right of author rules.

Conclusions

The analysis highlighted the potentiality of the offer and also a quite fragmented and heterogeneous picture, characterized by the lack of integrated databases. The spread of this technology in the Cultural Heritage sector is still in the experimental phase, although strongly rising in this sector. In particular, a high interest of the Cultural Institutions is detected with reference to the use of the potentialities connected to the AR applications with the aim of establishing a new relation with their visitors. Through these technologies, in fact, the cultural and historical contents are more broadly accessible, underlying in a particular way, the differences with the past, present and possible future scenarios. In this sense, the union between culture and technological innovation is an important instrument to provide services with a high emotional impact, able to attract interested subjects not only towards cultural contents, but also to the application of new technologies, accomplishing a function of diffusion and sharing of knowledge, and also the role of a highly instructive instrument. However, the proposed study is preliminary and the gathered data are only qualitative and hence, it is necessary to enriched the work with a structured survey that will involve both the visitors and the Cultural Heritage Institutions in order to know respectively the users' perceptions about the application of new and preferred technologies to the cultural site or museum and the return of investment for the organizational point of view.

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Managing by Appreciative Leadership to create efficient organizations and healthy co-workers

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Introduction

To be able to meet future demands all organizations have to reconceive: the co-workers and the leaders in the organizations have to allow everyone to constantly and simultaneously both lead and follow (Hock, 2006). To make this possible the work environment has to become more creative in order to support the co-workers in their work to meet future customer demands, (Bäckström et. al, 2011). ‘By emphasizing entrepreneurship, traditional organizations could probably better transform into tomorrow’s more creativity-based organizations’ (ibid p. 194). The leaders in societal entrepreneurship are visionary and engage and mobilize others, and this initiative of the social entrepreneurs can be referred to as the management of the future, (Moe, 2009). Eskildsen, Dahlgard, and Nørgaard (1999) conclude that there is a need for a change-oriented environment for the co-workers if an organisation wants to achieve business excellence. The creative way of learning could probably be more suitable when organisations work on developing their business towards more experience-oriented and transformational-oriented products or services, an approach which Pine and Gilmour (1999) consider is a necessity to be competitive in the future. How leaders act and behave influences the attitudes and behaviour of the rest of the co-workers, (Schein, 2004). By using Appreciative Leadership the creative potential among the co-workers can be mobilized and turned into positive power (Whitney and Trosten-Bloom, 2010).

According to Yukl (2006), there is an agreement between most behavioural scientists and practitioners that leadership is a real phenomenon which is important for the effectiveness of organizations. If leadership behaviours according to Quality Management are complemented by entrepreneurship and creativity and can generate more competitive organizations in the future, (Bäckström et. al 2011). An unstructured way of learning by asking questions can support the creativity in organizations, (ibid). Another more structured way of asking questions to support creativity and transformation within organizations is the act of formulating and asking appreciative questions, Ludema et al, (2000). This Appreciative Leadership behaviour has emerged from the Appreciative Inquiry approach that ‘suggests that human systems grow and construct their future realities in the direction of what they most persistently, actively and collectively ask questions about’, (ibid.). Appreciative Leadership sets learning and innovation in motion (Whitney and Trosten-Bloom, 2010). Appreciative questions lead to powerful performance and are tools for learning and performance management (ibid).

This form of inquiry is focused on studies where the emphasis has been on studying, learning and changing to the better by using examining ‘a root-cause of success analysis’, rather than looking at the root causes of failure which up until recently has been the most commonly used approach within Quality Management. When focusing on problems instead of possibilities, organizations are prevented from using their full potential which leads to decreased organizational capacity (Whitney Trosten-Bloom, 2010). Leadership that served well in the past seems not to be efficient enough to address the challenges of the twenty-first century (ibid). Appreciative Leadership, which is about harnessing that positive power, addresses those challenges as a leadership approach, (ibid). To meet the challenge the leaders must be aware of and respond to trends defining the social milieus of organizations and communities (ibid).

The purpose is to examine how leaders can manage the philosophy and tool Appreciative Leadership and to examine what effect it can have.

Methodology

The research started with a literature review focussing on the area of Appreciative Leadership. A successful preschool that had been recognized for working with Strange-based Leadership and Appreciative Leadership was then studied with focus on how the leader manages Appreciative Leadership. A chapter in the book ‘Den offentliga sektorns entreprenörer – en porträttbok’ (In English: The public sector entrepreneurs - A portrait book), Sundin (2004), was studied. The chapter describes the case of the manager in question. Workshops, interviews, observations and conversations were then held with her, both face-to-face and by telephone, in order to understand how she manages her leadership. Her co-workers participated in the workshops.

The co-workers at the preschool were asked to fill in a questionnaire on the measurement approach which measures health-related Quality Management (Lagrosen et.a. 2011; Bäckström 2009; Lagrosen and Bäckström 2005; Bäckström and Lagrosen, 2007). The measurement approach questionnaire was written earlier and had been tested and evaluated several times (ibid). The approach measures the extent to which the values ‘Leadership Commitment’ and ‘Participation of Everybody’ permeate the organization (Lagrosen et al. 2011; Bäckström 2009). The measurement approach questionnaire was handed out, filled in and collected in one sitting in summer 2009. Each dimension in the measurement approach was constructed by means of three different statements that represent the specific dimensions, (ibid). The respondents were asked to mark on a seven-point scale to what extent they agreed with the statements. This kind of graphical scale is known as an interval scale (Lekvall and Wahlbin, 1993). The scale ranged from “Disagree completely” to “Agree completely”. Another reason for using the measurement approach questionnaire was that it had been used earlier at 8 schools where 139 co-workers had filled it in. This made it possible to compare if the leadership used in the preschool had had any effect. 40 co-workers filled it in, which gives a response rate of 80% as there are 50 employers.

Appreciative Leadership

Appreciative Inquiry is an approach to organizational change which borrows practices from the context of organizational development as it is an invitation to a positive revolution in change, Withney et. al., (2010). The focus is on what is best for the

organization - in the past, present and the future within the Appreciative Inquiry activities, practices and processes (ibid). Bushe, (2007) emphasises the importance of generativity within Appreciative Inquiry, which he believes is both an input and an outcome. Cooperrider and Srivastva, (1987) also maintain that generativity is the core of Appreciative Inquiry. Many other approaches are deficit-based and focus on problems and how to overcome them, Withney et. al., (2010). Appreciative Inquiry is, in contrast to a deficit-based approach, a positive approach for change, (ibid). In Appreciative Inquiry the focus is on generativity instead of problem-solving, (Bushe, 2007). The problems should not be ignored but by focusing on strengths, this approach is more effective, particularly when a transformation of a situation, relationship, organization or a community is wanted, (Withney et. al., 2010). 'Appreciative Inquiry enables leaders to create natural human organizations – knowledge-rich, strength-based, adaptable learning organizations', Withney and Trosten-Bloom (2010) p. 19 .

Appreciative Leaders are, according to Withney and Trosten-Bloom (2010):

1. Willing to engage with other members of their organization or community to create a better way of doing business or living.
2. Willing to learn and to change.
3. True believers in the power of the positive.
4. Leaders that care about people, often describing the work of their organization or business in terms of helping people learn, grow and develop.

The five core Strategies of Appreciative Leadership are: Inquiry, Illumination, Inclusion, Inspiration and Integrity. Appreciative Leadership is a greater leadership and about positive power (ibid.).

Appreciative Leadership is a philosophy, a way of behaving and a set of strategies that give rise to practices applicable across industries, sectors, and arenas of collaborative action. Appreciative leaders are affirmative by choice; they use positive approaches to create sustainable values, they also more often see the potential in human beings and occasions when other leaders do not, (Withney and Trosten-Bloom, 2010). When appreciative leaders see such a potential they take action and talk with others about it and engage with others, (ibid). In a study of schools Bushe, (2007) found that the best predictor of success in an Appreciative Inquiry project was the quality of school leadership.

Health related Quality Management

Bäckström (2009) found that organizations that have achieved healthy co-workers with low sickness absence through their conscious and well-structured work were also working according to Quality Management. Workplace practice include managers giving guidance and taking their time to coach the co-workers so that they dare to prioritize and take decisions by themselves; carrying out regular personal development talks with the co-workers, really listening and trying to find drivers for action, as well as giving everyone the opportunity to be aware of the customer and what their own contribution is: who they are creating value for (ibid). Furthermore, Wreder (2008) found, when studying successful organizations, that leadership in the form of 'management commitment' was a supporting value and a prerequisite for Quality Management practices such as employee involvement, delegation and coaching when working with co-worker health. In addition, this is in line with Lagrosen et. al., (2007) and Wreder et al., (2008) who maintain that Quality Management can improve the

health status of the co-workers by bringing in more humane and effective practices and at the same time improving the working conditions. To organize healthier and safer workplaces and achieve excellence in product and service quality the same kind of overarching management system is needed Warrack and Sinha (1999). The Quality Management values 'Leadership Commitment' and 'Participation of Everybody' have been shown to correlate with the co-workers' perception of their health, (Lagrosen et. al., 2010). The underlying dimension of the values 'Leadership Commitment' and 'Participation of Everybody' regarding the relation to co-worker health was examined by Lagrosen and Bäckström (2005) and Lagrosen et al. (2010). In that study, it was pointed out that integrity, presence and communication, empathy and continuity are underlying dimensions of 'Leadership Commitment'. 'Development', 'Being Informed' and 'Influence' were found to be the underlying dimensions of the value 'Participation of Everybody'. These dimensions were also found to be established methodologies, values and practices in successful organizations that have achieved good workplace health and efficiency, (Bäckström, 2009). With these underlying dimensions a measurement approach was developed, in order to help managers examine to what extent the values 'Leadership Commitment' and 'Participation of Everybody' permeate their organization (Lagrosen et al. 2011).

The case organization

The preschool under study is situated in the town of Norrköping in Sweden. It is actually two preschools (A and B) which are located 1,3 km from each other. At each preschool there are four departments which are each led by one division leader. There are 172 children between 1-5 years old in the two preschools. There are 50 co-workers employed, of whom 44 have permanent positions including eight division leaders and one manager for both preschools. The current manager started as manager at Preschool A in September 1999 and then also at Preschool B in January 2001. When she started at Preschool B 50 % of the co-workers were on long-term sick leave. One year after the manager had started all co-workers were back at work except one who had retired.

According to Sundin (2004) the manager convinced the local authority to allow a new way of working with quality. From a analysis based on joy at work and quality she made a workplace analysis. The result was a work- and development plan for the preschool and a description of the improvement work called Life, Joy and Growing Power. This became a source of inspiration to other preschools' quality work, (ibid.). 2003 the manager wrote a essay called; 'The dream of the good' which was a project to accomplish improvement and development within the preschool. This essay and the project was about creating better conditions for children and co-workers who work with children, (ibid.)

Leadership within the case organization

The leader describes herself as a positive, driving person, Sundin (2004). The leader believes that she can rapidly transform theory into visible action in her preschools. She looks for possibilities and applies them in her own way. She believes that she finds it easy to engage and arouse enthusiasm among her co-workers and make them work for the creation of a good workplace with good work structures. She also says that she never gives up, (ibid). In their improvement work and in everything they read, they ask

each other questions. How is it? How do we want it to be? How can we create that? Who does what and when will it be done and when do we follow up? (Sundin, 2004).

The co-workers describe their leader as a person who is always one step ahead, (Sundin, 2004). They describe her as a glad, positive and a driving person who is good at convincing people and at marketing her preschools. She has a great circle of contacts and does not hesitate to seek for funding outside the community. She has a matter-of-fact manner and is knowledgeable. The co-workers also say that their leader is an inspiration who works for progress and knowledge development keeping the children's best as her first priority. They think she is a person that acts and never gives up. She gives her co-workers big challenges and creates job satisfaction, (ibid).

The manager manages a sustainable leadership and constantly aspires to have participation from everybody. She gives her co-workers appreciation in different forms and she believes in the act of seeing people's 'strengths'. Every Friday the eight division leaders and the manager have executive meetings which have an agenda and for which all are prepared. They use learning conversations and give each other seriously committed feedback when they talk. After that, they ask each other more penetrating questions. They continuously conduct workplace meetings, meetings with parents and study tours together for the two preschools. The managers have written several applications to different foundations for money for development and education for the co-workers. On one occasion they received 6 million SEK for education. They have conducted several courses in instant yoga, Life conversation, health promoting activities and the "dream of the good" method. Study trips to other countries have also been carried out. The managers ask their co-workers to "dream of the good" and to write it down when they work with organizational development. Then they work together to realize and implement their dreams. She maintains that courage and wisdom are important ingredients in her leadership as well as never giving up.

The results from the measuring approach

The results from the measuring approach are presented in Table 1 together with the mean score from the eight schools in the other project mentioned above as a comparison. The mean score for the two preschools are all over 6 on a seven-point agreement scale which can be considered as high. It can also be observed that Preschool A has higher scores for all dimensions than Preschool B.

	Empathy	Presence/Communication	Integrity	Continuity	Development	Influence	Being informed	Health
Preschool A	6.58	6.61	6.78	6.66	6.68	6.71	6.68	6.69
Preschool B	6.25	6.31	6.43	6.65	6.33	5.82	5.86	5.86
Total	6.44	6.48	6.63	6.65	6.53	6.33	6.33	6.34
Mean score	5.11	4.93	5.01	4.83	4.59	4.74	4.53	5.53

at 8 schools								
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Table 1. The mean score from the measuring of the dimension.

The comparison with the eight schools confirms that the results from the measuring approach are high. It can also be noted that the co-workers in the preschools perceive that the health-related Quality Management values ‘Leadership Commitment’ and ‘Participation of Everybody’ permeate their organisation. They also think they have good health.

Conclusions

The leadership, the methodologies and behaviour the manager in the preschool is using are not unique or new. Similar leadership methodologies and behaviours have been found in other successful organizations examined (Bäckström, 2009, Harnesk et al., 2005). According to Oakland (2001), it is important that managers believe that co-workers want to achieve, accomplish and influence activity, and that they do not need to be coerced to perform well. The leadership can also be described as an Appreciative Leadership since, for example, the four points of a Appreciative Leader, as described by Whitney and Trosten-Bloom (2010), can be found in the way the manager conducts her leadership. The leadership style which can be described as an Appreciative Leadership and that the manager at the preschool uses, can be confirmed as leading to good effects on the working environment as all the measured dimensions have a high score. The effect of her sustained leadership can be seen in the higher score at Preschool A which she has managed for more than one year longer than Preschool B.

The creative and visionary leadership that the manager in the case organisation is using has similarities with the initiatives of the social entrepreneurs that Moe (2009) referred to as the management of the future. These managers have used the creative potential among the co-workers which they have mobilized and turned into power in the manner that Whitney and Trosten-Bloom, (2010) have described as Appreciative Leadership. This style of management could probably be used within social entrepreneurship with positive effect.

It would be interesting to carry out further research by interviewing the co-workers and asking them how they perceive the leadership and then comparing that with the description from the leader. Interviews with the eight division leaders would also be very interesting. To examine how and if they had been influenced by the manager and then to examine how they are performing their own leadership. It would also be interesting to examine other leaders who are practicing Appreciative Leadership and to find out how they practice their leadership and what it has resulted in.

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Combining mechanistic and organic approaches to change: A case study on a Swedish national transformation program for medium sized enterprises

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Introduction

A majority of all research in the area of change revolve around larger companies, and there is a lack of studies demonstrating applied examples in smaller companies. From most perspectives, this is peculiar since the national economies rely on small and medium enterprises (European Commission, 2008). With an ever increasing competition for manufacturing companies due to globalisation, it has however become a priority for national policymakers to support their industries by change programmes. Industry Forum in United Kingdom, which has its origin in the automotive industry, is one such national programme. This programme has served as a role model for the Swedish programme Produktionslyftet which has the objective to enhance the performance of medium sized (in these case 30-250 employees) manufacturing enterprises (MMEs).

Produktionslyftet (PL) is a stimulating case to study, not in least because the programme has been involved with changes in over 100 companies. The original Produktionslyftet (PL1) was initiated in 2007 and worked with 60 companies before its end in 2010. PL2 was started in 2010, and involves 40 companies (as of May 2011) which are planned to be expanded to 100 companies before the programme end in late 2012. The objective of PL is to stimulate enterprises to evolve as learning organizations with inspiration from the Toyota Production System concept, under the term Lean Production. The programme consists of 3 interacting activities: an education in Lean Production for at least 2 employees, workshops on the companies for education and training, and finally two consultants from the programme stays at the company and aid in their transformation. All in all, this takes 18 months.

From the start, PL was expected to build upon “off-the-shelf” workshops and consultancy services, with a non-significant budget for development. The perception from Industry Forum was that it was all about introducing a battery of “standard solutions” to individual companies. However, it soon became apparent for the actors within the programme that the approach had to be improved, and it continued to evolve ever since.

From the start in 2007, the approach to managing change in this programme has changed in a few ways and there has been a collective maturity process for the consultants involved in this programme. Together, these changes have moved the programme approach from a focus on tools to a focus on understanding each company

and contextualising the approach. The purpose of this case study paper is to describe how Produktionslyftet operates, and to reflect on how the methodology has evolved in Produktionslyftet.

According to Palmer, Dunford and Akin (2009), there are two main approaches to managing change: Management as Control and Management as Shaping. The first of these treats the organisation as a machine; with managers directing, people being assigned roles and resources being allocated for efficient performance. The second approach treats the organisation more as an organism; with managers shaping, people being encouraged to be involved in decisions and organisational capabilities are enhanced for effective functioning. The first approach has theoretical proponents such as Kotter and Pettigrew while the second has proponents such as Lewin and Weick (Palmer, et al., 2009).

Beer and Nohria (2000a, 2000b) describe an adjacent view on change with the help of what they entitle Theory E and Theory O (see Table VI). Theory E comes close to Management as Control, while Theory O is closer to Management as Shaping (Palmer, et al., 2009). Beer and Nohria (2000a), while warning against an arbitrary mixing of these archetypical ways, argue that the most effective approach to organisational change is to carefully integrate Theories E and O. Burns and Stalker (1961) provide yet another way of describing change and empowerment: the “mechanistic” approach, which is close to Theory E and Management as Control, and the “organic” approach, which is close to Theory O and Management as Shaping. Quinn and Spreitzer (1997), while using this theory to analyse employee empowerment, also come to the conclusion that a combination of approaches is the best way to go.

Table VI: Theory E, Theory O, and Combined (Beer & Nohria, 2000b)

Dimensions of Change	Theory E	Theory O	Theories E and O Combined
Goals	maximize shareholder value	develop organizational capabilities	explicitly embrace the paradox between economic value and organizational capability
Leadership	manage change from the top down	encourage participation from the bottom up	set direction from the top and engage the people below
Focus	emphasize structure and systems	build up corporate culture: employees' behavior and attitudes	focus simultaneously on the hard (structures and systems) and the soft (corporate culture)
Process	plan and establish programs	experiment and evolve	plan for spontaneity
Reward System	motivate through financial incentives	motivate through commitment—use pay as fair exchange	use incentives to reinforce change but not to drive it
Use of Consultants	consultants analyze problems and shape solutions	consultants support management in shaping their own solutions	consultants are expert resources who empower employees

Method

This case study paper is co-authored by two. One of these is employed at the consultancy company which is one of the driving forces behind Produktionslyftet. This co-author has been heavily involved, as a consultant and workshop facilitator, in the

operation of PL since late 2009. The other co-author is a university researcher that is external to the project, the only contact with PL being through interviews and discussions with people from the programme, as well as accessing material provided by the other co-author. The participation of the internal co-author ensures high access to the empirical material including own experiences and first-hand reflections, while the external co-author contribute with an external perspective and a theoretical view.

The description of the case is based on interviews with PL staff, inside experiences and PL material. The interviews were conducted solely by the external co-author, recorded, transcribed and put together. Afterwards, the internal co-author filled gaps, as well as contributed with additional perspectives. The access to PL materials, from different periods of the programme, makes the view on the evolution of the programme more robust.

Produktionslyftet

The description that follows in this section depicts the norm for how the change work is done and may seem quite static. It is in the interviews emphasised that the approach are to some extent dynamical.

Produktionslyftet, together with partners (universities, company networks etc.), arrange so called “insight seminars” where the programme is described in overview. Some of the participants on these events usually become interested in more fully exploring the opportunities of PL and apply to be part of it. These seminars are today becoming less and less important due to word of mouth, since there are plenty of applicants even without active “marketing”.

The programme direction review the formal conditions regarding, among others, size and business sector and also visits the company in order to evaluate the chances for successful interventions. Assuming a company is accepted, the company is allocated a pair of consultants, or “coaches” as it is called within the programme. To each company the consultants’ time budget is roughly 350 hours, where most of this time is spent on the actual company site.

One of the first steps is a pure educational one. Each accepted company needs to send at minimum two people, one aspiring so called lean coordinator and one supporting, to a university openly organised course in Lean Production.

The first arrangement at the actual company, phase 1, consists of five different workshops, each being one full day accompanied with “homework” that needs to be completed before the next session. This phase constitutes the first 3-6 months. The workshops are attended by a so called Lean Steering Group, which is similar to a “project board”. The group consists of the executive team expanded by key stakeholders, for example the labour union. Some companies choose to include even more people, which results in a diversity of sizes of such steering groups. If the group become too large it usually transforms into a reference committee and an operative work group emerges. The workshops are relatively standardised with regards to approach and format, but what is discussed in them is related to the topical company.

1. General introduction to lean, together with “lean games” for understanding. A lean game is an activity that with simple means shows how practices such as flow, pull and good communication really can enhance a production line, for example by letting the attendees simulate manufacturing by more and more efficient assembling of Lego pieces. Homework: Create a pulse board that is visualising for the group and for all employees what PL is, who are participating, and what activities there are.
2. Change workshop. Participants are discussing leadership, motivation, and respect for the individual, which usually are new ways of thinking. Homework: Start thinking on an appropriate pilot area for work.
3. Value stream mapping of one flow: looking at a flow and identifying what part that are value added and what are not. A flow can for example be from order receiving to start of production, or from start of production to end of production, or from end of production to delivery. Most usually this is made in the manufacturing area, and this is the first encounter with the operations. This is used in order to further develop ideas for pilot area to work in. Homework: Consider important KPIs. Where does the company want to go, and what does it want with PL? How KPIs could/should be used to enhance the work.
4. In some companies, the steering group can initially not articulate a sense of direction other than that it should make money. This workshop covers areas such as “How does the company ‘think’?” and “Where does it want to go?”. The starting points of these discussions are often any existing business and quality policies. These are scrutinised and vague formulations such as “we aim to enhance our productivity” are discussed in terms as how to reach these goals and what principles the company should work according to. This workshop is focusing on why the company should be good in certain areas, for example high quality and connecting it to company goals. Sometimes it is hard to manage this workshop in one day, why it if so needs to be complemented with an additional day. Homework: Make a summary of workshop 4 and condense this into, for example, a pamphlet about stating the core principles of the company.
5. Summary of the four earlier workshops. The ideas and discussions so far are put together, and the pamphlet is being refined. It is also detailed what area that will be first piloted.

The main idea of phase 1 is to create a common sense on basic values, for the company as well as the participation in the programme. The “end product” of this phase is an “action plan”, and the steering group has by this time also decided on a pilot area for starting the change work.

With an action plan developed after phase 1, the idea is that the steering group “mounts the barricades” and announce the plans and intentions to the whole organization. One common way to support this process is to have a lean game with all or most employees.

By the end of phase 1, a lean coordinator has also been appointed. This person will work with supporting the drive in the following day to day activities: following up on

results and becoming more and more confident in running the new lean initiative. From this time, the whole steering group will not be as active, but more of a reference group; promoting the initiative throughout the organisation and supporting the various change activities. During phase 2, the steering group is gathered for continuous evaluation approximately every month.

The next step, phase 2, starts with work in the pilot area that was identified. For example, if the paint shop has been identified as a bottle neck in the performed value stream map, this may have been appointed as a pilot area. The change process starts by gathering all the people from this paint shop and again establishing a common sense on what goals the company has with this particular process step. This group constitutes a pilot group that performs changes within its boundaries, while being supported by the lean coordinator and the consultants. Thus, several education workshops are run with this group. These workshops, and education areas that are needed, are identified both in phase one with the steering group as well as together with the group. Examples on such workshops are further value stream mapping, standardised ways of working, reduction of machine downtime, and “5S”. These workshops are supported by a common standardised PL pool of “tool knowledge”; educational and support material for using the various methods and tools. It should be pointed out the knowledge/educational pool is standardised, but the selection of what workshops that are appropriate is not. For example, if the pilot group together with the consultants and coordinator decides that the root causes are that people often need to search for tools, “5S” might well be an appropriate place to start. In the beginning, the consultants often have large roles in supporting the process of identifying such problems and helping the group understand the problems.

After a few weeks with the first pilot area, when the changes in this is well underway, new pilot areas are started with following similar educational and change processes. With each new area that is started the lean coordinator assumes more and more responsibilities. Also, with each new pilot group, it is desirable to have individuals from the steering group included effecting the steering group to be operationally active. It varies a lot how many pilot areas that are started during phase two, but four to six of them can be considered normal. A common outcome is that more permanent improvement groups are formed in these pilot groups.

At the end of phase 2 (which is 18 months after the start of phase 1) the PL representatives leave the company with the ambition of having initiated internal drive within the company. The interviewed consultants are quite humble with what that can have happened during these 18 months: “during these 18 months the companies have merely started to have more insight in lean thinking, and the lean work has just only begun”. Every now and then, the consultants are hired as continued consultants to check back on the company, for example every quarter. However, such initiatives are outside the PL programme, and on the initiative of the companies.

The dominating idea of the programme is to distribute knowledge throughout the organisation and to have people from the companies take on leading roles in the lean change work within each company. According to one consultant, lean is all about working smarter, not harder. This may sound natural, but this consultant state that one main problem in many companies are that individual issues steal the attention of too many people; there are no systems in place to ensure proper and proportional responses

to arising issues, which in the end drains a lot of resources. The perceived most important effects by the 19 first companies are shown in Figure 11. Effects such as smaller batches and better delivery precision are mentioned, but the most important effects are perceived those that relate to ways of thinking, communication and culture.



Figure 11: Effects perceived as most important by representatives of the 19 first companies in PL1. Adapted and translated from Swedish language Produktionslyftet material

The evolution of the programme

Throughout the life of Produktionslyftet, there have been regular meetings among the consultants, with the intent of discussing and bringing the programme forward. These help the programme to evolve both continuously, and even more so in-between PL1 and PL2. There are three issues that are brought up as the major differences between them: forming coherent views within the companies, a more context sensitive approach, and personal development of the coaches.

At the start of PL1, it was assumed that the individuals in the companies shared a common sense of direction for the company, and a common view on what was going on inside the company. This was later shown to often not be the case; many of the people in the steering group had previously never actually had any discussion together, and especially not on these matters. As a consequence of this revelation, the programme does today focus much more on phase 1. In PL1, the most important thing in each company was to start “doing things”. Today, the most important thing is rather seen as creating a common understanding within the steering group, with the purpose of having these people as a strong team to work with lean production. These changes does not necessarily result in longer calendar times for phase 1, but show in a stronger emphasis during the sessions as well as the substantial “homework” to be done in-between the sessions.

Throughout the life of PL, it has always existed a toolbox with support for the usage of tools and methods, for example 5S, VSM and SMED. In PL2 this toolbox has been expanded with better support and also support for more methods. More importantly, there is stronger emphasis on deciding together with the company on what tools and methods being appropriate to start using, while in PL1 there was a bit more of pushing.

This seems to be both due to a central move in this direction, but also due to a change in the mind-set of the individual consultants. This personal development of the consultants is accentuated as a major advantage in the programme. With experiences from earlier companies, it is easier to provide companies with a clearer picture on what they will go through. It is generally also easier for the consultants to identify strengths and weaknesses, identifying good candidates for being Lean Coordinator and so on. These individual learnings are also spread throughout the programme by both the regular consultant meeting, and by the presence of assistant consultants (which normally are active in multiple companies at the same time). Today, the programme is perceived to having a clearer and sharper overall structure.

Some of these changes can also be illuminated by reviewing PL material describing the overall structure of the programme. For the start of PL1 (Figure 12), the steering group had a “lean-intro” and was subsequently thought of as self-driven. The next step was to implement the building blocks that were the standard tools, which always started with “5S”. Change management appears somewhere in the end in-between “Ergonomics” and “Measurements”. Furthermore, the action plan was something that was done “on the side”. Today (Figure 13), “learning” is central. It is more of together growing a new behaviour and fertile culture, starting with the steering group. There are still tools and methods, but they are more depicted as a toolbox to choose from and to gather support from.

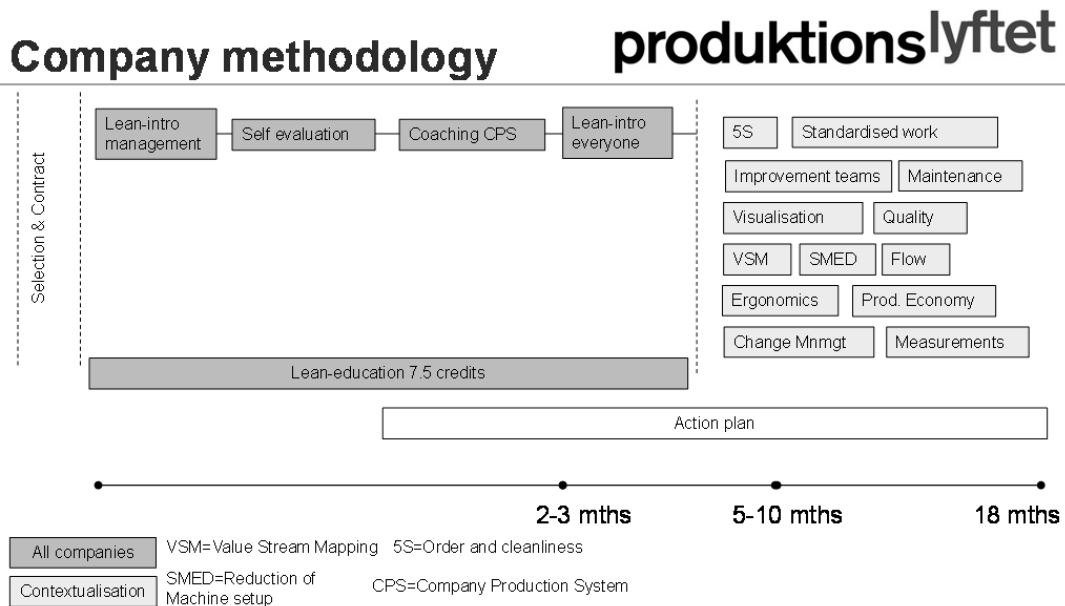


Figure 12: The approach in the early stages of PL1. Translated from Swedish language Produktionslyftet material.

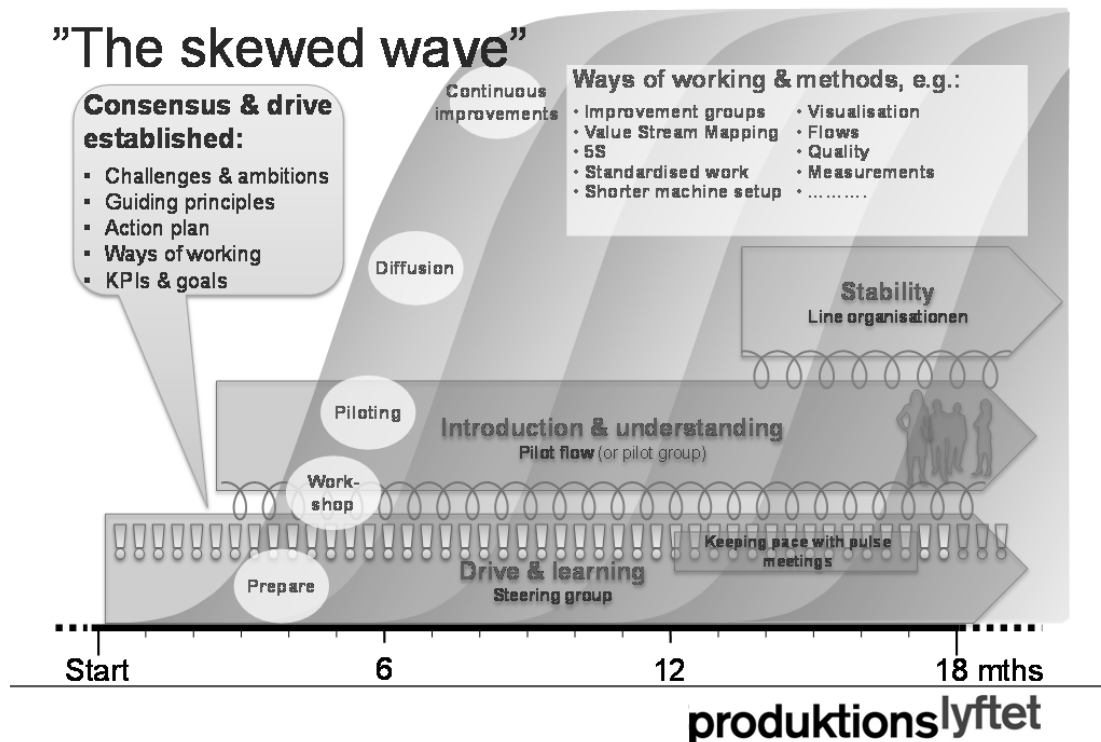


Figure 13: The approach by the middle of PL2. Translated from Swedish language Produktionslyftet material.

There were also four other issues that were brought up as noteworthy in the interviews:

- PL1 was fundamentally organised and managed from Swerea IVF AB and Chalmers University of Technology, both situated in the Gothenburg area. For PL2, Sweden was divided into 8 regions, each of them being managed by a university, in order to better continue working with more medium-sized industries all over the country. This also means that the two central organisations provide less main consultants, while still making sure to be represented by assistant consultants maintaining an overview of the activities in the companies, as well as bringing in experiences from other companies.
- Already in PL1 there was a demand on an active top management. However, this was not always the case in reality, why in PL2 there is a stronger focus on the necessity on management commitment, with higher demands on their presence and commitment. It is made sure that the MD does not simply sign on for the project and then delegate the participation.
- There is now a stronger focus on measuring, by developing and using appropriate KPIs etc.
- There are now many competitors to PL; entities that are offering similar types of company development support. During PL1, PL was more alone on the market.

Discussion

Table VII shows how PL1 and PL2 relates to Theory E and Theory O (Beer & Nohria, 2000a). During this time, the programme has moved towards a combination of Theory E and Theory O. By the start of PL1, the programme had an approach to change that roughly resembled a mechanistic approach with focus on tools to implement, while today it has moved towards an organic approach deciding on changes together with participation from all parts of the companies (Burns & Stalker, 1961; Quinn & Spreitzer, 1997). It should be noted though, that the most valuable effects in companies was already for the first companies in PL1 perceived as not being about tools or efficiency, but rather about culture and new ways of thinking.

Table VII: PL1 and PL2 in relation to Theories by Beer and Nohria (2000b)

Dimensions of change	PL1	PL2
Goals	E	EO
Leadership	E(O)	EO
Focus	E	EO
Process	E	EO
Reward System	-	-
Use of Consultants	E(O)	EO

The move towards a combination of mechanistic and organic approaches is endorsed by both Beer and Nohria (2000a) and Quinn and Spreitzer (1997). However, these changes have primarily evolved from the collected and individual experiences of the involved coaches. Meetings and deliberate efforts have changed the programme overall, while individual experiences has changed the approach of the individual coaches. The people involved in the programme has decided that no matter how useful tools such as 5S are, it has to be considered what the company really needs, and that it has to come from the people inside the companies, not from the outside.

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A health-related Quality Management approach to evaluating health promotion activities.

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Category: Research paper

Introduction and background

Work-life balance has a major impact not only on business productivity but also on the economy as a whole, (Hughes 2007) and Wolf (2008) maintain that implications for the workplace are enormous as mental disease goes hand in hand with significant productivity losses. According to Janssen et al., (2003), the occurrence and causes of sickness absence are affected by several factors, many of which are work-related and organizational. Examples of the former are work content and work conditions. The latter include, for instance, company size, the existence of health promotion programmes, and absence policies (ibid). When implementing corporate health promotion, the responsibility should mainly rest with the management (Plath et al., 2008). Thus health promotion activities are important in order to improve co-worker health and in the long term the efficiency in the organization. Advancing knowledge in the area of leadership for health promotion could make valuable contributions to increasing the health of the population, Andersson et al., (2005). Vinberg (2006) claims that increased workplace health and performance are connected to a good working environment and work organization.

The salutogenic approach to health, identifying factors that promote good health, (Antonovsky, 1987) instead of identifying and limiting those leading to ill-health has been common in health research. Viewing co-worker health as a resource for corporate quality, success and competitiveness is in line with this approach, (Wreder et al., 2008). Leadership theory research in general has shown that leadership behaviour can be used to predict co-worker health outcomes (Skogstad, 1997). Management strategy based on humanistic core values, supported by Quality Management, has been pointed out as important for co-worker health, (Wreder, 2008). Correlations between co-workers' perceptions of their health and values within Quality Management have also been found (Lagrosen, 2004; Lagrosen et al., 2007). A well-developed, structured approach for health-related quality management can be used as a management tool in order to assess and improve employees' well-being, satisfaction and motivation (Lagrosen et al., 2011). Taken all in all, research, knowledge and support to the management within the health promotion area are important.

The purpose of this paper is to describe health promotion activities conducted within a project and to measure the conditions for sustainable health within the case organizations. The purpose is also to test earlier previously developed measurement approach, which measures health-related Quality Management (Lagrosen and Bäckström, 2005 and Lagrosen et al., 2010).

Health promotion and measuring health-related Quality Management

Correlations between Quality Management on a company-wide scale and improved co-worker satisfaction and health as well as improved external customer satisfaction and financial results have been found in research, see for instance, (Park Dahlgaard and Dahlgaard, 2003; Dahlgaard and Park Dahlgaard, 2003a, 2003b). Wreder (2008) maintains that one way of working with co-worker health is to strategically and systematically work on creating a culture based on core human values, by choosing methodologies and tools which support the values present within Total Quality Management (TQM). Studying successful organizations, she found that leadership in the form of 'management commitment' was a supporting value and a prerequisite for Quality Management practices such as employee involvement, delegation and coaching when working with co-worker health. In addition, Bäckström et al (2009) found that organizations that have achieved healthy co-workers with low sickness absence through their conscious and well-structured work were also working according to Quality Management. Workplace practice includes managers giving guidance and taking their time to coach the employees so that they dare to prioritize and take decisions by themselves; carrying out regular personal development talks with the employees; really listening and trying to find drivers for action; as well as giving everyone the opportunity to be aware of the customer and what their own contribution is: who they are creating value for (ibid). This is in line with Lagrosen et al., (2007) and Wreder et al., (2008) who maintain that Quality Management can improve the health status of the co-workers by bringing in more humane and effective practices and at the same time can improve the working conditions. To organize healthier and safer workplaces and achieve excellence in product and service quality the same kind of overarching management system is needed Warrack and Sinha (1999). There is also research which describe how Quality Management can be practiced to support sustainable health among co-workers and also what is of most importance within Quality Management to influence co-workers' sustainable health (Bäckström, 2009, Lagrosen et al, 2010). The results show that the value 'Leadership Commitment' and the value 'Participation of Everybody' are important to support sustainable health among co-workers when Quality Management is practiced (Bäckström, 2009, Lagrosen et al., 2011) The underlying dimension of the values 'Leadership Commitment' and 'Participation of Everybody' regarding the relation to co-worker health was examined by Lagrosen and Bäckström (2005) and Lagrosen et al., (2010). In that study, it was pointed out that integrity, presence and communication, empathy and continuity are underlying dimensions of 'Leadership Commitment'. Development, being informed and influence were found to be the underlying dimensions of the value 'Participation of Everybody'. These dimensions were also found as established methodologies, values and practices in successful organizations that have achieved good workplace health (Bäckström, 2009).

A measurement approach was developed, with the found underlying dimensions as a base, in order to help managers examine to what extent the values 'Leadership Commitment' and 'Participation of Everybody' permeate the organization (Lagrosen et al., 2011). The measurement approach can be used to point out to what extent the organization is practicing the health-promoting values of Quality Management and in what areas improvement is needed to increase co-worker health, (Bäckström, 2009, Lagrosen et al., 2011). The measurement approach can also be used longitudinally to assess before and after carrying through an organizational change, (Lagrosen et al., 2011).

Description of the health-promoting project

The health promotion project was initiated in 2009 and school leaders and teachers in elementary schools in the county of Jämtland in Sweden were chosen as a target group. This county has a high unhealthy rate in terms of not being able to work due to sick-leave, compared to other counties in Sweden. Elementary schools as organizations were chosen since teachers, as an occupational group, are vulnerable because of increasing demands from society. Investigations from the Swedish Work Environment Authority show in self-report questionnaires where teachers were asked to evaluate their working conditions that more than 60 % of teachers were not planning to work or probably would not manage to work until pension. In today's society health is critical in the competitive labor market. During elementary school, the teacher is a role model for young children and has a major influence on the process of learning. It is important to create a working environment in which teachers feel physically, mentally, and socially healthy. To be able to investigate their needs a pre-project was conducted with funding from The European Social Fund (ESF). A survey containing 59 questions concerning health-promoting aspects was sent out. The results showed that there were both direct and indirect needs for capacity building. Direct needs were, for example, more knowledge about factors that promote health and indirect needs included aspects concerning the individual's health such as stress management in the working environment. Hence, the outcome of the pre-project showed that there were needs for improvement of qualifications and competence within the health-promoting area. Since there were obvious needs the project management decided to apply for funding from ESF to be able to carry out a health-promoting project.

Eight schools in the municipality of Östersund, and Krokoms were invited to participate in the project, which resulted in a target group of about 185 school leaders and teachers at seven municipal schools and one private school. The project, based on the findings from the pre-project, started in February 2010 with funding from the sport association of Jämtland-Härjedalen (Jämtland-Härjedalens Idrottsförbund), ESF and the county council of Jämtland, and in cooperation with Mid Sweden University who funded the project. The vision was to energize health promotion and sustainable development of society. The aim of the project was to create good conditions for the target group through capacity building and to give the teachers knowledge and tools to implement a health-promoting approach, both educationally but also in everyday life. Equality and availability are aspects that were fundamental conditions in planning and implementing the health-promoting activities. In the long run this health-promoting intervention will hopefully lead to a more health-promoting work environment and a decrease in the sickness rate. The activities conducted in the project are described below.

Methodology

The health-promoting project described above was studied with focus on the healthpromoting activities that were carried out. The project management informed the researcher about the project; its purpose, the participating schools and the planned activities within health-promoting areas in the initial stage of the project. In December 2010, information concerning changes to the original plan, what sort of health-promoting activities were planned and how they were to be conducted, were provided by the project management. A revised plan for all activities planned for the remaining project time was also provided.

Information on the Quality Management health-related measurement approach was distributed to the co-workers at the eight different schools at the beginning of the project. The target group had been informed about the project and the purpose of the measurement. Totally 141 questionnaires were collected but two were omitted from analysis, as they were not filled in properly. A total of 139 questionnaires were analyzed out of 185 possible co-workers, which gives a response rate of 75%. The questionnaire was developed based on the dimensions of the values 'Leadership Commitment' and 'Participation of Everybody' developed by Lagrosen et al., (2005, 2011). Each dimension in the questionnaire was constructed by means of three different statements that represent the specific dimensions, (ibid). The respondents were asked to mark on a seven-point agreement scale to what extent they agreed with the statements. This kind of graphical scale is usually considered to be of the interval type (Lekvall and Wahlbin, 1993). The extremities of the scale were "Disagree completely" and "Agree completely". To test the internal consistency and reliability of the statements within each construct, Cronbach's alfa analysis was carried out using the SPSS reliability analysis procedure (Malhotra and Birks, 2000). Correlations were then calculated using the Pearson Correlation Coefficient and its corresponding test-statistics. The Cronbach's alpha coefficient was computed for each dimension in order to test the internal consistency reliability. A value of 0.6 or less is generally considered unsatisfactory (Hair et al., 1998; Malhotra and Birks, 2000) and the coefficient tends to increase with the number of items or statements.

When the results from the measurement approach were analyzed, each school leader was informed about the result at their specific school and the mean value of all the schools in the project. A description of the meaning of each dimension that had been measured was handed out to the leaders. They were also informed of possible methodologies, behaviors and values that could help them to be able to increase sustainable health among the co-workers (Bäckström, 2009).

Health promotion activities accomplished within the project

Depending on the needs of the different schools, those involved in the education and the further training were different for different activities. Some of the activities were aimed at the leaders; the headmasters and the headmistresses and some of the activities were aimed at all; both co-workers and leaders within the school. In the first phase, the focus was on preparing the school leaders for what their co-workers would go through during the project. By doing so the project management could be more confident that the main target group would get the right information and resources to follow through. To ensure

participation the school leaders were involved in planning the practical aspects of the activities. This enabled customized solutions for every school and their co-workers. The activities for school leaders started in May 2010 and for co-workers in August 2010.

Activities aimed at the leaders

The activities for the school leaders were divided up into six different meetings during the 12 months of the project. Four of these were carried out during 2010 in May, June, September and October and the remaining two in 2011 in January and March. The first activity for the school leaders was a one-day lecture about salutogenic leadership and workplace health promotion. The salutogenic approach focuses on the factors that promote health instead of the factors that are detrimental to health. The kickoff for the directorate (group of school leaders) was carried out in June: two days with the purpose of letting the leaders get to know each other and to start the process of capacity building in the health-promoting area. This included lectures on communication and other tools for implementing the health-promoting perspective in the elementary schooling system. In September the leaders got together to summarize the development so far and to discuss the needs of every specific school and their co-workers. In October the school leaders met for a half-day about diet, and physical activity and exercise. In January the group met again to talk about progress made and how and in which way the project had affected the schools and their co-workers. The last activity for the directorate was in the end of March to discuss and plan the future. The reason why the school leaders had separate activities, besides being one step ahead of the main target group, was that when the project ended they as a group could help and support each other to keep up the health-promoting work.

Activities enriched to the co-workers

The first step in launching the project was to inform all co-workers of the eight schools and outline the project and their participation. This took place in May 2010 and at the same meeting the co-workers were asked to fill in a questionnaire on the measurement approach. During the project there were two meetings where all the 185 participants in the project would be gathered all at the same time. The first time was during the kickoff which took place in August; two days of introduction of the health-promoting perspective, and approach. The second time will be on June 13th 2011 when the “starting point” for the future takes place. During two days in September all coworkers were invited to participate at a half-day lecture in diet and physical activity and exercise. In October a series of workshops in communication started and, depending on the needs of each school, the communication activities were followed up and took place in the working environment of each school. There was also a day of different workshops and lectures to learn more about the salutogenic approach and integration of health promotion. During the whole project time the participants were offered personal trainers, students at the sport science program at Mid Sweden University, who they met once a week during a period of five to six months.

The activities in the project were planned to go from general, involving all co-workers, to become more school-specific and individualized. In October the co-workers got a menu of different health-promoting activities to choose from. These activities were: salutogenic leadership as a practical pedagogic, coaching I, coaching II, yoga, mental

training, physical activity and exercise, diet, balance in everyday life, movement and mental practice in the classroom, and motorical development as a foundation for learning (MUGI). Each teacher had an amount of hours to spend on one of the activities described above. The activities were optional and no one was forced to participate against their will. The aim of these activities was that each individual, regardless of position, could do something that he or she felt was meaningful as a person, not only a teacher.

The project ends with a “starting point” for the future that will take place in June 2011. This day will summarize the whole process and the co-workers’ experiences of being a part of a health-promoting project. At this stage the project management will hand over to the directorate whom together with their co-workers will continue the health-promoting process at each school. During this meeting the participants will fill in the questionnaire on the measurement approach as a way to evaluate if the health-promoting activities have had an effect on the co-workers’ perception of their health and if the permeation of the health- related values within Quality Management have increased.

Measuring of the starting conditions within the schools

The results of the measuring in the beginning of the project are illustrated in Figure 1, which illustrates the mean value of the dimensions and health status at all schools. The mean value for all schools for all dimensions varies from 4.53 to 5.54. The dimension that varies most between the schools is ‘Continuity’ which varies from 2.81 to 6.30. The health index is the dimension that varies least between the schools which varies from 5.18 to 6.03 which is rather high on a seven degree scale. These results from the measuring approach show that the conditions for sustainable health vary quite a lot between the schools.

	Empathy	Presence/ Communi- cation	Integrity	Continuity	Develop- ment	Influence	Being informed	Health
School A	5.67	5.93	5.73	6.30	5.80	5.70	4.37	6.03
School B	4.89	4.89	4.82	4.96	4.62	4.81	4.65	5.39
School C	5.83	5.33	5.54	4.88	5.23	5.17	4.35	5.60
School D	5.85	5.74	5.52	4.89	5.00	5.48	5.63	6.26
School E	3.38	3.57	3.33	2.81	3.05	3.24	4.29	5.29
School F	5.26	4.64	5.36	4.43	4.74	4.71	4.45	5.71
School G	5.41	5.51	5.39	4.76	4.71	4.57	4.25	5.18
School H	4.74	4.26	4.56	4.86	3.83	4.30	4.44	5.44
Total	5.09	4.93	5.00	4.82	4.59	4.74	4.53	5.54

Table 1. The results from the measurement in all the schools.

As the leader was informed about their own mean value they could compare their own results with the mean value of all schools. The results gave the leader information about the co-workers’ perception of their health, and the co-workers’ perception of to what extent the values ‘Leadership Commitment’ and Participation of Everybody’ permeate the schools. It also gave them information as to which areas they as leaders had possibilities to improve.

1. The test of the measurement approach

DIMENSION	MEAN SCORE	ST.DEVIATION	CRONBACH'S ALPHA
Empathy	5.0983	1.11962	0.837
Presence/Communication	4.9257	1.05489	0.637
Integrity	5.0024	1.06284	0.783
Continuity	4.8177	1.34249	0.671
Development	4.5947	1.29583	0.752
Influence	4.7386	1.16079	0.552
Being Informed	4.5276	0.95797	0.535
Health -index	5.5372	1.03832	0.789

Table 2. The results of the internal consistency reliability analysis of the measurement approach.

The Cronbach's alpha coefficient was computed for each dimension in order to test the internal consistency reliability. A value of 0.6 or less is generally considered unsatisfactory (Malhotra and Birks, 2000), and the coefficient tends to increase with the number of items or statements, (Hair et al., 1998). Six of the dimensions score higher than 0.6. The dimensions 'Influence' and 'Being Informed' score less than 0.6 which can be considered rather low. There is also some variation in the data where 'Continuity' has the highest standard deviation indicating a substantial variation in perception of that dimension among the co-workers. In earlier tests that dimension also had the highest variation. The dimension 'Continuity' also has a high variation.

We also calculated the Pearson correlation between the results on the statements regarding the dimensions and the statements regarding the health index. The results are presented in Table 3.

DIMENSION	PEARSON CORRELATION	SIG.
Empathy	0.206*	0.015
Presence/Communication	0.217 *	0.010
Integrity	0.180 *	0.033
Continuity	0.134	0.115
Development	0.082	0.336
Influence	0.328**	0.000
Being informed	0.238**	0.005

Significance level: * $p < 0.05$; Significance level: ** $p < 0.01$

Table 3. Correlation between the dimensions and the health index

As can be seen in the table, the two dimensions 'influence' and 'being informed' were highly significantly correlated with the health index with a p-value for the first mentioned dimension of only < 0.000 . A significant correlation can also be seen between 'integrity', 'presence/communication', 'empathy' and the health index. Thus, we can conclude that most of the dimensions are related to good health among the employees.

Discussion and Further research

The description of the health promotion activities accomplished within the project can help managers and project leaders to plan and carry out their projects and activities in their striving for sustainable health among the co-workers and for efficient organizations. Before the project is finished the co-workers will be asked to fill in the measurement approach questionnaire once again. Then a comparison between the results in the beginning of the project and the results in the end of the project can be done. That comparison can confirm if the health promotion activities have influenced health among the co-workers. The comparison can also confirm if the underlying dimension to the values 'Leadership commitment' and 'Participation of Everybody' permeates the schools to a higher extent after having conducted all those health promotion activities. It would also be interesting to follow up the schools later maybe after a year and test if the values have permeated to a greater or lesser extent. Another interesting further object of research is to interview the leaders and the co-workers to investigate their experience of the health-promoting activities in the project. In those interviews it could be interesting to investigate if the co-workers think the leaders have changed their leadership after the health-promoting activities and if the leaders think they have changed their own leadership and also if the co-workers think they have changed their way of teaching the children.

Since two of the dimensions had lower Cronbach's alpha than 0.6, a factor analysis would be valuable in order to investigate which the underlying factors are in this material. New dimensions could be found which perhaps can give new insight into correlations with employees' perceptions of their health. In our previous research (Lagrosen et al., 2011,) the dimensions 'Development' and 'Influence' had Cronbach's alpha higher than 0.6. However, that research study was carried out in a manufacturing company (Lagrosen et al., 2011). A manufacturing environment is quite different from an elementary school environment. This could be a reason for the different results.

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Customer Experience Creation: the Case of Transport Services Company Transteda Ltd

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Introduction

The global competition obliges organizations to search for new sources competitive advantage. At present the organizations, which do not differentiate products and services as well as competes only by prices, have little possibilities to survive. Patterson et al. (2008) state that when creating the desired experience for a customer the organizations, in fact, offer exceptional service. However, modern organizations, though well knowing habits of customer purchase, not sufficiently go deep into customer experience that determines his / her satisfaction and loyalty. A customer who does not have any experience does not exist. Every customer acquires positive or negative experience. So every organization should organise service rendering so that customer's experiences would form positive experience at every point of his / her interaction with the organization as well as would ensure long-term collaboration with the service provider. Thus the positive experience of service customers is not dissociated from the financial results of the organization, which are achieved when having a larger number of satisfied and loyal customers.

Lithuanian transport and logistics sector distinguishes in a large number of market and acute competition. Transteda Ltd is the company of private capital registered in Lithuania. The main activity of the company is international and domestic transport services by road. The company provides wide range of the services: transportation of cars; transportation of cargos' covers the carriage of full, partial, frozen, hazardous goods in the entire Europe; transportation of part loads is the service used by the customers, who want to deliver the shipment that does not make the full cargo; transportation of cargos in containers is used to carry the goods by sea from such countries as China and the USA; additional insurance of cargos is the additional guarantee to the customer when an expensive cargo is transported. The transportation directions are very different, starting with Western Europe and Scandinavia, and ending with Turkey and the CIS countries. Some part of the vehicles is working for regular customers on regular routes, while the other part serves the irregular needs of the customers. Transteda Ltd creates added value for each customer safely and effectively, with enthusiasm, accuracy and reliability. In its services company emphasizes exceptional attention to the customers, quality and safety of the provided services, as well as the coordination of information. The managers of the company coordinate company's activity effectively and thus can suggest the most optimal transport solution for the customers.

Transteda Ltd fast develops; it pursues not only to enlarge the number of its customers, volumes of transported cargos but also to improve relations with its customers; thus the enterprise faces the objective how to ensure satisfaction of service customers and to strengthen their loyalty for the enterprise. One of the ways to solve this objective – is to manage the formation of positive experience of customers.

The aim – is to envisage the possibilities to advance the management of service customers’ experience at Transteda Ltd.

Customer experience: a brief literature review

Defining customer experience

One of the main features of today’s service customers – increased expectations and requirements for services organizations. This is true for business-to-customer and business-to-business customers. The management of positive experience at every touchpoint of interaction with the organization can help to win intelligent customers’ satisfaction and loyalty. Temkin (2009) notes that an average \$10 billion company can generate \$284 million of additional revenues from customer experience improvements. Johnston and Kong (2011) study has suggested that there were three areas of perceived benefit; the customer, the staff and the organisation. Thus satisfying customer experience is needed. Customer experience leads to customer satisfaction, which in turn acts as an antecedent of brand loyalty, customer retention, market growth and the overall profitability of the organization (Garg et al., 2010). Unfortunately, most companies do not fully understand this link.

The notion of the customer experience has emerged from a synthesis of six concepts: paradigm shifts in ideas of the customer, relationship marketing, customer lifecycles, service framework theories, customer spending psychology and services sciences, management, and engineering (Ojiako, Maguire, 2009). Customer experience has been defined in various ways. Some definitions are presented in Table I.

Table I. Definition of customer experience

Researchers	Definition
Gentile, Spiller and Noci, 2007, p. 397	„The customer experience originates from a set of interactions between a customer and a product, a company, or part of its organization, which provoke a reaction. This experience is strictly personal and implies the customer’s involvement at different levels (rational, emotional, sensorial, physical, and spiritual)”
Meyer and Schwager (2007), p.118	„Customer experience is the internal and subjective response customers have to any direct or indirect contact with a company. Direct contact generally occurs in the course of purchase, use, and service and is usually initiated by the customer. Indirect contact most often involves unplanned encounters with representatives of a company’s products, service or brands and takes the form of word-of-mouth recommendations or criticisms, advertising, news reports, reviews and so forth.”
Howard (2009), p.1	„Total Customer Experience (TCE) can be defined as the overall impression a customer develops about a company, based on perceptions and experiences at every point of interaction with that company”.

Verhoef et al. (2009), p.32	„Customer experience construct is holistic in nature and involves the customer’s cognitive, affective, emotional, social and physical responses to the retailer... the customer experience encompasses the total experience, including the search, purchase, consumption, and after-sale phases of the experience, and may involve multiple retail channels“. “This experience is created not only by those elements which the retailer can control (e.g., service interface, retail atmosphere, assortment, price), but also by elements that are outside of the retailer’s control (e.g., influence of others, purpose of shopping)”.
Shaw, Dibeehi and Walden (2010), p. 3	„A customer experience is an interaction between an organization and a customer as perceived through a customer’s conscious and subconscious mind. It is a blend of a an organization’s rational performance, the senses stimulated and emotional evoked, and intuitively measured against customer expectations across all moments of contacts“
Walter, Edvardsson and Öström (2010), p. 238	“Customer experience is defined as the customer’s direct and indirect experience of the service process, the organisation, the facilities and how the customer interacts with the service firm’s representatives and other customers. These in turn create the customer’s cognitive, emotional and behavioural responses and leave the customer with memories about the experience.”
Johnston and Kong (2011), p. 8	“The customer’s experience is their personal interpretation of the service process and their interaction and involvement with it during their journey or flow through a series of touchpoints, and how those things make the customers feel.”

According to customer experience definitions in the literature, all customers have experience (good, bad or indifferent) during an interaction with the organization and it is inherently subjective and personal.

As Schmitt (1999) states, experiences provide sensory, emotional, cognitive, behavioural, and relational values that replace functional values. Schmitt notes that, while customers may frequently engage in rational choice, they are just frequently driven by emotions because consumption experiences are often directed toward the pursuit of fantasies, feelings, and fun. Palmer (2010) argues that a combination of three factors - stimulies, context and situational variables - help shape a consumer’s attitude to an event. People perceive a stimulus differently according to its sensory characteristics and information content. In perceiving stimuli with a given set of characteristics, individuals will also be influenced by the context of the stimulus. Situational variables in which the information is received, including social, cultural and/or personal characteristics - perceptions are greatly influenced by individual characteristics, including prior experience with a particular product or service offering.

The brands are important for customer experience formation as well. As Howard (2009) notes, the brand and new channels of interaction, based on new technologies, influence the customer experience. From brands the customers are looking for something real and authentic and not just ad slogans and messages. They want something that engages their senses and touches their hearts, something that excites or intrigues them (Schmitt, 2009).

Brakus et al. (2009) distinguish the product, shopping, service and administration experiences. Experience of the product formed when customer search for, examine and evaluate products. It can be direct, when the customer has physical contact, and indirect, when the product is in a virtual space or advertised. Shopping and service experience is under the influence of customers' interaction with the organization employees, physical environment, work policies and practices. The customer experience takes hedonic, emotional, fantasy and alike tones, in other words, it is multidimensional. Also Kim et al. (2011) study provides evidence that the customer experience construct is multidimensional and therefore hierarchical in nature. Kim et al. (2011) developed the index that identifies and measures the underlying dimensions of the customer experience. Their research resulted in a seven-factor model comprised of the following dimensions: environment, benefits, convenience, accessibility, utility, incentive, and trust.

According to Frow and Payne (2007), experiential consumption emphasises emotions and contextual, symbolic and nonutilitarian aspects of consumption where value resides not in the object of consumption but in the experience of consumption.

Table II illustrates the factors what form the user experience in different phases of use.

Table II. The factors of customers experience in different phases of use (Adopted from Arnould et al., 2004; Venkat, 2009)

CUSTOMER EXPERIENCE			
<i>Pre-purchase consumption</i>	<i>At purchase / consumption</i>		<i>Post-purchase</i>
	<i>Buying experience</i>	<i>Usage experience</i>	
<ul style="list-style-type: none"> • search (specific, using traditional means, the Internet, friends' recommendations) • future purchase planning; • finance proportion planning; • expectations 	<ul style="list-style-type: none"> • option; • payment; • service encounter; • atmosphere 	<ul style="list-style-type: none"> • feeling and experience (testing, contact, feeling, attitude); • glut; • excitement; • changes 	<ul style="list-style-type: none"> • memories of past experiences; • stories; • comparison of old experiences with new ones; • sharing experiences with friends; • the desire to re-use the same service

Each phase of the use is imposing new points of contact with the organization in determining the customer experience (Mascarenhas et al., 2006). Venkat (2009) argues that every customer, during service delivery from the contact with the organization, takes appropriate decisions on their future behavior. Thus it is important to identify all touchpoints where interests of customers and the organization are concurrent. As each individual aspect of the service forms the customer experience, the organization activities, which are likely to influence the customer experience, must be constantly monitored and each customer's response requires attention. All these things influence customer experience and ultimately the level of customer satisfaction or dissatisfaction.

Customer experience dimensions and clues

Customer experience is dynamic and by organization is not created exactly the same way for every customer. Anything perceived or sensed - or conspicuous in its absence - is an

experience clue (Berry and Carbone, 2007). An organization cannot manage customers' emotions, but it can manage the clues embedded in customers' experiences.

Schmitt (2003) indicates five types of experiences: sensory experiences (*sense*), affective experiences (*feel*), cognitive experiences (*think*), physical experiences, behaviors, and lifestyles (*act*) and social-experiences that result from relating to a reference group or culture (*relate*). Gentile, Spiller and Noci (2007) assume six components of the customer experience. They are similar to Schmitt (2003), but Gentile, Spiller and Noci *act* type of experience define into *lifestyle* and *pragmatic*.

Gentile, Spiller and Noci (2007) make a distinction between two kinds of customer value: *utilitarian value* (or functional value) and *hedonic value* (or experiential value). Angelis et al. (2010) state that in addition to the components required in services provision, such as appropriate physical environment, implemented processes and sufficient staff, managers must also incorporate behavioural components. These can be grouped into emotions and participation activities (Fynes and Lally, 2006).

Pine and Gilmore (1998) think about experiences across two dimensions (the customer participation and the connection, or environmental relationship) and classify customer experience into four parts: entertainment, educational, escapist, and esthetic. Entertainment experience is those in which customers participate more passively than actively; customers connection with the event is more likely one of absorption than of immersion. Educational experiences involve more active participation, but customers are still outside the event. Escapist experiences involve greater customer immersion. During esthetic experience customers are immersed in an activity or environment, but they themselves have little or no effect on it.

As Berry and Carbone (2007) state, experience dimensions are emotions, attitudes, and behaviours. Emotions represent how customers feel about themselves, attitudes - how customers feel about the company, behaviors - how customers act. According to Berry and Carbone, an organization's first step toward managing the total customer experience is recognizing what the authors call clues: the signals or messages given off by everything involved in the buying process. Berry and Carbone declare three main categories that form the experience clues: functional, mechanic, and humanic. Functional clues concern the technical quality of the offering. It means that anything that influences the customer's perception of technical quality is a functional clue. Mechanic clues make influence on sensoral processes. The building design, equipment, furnishings, displays, colors, textures, sounds, smells, lighting etc visualize the service and communicating with customers. Human clues come from the behavior and appearance of service providers, for example the choice of words, the tone of voice, the level of enthusiasm, the body language, appropriate dress and neatness. Human interactions in the service experience provides the primary opportunity to extend respect and esteem to customers and, in so doing, exceed their expectations and cultivate emotional connectivity.

Summarised the dimensions and clues of customer experience are presented in Table III.

Table III. The the dimensions / clues of customer experience

Researchers	Customer experience dimenstions / clues
Pine and Gilmore (1998)	Entertainment, educational, escapist and esthetic
Schmitt (2003)	Sensory (sense), affective (feel), cognitive (think), physical, behaviors and lifestyles (act) and social (relate) experiences
Gentile, Spiller and Noci (2007)	Sensorial, emotional, cognitive, pragmatic, lifestyle, relational components
Fynes and Lally (2006)	Emotions and participation activities
Berry and Carbone (2007)	Emotions, attitudes and behaviours
Berry and Carbone (2007)	Functional, mechanic and humanic clues

Pine and Gilmore (1999) argue that, in an experience economy, companies must make memories and create the stage for generating greater economic value, rather than simply making goods and delivering services. Thus we can state that organizations must manage customer experience clues, if they want to offer their costumers memorable activities.

Research methods

The experience of the Transteda Ltd customers was analysed by applying quantitative and qualitative methods: survey-in-written and semi-standardized interview.

The respondents of the survey-in-written are the representatives of the fixed drivers, who per month transport not less than 10 tons of the cargo. Having designed the diagram of service rendering, nine interaction touchpoints were identified, in which customer experience is forming: 1) search for information, 2) clarification of needs, 3) search for a cargo, 4) cargo offering, 5) cargo order, 6) preparation for transportation, 7) cargo loading, 8) cargo delivery and 9) document registration. Referring to them, the questionnaire was formulated. Its aim is to survey customer experience before using the service, when using the service and after using the service as well as to identify the most important components of the experience of the representatives of the enterprises participating in the survey – behaviour, viewpoint and emotions – at every touchpoint of customer interaction with the Transteda Ltd company. The data of the survey were processed by the programme SPSS 18 *Statistics*.

The semi-structured interview was performed with five informants:

- the first informant – the director who has managed the enterprise for two years, before this he worked as purchase manager at this enterprise. Interview duration – 75 min.;
- the second informant – the purchase director who has worked for three years in this enterprise; he is responsible for the offering of the possessed cargos to customers. Interview duration – 60 min.;
- the third informant – the sale director who has worked for three years in this enterprise, before he worked as sale manager and directly communicated with ther enterprise’s customers. Interview duration – 55 min.;
- the fourth informant – the purchase manager, his work experience is two and a half years. Interview duration – 75 min.;
- the fifth informant – the purchase manager, his work experience is two years. Interview duration – 60 min.

The purchase managers directly communicate with the customers of the Transteda Ltd company; form the value added for the enterprise's customers and at the same time they convey the customers' opinion about the enterprise for the directors.

As the agreement of the informants to record the interview was obtained, later the transcription of the records was performed.

The analysis of the results

The results of the survey-in-written

Transteda Ltd collaborates with 52 fixed drivers. 35 questionnaires were sent, 31 was returned (the feedback of the questionnaires is 88.6 percent). The characteristics of the respondents are presented in Table IV.

More than one fifth of the respondents represent the enterprises, which diversify their activity, i.e. transport new and used cars, sell them, and execute transportations in Europe. Only five respondents represent specialised enterprises of drivers. The enterprises represented by the respondents are very different according to the duration of functioning in the market. Most respondents are from the enterprises, which have been working for three – seven years. The number of the employees and trucks defines the enterprise's size. According to the number of the employees, the representatives of the small enterprises, which had up to 10 employees and up to 5 trucks, took part in the survey mostly. More than one fifth of the respondents are from the enterprises, which have collaborated with Transteda Ltd from one to four years.

Table IV. The characteristics of the respondents who participated in the survey

Criteria	Groups	Respondents	
		number	part (percent) in the total number
Character of enterprise's activity	Transportation of new and used cars	26	83.9
	Work in regular routes in Europe according to long-term contracts	13	41.9
	Trade in cars	18	58.1
	Other	1	3.2
Duration of enterprise's activity	Up to 3 years	4	12.9
	3-7	18	58.1
	8-12	2	6.5
	13-18	7	22.5
Enterprise's size (according to the number of employees)	Up to 10	15	48.4
	11-19	11	35,5
	More than 20	5	16.1
Enterprise's size (according to the truck park)	Up to 3	10	32.3
	4-6	16	51.5
	7-9	2	6.5
	More than 10	3	9.7
Duration of the collaboration with the	Iki 1 m.	4	12.9
	1-4	27	87.1

Below we will discuss what influences customer experience in interacting with the Transteda Ltd company.

Search for information. Two thirds of the enterprises represented by the respondents accumulate the information about cargo transportation enterprises in their database. Despite this every time in searching for optimal price, the proportion of the quality and transportation deadlines, the information is searched for by other channels, i.e. the phone calls to the enterprise (45.2 percent of the answers) or e-mail is used (64.5 percent of the answers). This was pointed out by the representatives of the companies, most frequently of small ones, that did not have any database. The Internet website as information source, according to the respondents, is important only when starting collaboration when the main information about an enterprise is necessary. More than half of the respondents (n=16 or 53 percent) confirm that the answers to the e-mails come very fast from Transteda Ltd, i.e. in the same day or the next day; the rest part of the respondents (n=15 or 47 percent) indicates that the answers come in several days. Most respondents (n=27 or 87 percent) point out that the priority is given to a phone call when choosing whether to write an e-mail or to phone because in this way issues are solved more efficiently. Usually the enterprises represented by the respondents wish to fast find a cargo – more than half of the respondents (n=16 or 51.6 percent) indicate that they dedicate up to several hours for the search of a cargo, more than one third (n=10 or 32.3 percent) – several hours. In such situation communication by phone is more convenient. However, the respondents point out that direct contact with the representatives of Transteda Ltd by phone not only enables to get and / or to specify the information, however it can cause unpleasant feelings – the enterprise’s employees sometimes are inaccurate, hasten, ask for the information, which they should know, according to the respondents.

Clarification of the need. The level of service quality and customer satisfaction depends on how a service provider is able to find out about the needs. 61.3 percent (n=19) of the respondents state that the employees of Transteda Ltd efficiently react to the needs of the customers; however, the rest part of the respondents (almost one third) would wish faster reaction of the managers. One respondent stated that he did not feel managers’ interest in the needs of the enterprise he represented.

Search for a cargo. When choosing an offering, the respondents give the greatest importance for road taxes and faster payment of the provided services (by 71 percent responses), transportation complexity (58 percent) and route length (54.8 percent responses). The actions of the enterprises represented by the respondents when the need for the cargo transportation emerges are inadequate. In such case a bit more than one fifth of the respondents (n=7 or 22.5 percent) directly contact only with the Transteda Ltd company; however, most respondents (n=18 or 58.1 percent) – present their queries to several service providers. When answering the question how Transteda Ltd distinguished among enterprises functioning in the same business, the respondents pointed out the diversity of the provided services (n=14 or 45.2 percent) and its attention to the customers (n=13 or 41.9 percent). The respondents representing smaller enterprises state that large enterprises pay less attention to the desires or claims of small enterprises. It could also be said about Transteda Ltd ($p \leq 0.01$, and $r = -0.516$). As it is mentioned above, in the *business-to-business* market experience elements are the same as of *business-to-customer* market customers. Thus it is hard to properly communicate

with the employees, who perform the search for cargos. 64.5 percent of the respondents state that the owner of the director of the enterprise carries out the search for cargos, 35.5 percent – one or several managers.

Cargo offering. Though most respondents (n=24 or 77.4 percent) think that Transteda Ltd reacts to the needs, 7 respondents answered this question negatively. 5 of them (71.4 percent) immediately address competitors' enterprises, 2 respondents indicate that they do not communicate with the surveyed enterprise till it shows the initiative. When they get several analogous offers, the respondents' enterprises not necessarily choose the enterprise, with which they collaborate for a long time and with managers of which friendly relations are created ($p \leq 0.01$, and $r = -0.702$). Customer flexibility plays much more important role in agreeing for prices and the guarantee that the services will be paid immediately ($p \leq 0.01$, $r = -0.752$). Priority cargo offers are provided for the enterprises, which have long-term agreements with Transteda Ltd. The respondents admit that the long-term agreements with Transteda Ltd have both advantages and disadvantages. Some advantages are mentioned: the long-term agreements ensure better conditions (8 answers) and help spare time (10 answers). Among disadvantages it was mentioned that it needed a lot of investments (12 answers), the enterprises do not have the drivers able and willing to work in the European market for a long time (8 answers), they fear to lose flexibility in the market (6 answers). The speed of the solution about a cargo by the enterprise represented by the respondents is influenced by the precise information about the cargo conveyed by managers (22 answers), provision with the cargo in the further route (12 answers). The enterprises choose competitors' offers in case little information about the cargo is given by the managers at Transteda Ltd ($p \leq 0.01$, and $r = -0.744$). Thus the more precise offers would be given to the customers by Transteda Ltd, the greater probability to increase amounts of transported cargos.

Cargo order. When choosing the Transteda Ltd cargos from several alternatives, the ensurance of the payment for the services (16 answers), good work relations with the manager (15 answers) and the attractive price (9 answers) are important for the enterprises represented by the respondents. The customer experience is negatively influenced by negative critical events. In the surveyed services one of such events is the cancellation of the cargo order. 11 out of 31 respondents state that their enterprises have not faced this. Though seldom but in 18 out of 31 enterprises represented by the respondents this happens. 10 of them point out that instead of the cancelled cargo the Transteda Ltd offers another one; however, 7 respondents stated that Transteda Ltd tried to avoid its responsibility. In the stage of cargo order the rationality is inseperable from emotions. The enterprises of most respondents who participated in the survey have collaborated with Transteda Ltd for a long time. In business relations with this enterprise the respondents positively value their emotional state (they feel trust in the enterprise and are sure for fair collaboration, consider themselves as exceptional customers) (15 times), as well as negatively (they feel as ordinary customers, exploited through service prices, fear for harms) – also 15 times.

Preparation for transportation. The results of the Transteda Ltd activity depend on how successfully the drivers cope with their tasks. Thus the company also contribute to cargo transportation: exceptional insurance conditions are offered (mentioned for 17 times), fuel cards are given (mentioned for 5 times), and cheaper ways of cargo transportation are chosen (mentioned for 4 times). Nevertheless the respondents pointed out for 13 times that the driver takes the responsibility for cargo transportation. In order

to prepare for transportation more fluently, Transteda Ltd has formulated the transportation recommendations for drivers. Most respondents (n=25) state that the drivers of their enterprises know well these recommendations and follow them.

Cargo loading. The results of cargo transportations are influenced by how the discrepancies of the cargo and documents are being fixed. Here the most important role goes to drivers. The respondents point out that the fixing of the discrepancies are impeded by drivers' poor knowledge of foreign languages (mentioned by 16 times), their irresponsibility (the discrepancies are not announced) (mentioned by 12 times). The respondents assumed that after the trainings held by Transteda Ltd the drivers acquired enough knowledge and that, having started the collaboration with the enterprise administrating discrepancies, they diminished significantly (mentioned by 6 times).

During the cargo loading the drivers face different problems. The most frequently mentioned reason is when the cargo is not available (n=17). Other reasons are the discrepancy in the number of transported vehicles and incorrect addresses (by n=13), Lithuanian drivers' discrimination (n=12), dishonest behaviour of the employees in the place of the cargo loading (n=5) and indifference of the Transteda Ltd employees (n=2).

Cargo delivery. Time management is the important factor of customer experience. According to the opinion of 45.2 percent (=14) of the respondents, suitable planning of the use of transport vehicles increases the trust in Transteda Ltd. More than one third (n=10) of the respondents point out that the discrepancies of the time planning become the reason for conflicts with Transteda Ltd.

Document registration. The enterprises represented by the respondents present the documents on a transported cargo during the period from one week to one month and longer; however most frequently it lasts for two weeks. Almost two thirds (n=23) of the respondents representing the enterprises point out that, when presenting the documents, Transteda Ltd does not create any exceptional conditions in comparison to other enterprises. 25.8 percent (n=8) of the respondents state that Transteda Ltd forces the drivers to present the documents too fast. Several respondents (n=3) pointed out that the enterprise requires too many documents proving the cargo transportation and that the rush in presenting documents when one needs to take the services of express transportation agencies is too costly (n=2). Though the respondents evaluate the requirements for the deadlines of document presentation at Transteda Ltd more unfavourably than favourably, most respondents (64.5 percent or n=20) admit that faster document presentation to Transteda Ltd helps to ensure faster service payment for the drivers.

Transportation analysis and report. The long-term collaboration with Transteda Ltd increases the probability to get better cargos and attractive price (correspondingly 58 percent (n=18) and 48.4 percent or n=15). Some respondents (n=6) think that the long-term collaboration does not provide any exceptionalism. Most respondents (58 percent or n=18) when answering the question whether the enterprises represented by the respondents presented any claims about the services for Transteda Ltd pointed out that they expressed their discontent to the manager by phone. The claims by e-mail or having met face-to-face were mentioned by 22.6 percent (n=7) and 25.8 percent (n=8) of the respondents. Almost one third (n=9) of the respondents who participated in the

survey did not claimed for the services of Transteda Ltd. Transteda Ltd does not react to the claims: 48.4 percent (n=15) of the respondents were sure of it. However, 41.9 percent (n=13) of the respondents were of opposite opinion.

Most respondents think that the amounts of cargo transportations through Transteda Ltd could increase due to more attractive prices and payment improvement (correspondingly, 80.6 percent or n=25 and 58.1 percent or n=18). More than one third of the respondents (35.5 percent or n=11), when continuing the collaboration with Transteda Ltd, would wish bigger offer of cargos. Despite the expressed remarks, even 87 percent (n=27) of the respondents who took part in the survey would recommend Transteda Ltd for their acquaintances.

Table V presents the factors and means making the greatest influence upon Transteda Ltd customer experience as well as the prevailing experience at different stages of using the service.

Table V. The experience of the surveyed Transteda Ltd customers and the factors influencing it

Consumption stages	Experience components	Factors and means forming experience	Clues	Prevailing experience
Pre-purchase / consumption	Behaviour	Communication by e-mail	Mechanic	Positive
		Reaction to queries about the cargo	Technical	More positive
At purchase / consumption	Viewpoint	Diversity of services	Technical	Positive
		Size of an enterprise	Technical	More negative
		Time during which a cargo is offered	Technical	More positive
		Relations with managers	Human	Positive
		Trust	Technical	Positive
	Behaviour	Detailed offer	Technical	More negative
	Emotions	Attention to customer	Human	More positive
Sense of customer exceptionalism		Human	More negative	
Post-purchase	Viewpoint	Collaboration succession	Technical	More positive
		Collaboration conditions	Technical	More negative
		Payment for services	Technical	More negative

The results of the semi-structured interview

First of all, the respondents were asked to express their opinion about the Transteda Ltd customers. “<...> a customer – is a helping hand when seeking for long- and short-term aims of the company <...>” (the first informant); “<...> customers give the possibility to earn more, <...> to realise oneself as employee <...>” (the fourth informant); “<...> a customer – is a direct carrier of the profit for Transteda Ltd <...>” (the third informant). Thus the interview participants perfectly understand the importance of Transteda Ltd customers for the company. The customers are related not only to the financial profit for the company, the material wellbeing of the employees but also to their self-expression. The answers to the question how they are divided at Transteda Ltd reveal the prevailing viewpoint of the informants. “<...> customers are not classified at all, unless in the thoughts of the managers <...>” (the first informant); “<...> I divide customers into potential and working <...>” (the fifth informant); “<...> customers are

particularly classified according to regions and countries; work character (tents, auto-vehicles); the country of cargo transportation destination <...>“ (the second informant). Customer distribution is important in respect of experience management – different groups of customers possess unequal needs, expectations, use unequal services, different frequency and alike; thus for them Transeda Ltd should formulate different suggestions and choose suitable communication means. The informants’ answers show that the stable system of customer classification does not exist in the company.

Expectations are one of the important factors forming customer experience. “<...> *I think that competitive prices and stable payments are the most important for drivers <...>*“ (the first informant); “<...> *a driver as any other customer hopes that the company will meet his needs; perhaps, more precise information, good service <...>*“ (the second informant); “<...> *three things: good, i.e. less than competitors, prices, regular payment and precise information about cargos <...>*“ (the third informant); “<...> *the cargos adequate to needs, fast payment <...>*” (the fourth informant); “<...> *alongside cargos, payments it is important for the drivers whether they will be pleasantly served, how easy it will be to collaborate <...>*” (the fifth informant). The analysis of the informants’ answers allows drawing the conclusion that the drivers from Transteda Ltd hope not only for sufficient amount of cargos, reasonable prices, timely payment for the services, precise information, but also for pleasant serving and constructive collaboration.

The informants differently answered the question what customer experience was. “<...> *this is the emotional state of a customer, which he / she experiences after the purchase of a service. This involves the positive or negative assessment and experienced financial profit of the company providing services <...>*” (the first informant); “<...> *company’s responsibility, adequacy of the need, managerial communication, personal relations with managers, service quality, the competitive ability of prices and payments in time for the provided services <...>*” (the second informant); “<...> *the company’s manager forms customer experience by communicating with customers, what can influence positive and negative customer experience <...>*” (the third informant); “<...> *customer experience depends on the number of transported cargos, it is influenced not only the experience acquired during service rendering by Transteda Ltd but also by previous experience when using competitors’ services <...>*” (the fourth informant). When defining customer experience, the informants point out not only cognitive but also emotional state, which is determined by different factors. The informants think that the greatest part of customer experience is formed by service quality, price, loading conditions, as well as harm and payment deadlines. The informants consider employees to be the important factor for customer experience formation “<...> *work interaction with customers depends on the level of employees’ responsibility <...>*” (the fifth informant) and professionalism of the customers “<...> *experience consists of work professionalism of the customer <...>*” (the fourth informant).

The informants gave different answers to the question what problems the customers faced due to the actions of the Transteda Ltd company: “<...> *that we work respectably, there no big problems, perhaps some small <...>*” (the first informant); “<...> *sometimes a driver gets not the cargo he was waiting for or the cargo is cancelled on the whole <...>*” (the second informant); “<...> *sometimes customers get*

unpleasantly surprised that the price of the service does not correspond <...>” (the third informant); “*<...> I feel uneasy when drivers reproach for the deadlines determined by our company, everyone wants to get money for the provided service as soon as possible. Everyone needs circulating asset <...>*” (the fourth informant); “*<...> sometimes we change the time of cargo loading or we cancel the cargo <...>*” (the fifth informant). It is possible to state that the informants admit the mistakes made by Transteda Ltd, due to which the drivers face problems; thus timely solution of the problem could help neutralise negative experience. However, Transteda Ltd unwillingly takes the responsibility for problem solution: “*<...> we do not speak about the compensation till the customer does not claim for it because in the company the viewpoint that it is possible to compensate the costs for the customer in the case if the company sees the would-be or gets the direct profit <...>*” (the first informant); “*<...> sometimes, when we cancel the cargo transportation, we offer the drivers financial compensation. We more often do this for the customers who collaborate with our company for a long time <...>*” (the second informant); “*<...> if we cancel one cargo transportation, we compensate it by another <...>*” (the third informant); “*<...> theoretically we should compensate unfulfilled promises and pay certain sum of money, but practically it happens very seldom. The Transteda Ltd company does not possess any special finance reserve. The truth is that not so often cancel cargos, we need to possess some finances, from which we could compensate the drivers. We do not accustom the drivers to this <...>*” (the fourth informant).

Information communication technologies are applied for the management of customer experience. The question whether Transteda Ltd uses the programmes helping to ensure long-term information about the customers was also given. It became clear that till 2011 the MS Excel programme was used for accumulating the data on the customers, however “*<...> it was faced with the problem when some part of the data on the customers occasionally disappeared from the lists when the information on the customers was shared by enterprise’ employees <...>*” (the second informant). In addition, the data about customers are “*<...> renewed seldom enough <...>*” (the fifth informant) or “*<...> only the most important information is renewed if some new information about the customer is provided and it is important for the company <...>*” (the third informant). The amount of the data, which the enterprises will possess about the customer “*<...> depends on every employee’s accuracy and responsibility level <...>*” (the fourth informant). In the beginning of 2011 the CRM systems has been launched; it gives the possibility to accumulate the data about customers in one programme, to do statistical calculations, it is the most important “*<...> to see the evolution of the collaboration with the customer in analysing previous records <...>*” (the first informant).

The informants differently explain why customers should continue the collaboration with Transteda Ltd: “*<...> Transteda Ltd is a responsibly and honestly working enterprise <...>*” (the first informant); “*<...> our enterprise has long-term goals, does not flounce about, does not look for easier way, we work for our customers. They get profit from the collaboration with our enterprise <...>*” (the second informant); “*<...> an infrequent enterprise is strong in transportation offers. It is very important for the customers <...>*” (the third informant); “*<...> we have a lot of advantages in comparison with other market players. I would say that the personnel of Transteda Ltd are very competitive. I am pleased that the customers say that for them it is not useful but also pleasant to communicate with our personnel <...>*” (the fourth informant).

The long-term collaborator with the customers for the Transteda Ltd “<...> ensures stability <...>” (the first informant), “<...> ensures the possibility to obtain recommendations, to attract new customers <...>” (the second informant) and “<...> to enlarge organization’s profit <...>” (the third informant). In order to retain the customers, the Transteda Ltd “<...> suggests competitive prices <...>” (the first informant), “<...> shorten payments, provides fuel cards <...>” (the third informant), “<...> offers exceptional insurance proposals and administration <...>” (the second informant).

When summarising the results of semi-structured interview, it is possible to draw the conclusion that the organization understands the importance of customers’ experience as well as the mechanism of its formation, envisages the shortcomings of its activity that negatively influences customers’ experience; however, in most cases it values itself better than the customers who participated in the survey.

Conclusions

More than half of the representatives of the regular customers participated in the survey of customer experience in Transteda Ltd company. This suggests that research findings on the company actions and means that form the experience may be relevant to other customers. As the company declares long-term and mutually beneficial relationships with their customers, their satisfaction and loyalty to the company, it should audit the customers’ experience and on the basis of the results, prepare the strategy of customer experience management.

The experience of surveyed customers cooperating with Transteda Ltd. is highly diverse. The companies’ actions and means at different stages of service delivery process vary in diversity and complexity. Thus the experience expresses in customer behavior, attitudes, and emotions. The greatest influence on the formation of experience is made by the technical clues that influence more customers’ rationality than emotions. However, the customers’ acquired experience is understood differently by interviewed Transteda Ltd employees compared with surveyed customers.

In the pre-purchase/consumption stage, the customer has two points of contact with the firm - in search for information and presenting his/her needs. Transteda Ltd company communication (information on the Internet, e-mails, calls to firms, customers’ needs identification, price negotiation and account guarantee) allows the formation of positive customer experience. The behaviour dimension that influences the mechanical and technical clues dominates. *In the purchase/consumption stage*, the customer experience forms during the seven touchpoints with the company: cargo searches, bidding, ordering, and preparation for transportation, cargo loading, delivery and documents registration. In this stage, which is the longest one of service delivery, customers acquire more positive than negative experience. Technical and humanic clues influence the customers’ behavior, attitudes, and emotions. *In the post-purchase stage*, the customer contact with the company in the transportation analysis and presentation of the report. In this stage, negative experience (precisely negative attitude), which is resulted by the proposed cooperation and payment terms of Transteda Ltd company, dominates. The representatives of the company understand the importance of customer experience, its formation mechanism; see the business weaknesses that have negative impact on the

customer experience, but nevertheless self-assessment in many cases is better than the answers by surveyed customers.

In order to seek for customer satisfaction and loyalty, long-term cooperation with customers the Transteda Ltd company should follow the basic principles. These principles could be the beginning of the customer experience management: to know better its customers, go into customer reactions in all stages of service process, to use better software for collecting and analyzing customers' information.

As an experienced player in the transportation market, Transteda Ltd company should initiate the creation of loyalty programs, which up to now are not in this business in Lithuania and propose more innovation in services.

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A Holistic Approach to Decision Theory-based Inspection Planning

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Introduction

Besides the time-consuming and cost-intensive impact of an inspection plan's implementation on the production, large periods of time are attached to inspection planning within production scheduling. It is necessary to parallelise the planning discipline within the Simultaneous Engineering approach with other departments and entrepreneurial processes in order to reduce the time-to-market continuously. This confronts the inspection planning with competitive challenges as decisions have to be made fast and precisely taking into account interdependencies in order not to retard the development process. Since at the time of planning not all relevant data is disposable planning activities often have to be carried out with uncertain input information. Other criteria that increase the requirements of inspection planning are the augmented complexity of products and processes, which base on shortened innovation cycles and an increased number of product development processes as well as the dynamics of the economic sphere of activity. For example, differentiated inspection plans have to be developed for several varieties and integrated into the respective process structure. However, in the last years inspection planning was only insignificantly modified or further developed in order to react on the amplified requirements.

Situation analysis

Inspection planning

Inspection planning is defined as planning of the quality inspection (DIN, 2004) and was formerly exclusively focused on the product (VDI/VDE/DGQ, 1985). It consisted of the planning itself, data collection and analysis (Pfeifer, 2002). Nowadays the equipment and the production process become more and more part of inspection planning. The term inspection planning also subsumes planning the inspection of services (Pfeifer, 2001; Pfeifer, 2002). It can be classified into product-dependent as well as product-independent inspection. While the latter includes the development of inspection methods and the inspection-data processing, the former contains the creation of an inspection plan.

Through planning inspections of the different production steps inspection planning pursues the goal to control and regulate the quality within a company (Pfeifer et al., 2007). It should transfer quality requirements of products or processes into the structural conditions of the company and, therefore, plan the quality inspection of the entire

production process, beginning with incoming goods and ending with the delivery of the product (VDI/VDE/DGQ, 1985).

The main tasks of inspection planning are, in addition to the selection of inspection characteristics and the evaluation of the necessity for inspection, to guarantee the determination of type, point in time, extent, location and personnel of the inspection as well as to choose the inspection equipment and to create the instruction (VDI/VDE/DGQ, 1985). Quality can be inspected by two different types of inspection: whereas the attribute inspection provides a “simple, discrete response”, the variable inspection obtains the “quantitative value of the quality characteristics” (Liangsiri, 2007). Besides, it has to be defined at which point in time inspection should take place: either at the beginning, during or at the end of the production process. To avoid that defective intermediate products are further processed the inspection should take place as early as possible. However, some product characteristics can only be inspected at the end of the process chain due to constructive or practical reasons (Eversheim, 2002). The inspection extent which ranges from “no test to random and intermittent tests and all the way to a 100% test” (Liangsiri, 2007) influences inspection and defect costs significantly. Whereas the 100% test is mainly applied for safety relevant parts (Liangsiri, 2007), generally the sample size for inspection has to be considered according to published standards or intra-company directives in order to assure quality and at the same time minimise costs (Pfeifer, 2001; Pfeifer, 2002; Liangsiri, 2007). The decision on the inspection location is influenced by the inspection characteristics and equipment as well as the work piece size and the production flow (Melchior & Lübbe, 1999; Pfeifer, 2002). In addition, the decision on the inspection location is highly connected to the choice of inspection personnel (Bernards, 2005). Three different types of inspection personnel are considered: external as well as internal highly skilled inspectors and workmen who inspect their work themselves. One advantage of self-inspecting at the production place is the high commitment of the manufacturing personnel which can prevent defects and therewith costs (Pfeifer, 2002; Schmitt & Pfeifer, 2010). For selecting the right equipment many criteria must be taken into account, such as the inspection type, the measuring range and inaccuracy, the accessibility, the capability, directives and the availability as well as environmental influences and, of course, costs (Bloch et al., 2000; Pfeifer et al., 2007; DIN, 2006). Further explanations on interactions between inspection planning’s attributed tasks can be found in chapter 4.

One approach to challenge inspection planning within the product creation process is Simultaneous Engineering and, thus, the parallelisation of processes within a company (Stoffels, 2001; Westkämper, 2004). Figure 1 illustrates both the sequential and parallel steps within the production cycle with increasing product maturity. In case of the sequential product creation process each step on the way to a product’s market maturity is brought to a close before the next step is started. The results of this procedure are long development periods (Eversheim et al., 1995) as well as high defect costs (Eversheim, 1997). While the long period to product maturity can be explained by the sequential order of the processes, the high defect costs are a result of the timeframe between the ‘early’ defect origin on the one hand and the ‘late’ defect detection and adjustment within the product creation process on the other hand (Pfeifer, 2001).

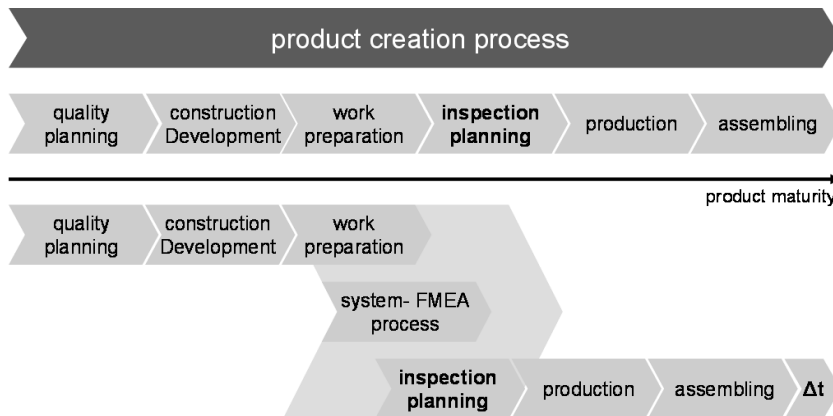


Figure 14: Simultaneous Engineering approach.

The bottom part of figure 1 shows the parallelised steps of inspection planning as well as the resulting shortened time to market (Pfeifer, 2001; Schloske, 1999). For this the application of QM-methods like the system-FMEA process plays an essential role. Since for creating the inspection plan information from the work plan is needed, the tasks of work and inspection planning can only be executed in an overlapping, non-parallel way (Schloske, 1999; Pfeifer, 2001; Brauchle, 1996). Parallelisation serves to increase the requirements for the inspection planning process. Decisions must be made quickly considering the interdependencies in order not to slow down the development process. In addition inspection planning must take place with uncertain input information since not all relevant information is available at this stage.

Decision Theory

Decision theory is based on a logical and empirical analysis of people's rational decision behaviour. It focuses on the deduction of descriptive respectively prescriptive statements concerning the result of a decision (Bamberg & Coenenberg, 2006). Descriptive statements specify how decisions were made in the past. They are based on the research of the structure of factors that had an influence on the decision. In contrast prescriptive statements specify the rational limiting factors of a decision without containing any information about the actual result of the decision itself (Laux, 2007). A possible solution for a decision problem is given by the action alternatives which describe how the decision maker can react to a decision problem (Nitzsch, 2002). Those alternatives must be mutually exclusive and practicable (Laux, 2007; Sieben, 1994; Eisenführ & Weber, 2003). If at least two action alternatives differ in their results and, thus, a selection of those alternatives has to be made, we call this a decision problem (Laux, 2007). The decision situation that can lead to a solution by implementing decision models follows the decision problem (Kahle, 2001). An optimal solution is defined as attaining a fundamental goal (Nitzsch, 2002) - only one action alternative can be realised (Engels, 1962). In the literature different decision models by different authors (Nitzsch, 2002; Engels, 1962; Eisenführ & Weber, 2003; Laux, 2007; Sieben, 1994; Meyer, 1999; Kahle, 2001) can be found which have a similar basic structure.

The Aachen Quality Management Model as a framework for Process Planning

The Aachen Quality Management Model provides a holistic visualisation of the corporate quality management in order to cover all economical requirements taking into account “the articulated and implicated customer demands, the defined management strategy and the actual companies’ ability” (Schmitt et al., 2008). Quality is understood as the overlap between customer requirements, corporate orientation and corporate skills (Schmitt et al., 2008), figure 2. Hence, quality refers to capability factors within a company as well as human resources or technical equipment. This clarifies why quality management has to be embedded in any section of a company (Schmitt et al., 2010).

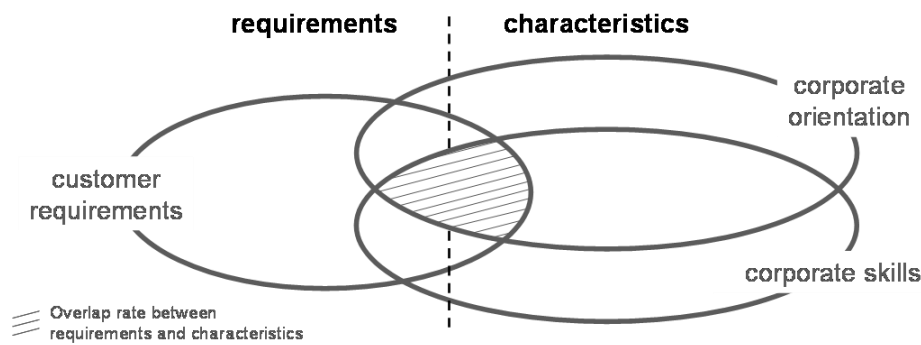


Figure 15: New definition of quality (Schmitt et al., 2008)

By enabling companies to visualise, harmonise and align their project and process landscape the production systems’ efficiency and effectiveness is significantly increased. Unlike other quality models like EFQM or the ISO 9000 family, the Aachen Quality Management Model provides this holistic view. The constitutional elements of the Aachen Quality Management Model are Market, Management, Quality Stream and Resources & Services (Schmitt & Pfeifer, 2010).

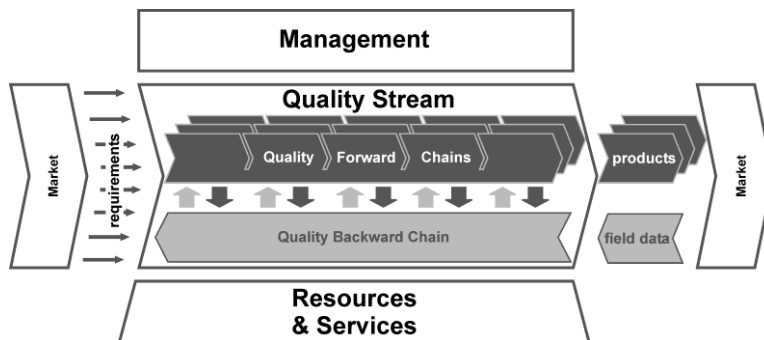


Figure 16: The Aachen Quality Management Model

Figure 3 illustrates that the Market is both initiator and recipient of the company’s performance. As initiator it demands a specific product and, consequently, defines the requirements. At the same time the Market represents the consumers which receive the products and supply the company with field data.

The Quality Stream, as the core element of the model, refers to the quality-creating processes within a company. It consists of two structural elements: the Quality Forward Chains and the Quality Backward Chain. While the Forward Chains include the proactive and preventive measures per product group, e.g. the inspection planning, the

Quality Backward Chain organises the reactive and corrective actions for all product groups. The links to the Backward Chain via control and improvement loops point out the holistic and bidirectional structure within the Quality Stream (Schmitt et al., 2008).

The alignment of the Quality Stream is specified by the Management. Hereto the demand and accomplishment of the company's vision and the related values and convictions are particularly important. The Management represents the pursuit of strategies and goals, forms organisational structures and establishes a management system to support the process organisation (Schmitt et al., 2008).

The element Resources & Services describes the company's skills, which empower the Quality Stream, among those employees and equipment as well as the existing infrastructure, technology and methodological knowledge.

The Aachen Quality Management Model is both an illustration of quality-orientated processes and a tool to design them. Thereby, it is crucial to define the objective of modelling the business processes. The model helps companies to adjust their quality-creating operations and to illustrate them transparently. Each component of the constitutional elements serves as a reference point for a company-specific arrangement of quality-orientated tasks.

The illustration allows the allocation of specific tasks, departments and processes of a company as well as both the linkage between them and the highlighting of cause and effect coherences. Thus, on the one hand the Aachen Quality Management Model creates transparency concerning the origin of performance. On the other hand it allows the identification of capabilities.

An Approach to develop inspection planning within the Aachen Quality Management Model

This paper develops inspection planning within the company's environment. Modern processes are often non-transparent and products are often very complex which is why it is not trivial to define the optimal point of inspection and to detect all possible defects and their consequences. In the last years the methodological development of inspection planning has basically stagnated. This leads to the challenge of incorporating it into internal processes and, thus, to develop new methods and to detect new interfaces of inspection planning for a holistic model. Hence, the integration into an overall entrepreneurial structure is of essential interest. The Aachen Quality Management Model acts as the framework for this implementation. It enables inspection planning's holistic definition and helps to identify interfaces, interdependencies and relevant information flows with adjacent divisions and operating areas.

The interactions inspection planning displays within the Quality Stream are of special interest and will be focused in this paper. This integrated approach serves as a basis for subsequently defining a decision model to inspection planning.

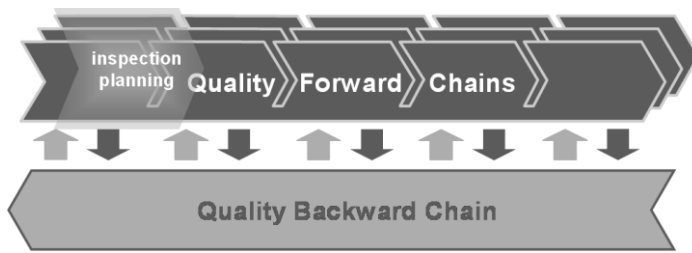


Figure 17: Positioning of inspection planning within the Quality Stream.

Integrating inspection planning into the Aachen Quality Management Model:

Inspection planning as a quality-creating process is positioned within the Quality Forward Chains, figure 4. As an activity belonging to the production preparation phase it is located at an early stage of the Quality Forward Chains. It proactively plans the realisation of inspections in production processes and facilitates the preventive assurance of quality demands in products. Especially due to its proactive character and its consequences on subsequent steps of the product creation process, decisions made within this planning discipline have great effect on the production process. Thus, it is essential to analyse the steps of decision-making in inspection planning and scrutinise it regarding the entrepreneurial background.

The first challenge is to identify the interfaces and interdependencies existing between inspection planning's own attributed tasks. Focussing on the planning discipline itself, we gather a deep inside view into interior information flows, figure 5. By analysing the interfaces, it is possible to specify groups of activities which have to be determined jointly for logical reasons. Several inspection planning tasks require identical input information, partially from other criteria/ tasks addressed within inspection planning. Additionally a number of tasks provides data and information bilaterally.

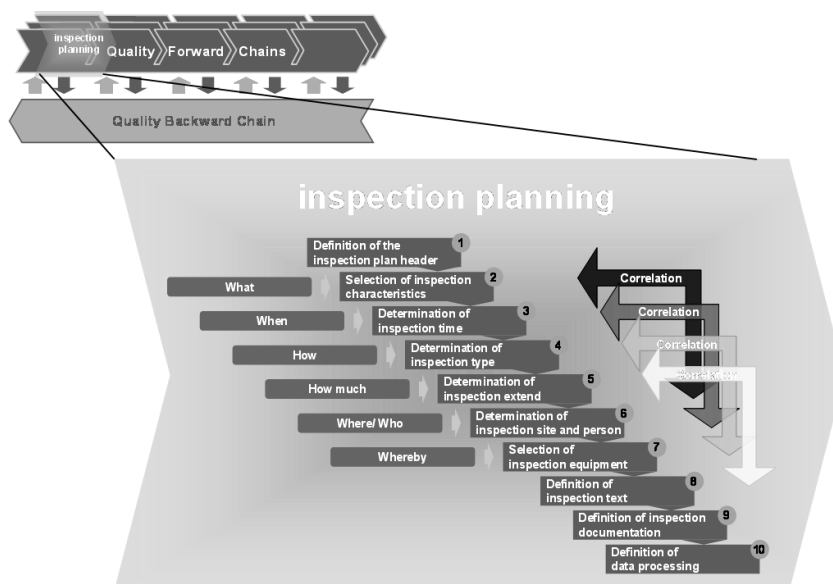


Figure 18: Correlations within inspection planning's attributed tasks.

Especially the four functions inspection location, personnel, equipment and point in time are interlocked closely. Therefore, it is not useful to separate the determination of

these tasks (Bernards, 2005). Several correlations are obvious, e.g. the need to measure an item with a coordinate measuring machine determines the inspection location, i.e. an isolated room beside the production line, and the inspection personnel. But for example also the inspection type has an influence on other tasks, e.g. the inspection equipment's choice. Some of these interactions are already mentioned in the state of the art.

Besides all these internal correlations also economic aspects determine the inspection planning tasks' definition. The relevant interactions have to be considered when specifying a decision model for inspection planning.

Furthermore, a specification and analysis of the interactions inspection planning exhibits with adjacent areas of the Quality Stream is of interest. The focus lies on areas located in the Quality Forwards Chains as well as the reactive processes of the Quality Backward Chain. Inspection planning is dependent on several information on and from previous, parallel and subsequent processes. Additionally some of these processes depend on this planning discipline reversely.

According to VDI/VDE/DGQ guideline 2619 (VDI/VDE/DGQ, 1985) knowledge concerning the function and application of a work piece, the production steps, production and technical documents as well as the available inspection equipment is of relevance when defining the inspection plan.

Interfaces with proactive processes are mainly derived from the research within the field of Simultaneous Engineering which can be transferred to the Quality Stream:

Quality planning specifies product features based on customer evaluation. These features are highly critical to product quality as a failure within one of them influences customer satisfaction negatively. Thus, inspecting these features' quality is exceedingly important. Quality planning supplies inspection planning with the relevant information concerning the items which are critical to customer satisfaction (Eversheim, 2002) but also relevant concerning laws, guidelines or safety regulations. Consequently, quality planning uses inspection planning as facilitator of its quality goals to work preparation. Furthermore, it provides inspection planning with the necessarily to use classical quality management methods like Failure Mode and Effects Analysis (FMEA) or Quality Function Deployment (QFD).

Planning a product's quality goes hand in hand with an *economic evaluation*. The application of certain quality assurance methods within production has to be compared with the cost of a defect potential (Raffo, 2000). In order to determine the inspection cost inspection planning has to provide the costing department with cost centre related information on inspection location, personnel and equipment. Inspection planning uses information on the cost of a defect potential to assess the inspection need. As a consequence it is possible to align quality planning's information on necessary inspection items with this additional data to plan the assurance of quality demands reliably. Furthermore, the costing department supplies inspection planning with facts on value-added steps. According to the appreciation in value it is one of inspection planning's goals to minimise possible scrap costs through an earliest possible inspection. Costs play a central role concerning decisions of inspection planning. Hence, a decision model has to consider costs obligatorily.

Inspection planning receives information on the work piece concerning overall functionality, required safety issues as well as product life time from *construction*. This includes knowledge on safety-critical work piece items and the concomitant tolerances in particular. Special effort for coordination is needed as construction requires information on the available inspection equipment and its performance. This is essential to plan the possible manufacturing and inspection effort.

In coordination with *production planning* and *work preparation* inspection planning establishes the prerequisites for the economic and requirements satisfying manufacturing and inspection of products (Pfeifer et al., 2007). The process sequence has a huge impact on planning the inspections as several of them have to be carried out before additional value is added to the product in order to recognise failures in an early stage of product creation. Furthermore, the cycle time has to be taken into consideration as the different process steps have to match.

The inspection plan which is built on the information gathered and restrictions defined through the steps described before determines when, how and how many inspections have to take place in the production process. Contrary, production itself supplies inspection planning with data on lot sizes, schedules, capacity plans and material flow as this information influences the inspection plan generation. It is obvious that a closed control loop has to be integrated in order to enable dynamic inspections adjusted to the environmental conditions.

This approach is seized and the following deliberations concentrate on the integration of additional closed control loops to inspection planning.

Current research activities of the Laboratory for Machine Tools and Production Management study inspection planning's integration with the reactive processes located in the Quality Backward Chain, figure 6. Until now the data contained in reactive processes is not reprocessed completely in order to use it in inspection planning. The information included in this data is regarded as an essential input factor for the definition of inspection planning and the adjustment with the proactive process data. Reactive process data provide information on the performance of downstream to inspection planning located processes. Consequently, a detailed specification of the interfaces of the Quality Backward Chain with this planning discipline and the analysis of the transferred data is of special interest.

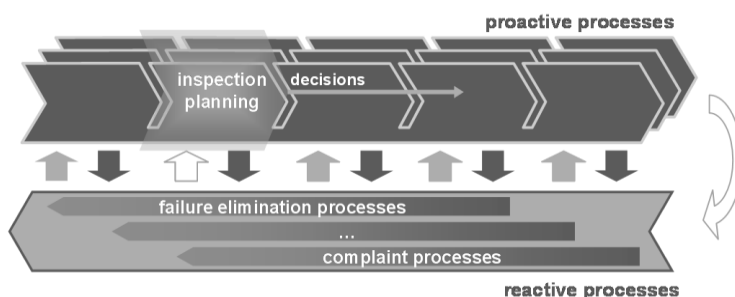


Figure 19: Interfaces of the Quality Backward Chain with inspection planning.

Inspection planning receives data within the long-run analysis of inspection data. These data e.g. enable to dynamise the inspection extent by adjusting it accordingly to the results of previous inspections completed in the production process (Eversheim, 2002).

The effect of inspection data on inspection planning is implemented into several ERP systems used in companies. Nevertheless, it is not worked out scientifically in detail and interdependencies between inspection data and data of other reactive processes have not been an issue of research at all.

Former research activities do not focus on usability studies of information which reactive processes, such as failure elimination or complaint processes, contain for inspection planning.

Consequently, an implementation of these data into the planning discipline is not developed yet. Field data, e.g. giving information as to the performance of certain product respectively inspection features and the customer satisfaction, hold high potential for defining inspection planning in terms of a holistic approach. In correlation with the inspection data it is possible to discuss new methods for the inspection plan's design when focussing features which were approved as OK but fail on the market. The same accounts for product failures occurring in the production process.

Relevant reactive processes have to be subject to a detailed analysis in order to figure out which data are essential for inspection planning. For a holistic investigation inspection planning's requirements for these reactive processes have to be analysed. Hence, the development and definition of interfaces can be carried out on a reliable basis that considers the planning discipline's own requirements as well as the entrepreneurial orientation.

The reactive data contain an amount of information that can be efficiently used in inspection planning. In correlation with proactive data a holistic decision model can be formed. Special focus lies on interactions with the economic evaluation. Decisions concerning an inspection plan's adjustment have to be made based on a reliable economic evaluation. As a consequence, reactive information can not be evaluated isolated. Rather a holistic examination is of interest in order to meet the macro- and mirco-economic situation.

Conclusion

The determination of all relevant interfaces and interactions inspection planning reveals and the holistic design within the Aachen Quality Management Model constitute the development of a decision model for inspection planning. The planning discipline's own attributed tasks describe several interdependencies with each other. These interdependencies are by some means easy to consider in a decision model as they are not characterised by a huge complexity. Interfaces inspection planning exhibits with other entrepreneurial processes are in their entirety not obvious. Additionally the consequences on inspection planning following distinct decision in different processes are manifold, partly antipodal and not always predictable. The same applies for decisions made in inspection planning itself. Thus, it is highly important to get a holistic image of all of inspection planning's interfaces, the information flows and their interdependencies. Especially the data contained in reactive processes, which provide information on the results of processes that are located downstream to inspection planning, has to be considered when aiming a decision model that reflects the overall economic and entrepreneurial situation.

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Identifying and Evaluating Characteristics that are Difficult to Quantify Using the Repertory Grid Technique

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Keywords: Repertory Grid, quality characteristics, perceptual dimensions, cell phones

Category: Research Paper

Purpose: How to identify and evaluate characteristics that are difficult to quantify

In the marketing research literature many approaches exist that make it possible for producers of goods and services to understand how customers distinguish between their products and the products of competitors. So, e.g., in the perceptual mapping approach (see, e.g. Carroll, Green 1997, Bijmolt, Wedel 1999, Borg, Groenen 2005 for recent reviews) (dis)similarity ratings of customers with respect to pairs of offers are collected (using scales like 0=“completely similar” to 100=“completely dissimilar” for rating a pair of offers). Then, an MDS procedure is used to transform the matrix of observed dissimilarities into a representation of the products by points in a low-dimensional space (e.g. 2- or 3-dimensional) in that way that the ranking of the Euclidean distances correlates to the ranking of the observed dissimilarities. That means a representation is derived where points for similar products are positioned nearby whereas the points for dissimilar offers are positioned far away from each other. Figure 1 shows a sample application of the perceptual mapping approach using MDS: Five products have been rated by customers on a dissimilarity scale and a 2-dimensional representation has been derived. If the derivation was successful, one can say that the perceived dissimilarity of the products can be reproduced using two dimensions. As the representation can be rotated, mirrored or stretched without losing its meaning, normally it is rotated in that way that the dimensions of the low-dimensional space can be interpreted (e.g. “high quality”, “modern”).

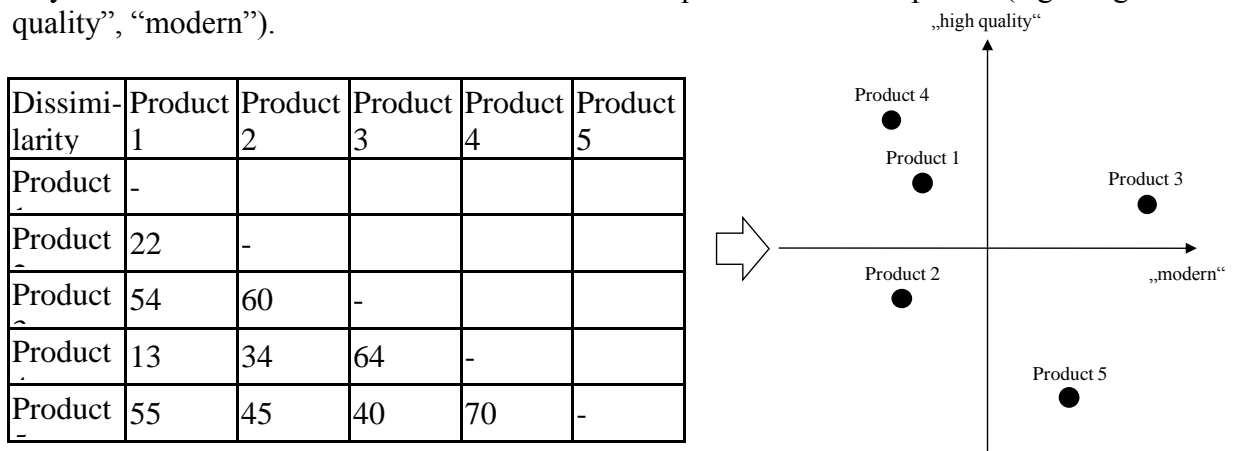


Figure 1: Identification of characteristics using multidimensional scaling: Observed dissimilarities between products on rating scales (0=“completely similar” to

100=“completely dissimilar”) are transformed into a two-dimensional representation, the representation then is rotated in order to identify characteristics (“high quality”, “modern”)

The derived perceptual map can then be used to discuss the positioning of the different products, e.g. to look for uniqueness and improvements, or to develop advertisement goals to improve the positioning of the own products. Many alternative procedures exist for this purpose, e.g. procedures that integrate preference ratings of customers or customer segments via ideal points or procedures that derive optimal positionings for new products (see, e.g. Baier, Gaul 1999). However, whereas these approaches are quite good in deciding how many characteristics/dimensions are needed to describe the customers’ perception of the products, the naming or the categorization of these characteristics/dimensions still is an open question: For describing two orthogonal dimensions of the two-dimensional space in Figure 2, of course, many (correlated) namings are possible (e.g. “high quality”, “expensive”, “reliable” and so on). Whether they really reflect the customers’ view on the market is unclear. Therefore, in the following, a psychometric method is proposed.

New approach: Applying the repertory grid technique for this purpose

In the mid 1950s George A. Kelly (1955) developed the repertory grid technique within his psychological theory of personal constructs. This theory assumes that human beings form construct systems in order to evaluate themselves, their environment and their relationship to one another. Constructs are assumed to be dichotomous distinctions that are determined in relation to real objects (e.g. persons, situations, issues or possible solutions). After its construction using real objects these dichotomous distinctions become abstractions. They help to classify new objects or to evaluate them (Catina, Schmitt 1993: 14f.).

To use the individual construct systems in psychotherapy Kelly developed the so-called role construct repertory grid (Kelly 1955). The survey instrument was later also in the non-clinical field applied and became known as the repertory grid technique (Scheer, Catina 1993: 9, Stewart 1997). The repertory grid technique is usually applied in a vague environment with concrete objects, where a construct system is searched for that individuals use to distinguish between known and possible new objects.

The basic shape of the repertory grid technique basically consists of a series of dichotomous discrimination tasks in which a person divides three relevant elements of a given set of objects into two nonempty groups by a self-selected distinctive way (triad comparison). The person then is asked for the underlying criteria for grouping the objects into two groups, which is then understood as the (personal) construct. The aggregation of these criteria about all triad comparisons is identified as the (person-specific) construct system. Applying this interviewing technique to a sample of persons and aggregating the results across the persons is assumed to develop target group-specific construct systems.

The main application field of the repertory grid technique is psychology, however it has also been used in the field of marketing or quality management (see, e.g. Sampson 1972, Marsden, Littler 2000, Baier, Kohler 2008, Heine 2009). Figure 2 shows a sample application to the market already analyzed in Figure 1: A sample of customers is

individually presented all possible triads of the five products, i.e. the 10 triads (Product 1, Product 2, Product 3), (Product 1, Product 2, Product 4), (Product 1, Product 2, Product 5) and so on. For each triad the customer is asked to group them into two non-empty groups, e.g. (Product 1, Product 2) vs. (Product 3), and to describe what separates the products of the two groups.

Triads	Please group the three products!	What separates the groups?
1) Product 1, Product 2, Product 3	Product 1, Product 2 ⇔ Product 3	“modern”, “fresh”
2) Product 1, Product 2, Product 4	Product 1, Product 4 ⇔ Product 2	“expensive”, “high quality”
3) Product 1, Product 2, Product 5	Product 1, Product 2 ⇔ Product 5	“high quality”
4) Product 1, Product 3, Product 4	Product 1, Product 4 ⇔ Product 3	“modern”, “new”, “colored”
5) Product 1, Product 3, Product 5	Product 3, Product 5 ⇔ Product 1	“modern”
6) Product 1, Product 4, Product 5	Product 1, Product 4 ⇔ Product 5	“fresh”
7) Product 2, Product 3, Product 4	Product 2, Product 4 ⇔ Product 3	“established”
8) Product 2, Product 3, Product 5	Product 3, Product 5 ⇔ Product 2	“established”

...

Figure 2: Application of the repertory grid technique to five products: All triads of products are presented to a customer, for each triad she/he is asked to group them into two nonempty groups and to name separating characteristics

As a result, we receive identified characteristics that customers use to distinguish between products in our market, e.g. “modern”, “fresh”, “established”, “expensive”, “high quality”, which now, in a last step can be used for rating the five products according to these characteristics and deriving perceptual maps by via dimensional reduction techniques like, e.g., principle components analysis.

Application of the new approach to the field of cell-phones

The new approach is applied to the selection of dimensions in the field of cell phones for students (see, e.g., Abu Assab, Baier 2010 for an application of QFD and conjoint analysis for a similar purpose in the cell phone market). A sample of 20 customers was interviewed using the repertory grid technique for perceptual mapping as described in the previous section. The customers were 19 to 28 years old, 23 on average, 30 % female and 70 % male students which represents quite good the student population at a technical university. All of them already have a cell phone, most of them planned to buy a new cell phone within the next six months. The concrete products which were used for the interview were the following: LG Optimus 7, Sony Ericsson Xperia X10, LG Optimus One, Nokia E75, HTC Desire, Samsung Wave II, Blackberry Bold, HTC

Touch Pro, Nokia C7, Apple iPhone 4. The customers were shown all cell phones using real products and real product brochures. Then, they were asked to choose five out of available cell phones. The selection of the five should be done under a “relevant set” assumption, that means simulating their next cell phone purchase. Afterwards – as described above in a repertory grid application – they were presented all possible triads of the five cell phones. In each case they had to group them into two non-empty groups and to describe what separates the products of the two groups. Finally, they were asked to rate all cell phones according to their chosen characteristics on a 7-point rating scale. The interview lasted for each customer roughly 60 minutes.

Afterwards, the characteristics and ratings were aggregated across the customers. Table I shows the mean values for all cell phones and the most named characteristics. From Table I one can see, that a huge range of characteristics was developed to distinguish between the cell phones, ranging from “angular vs. round” to “limited vs. good readability”.

	angular vs. round	complicated vs. simple	handline	unhandily vs. handily	complicated vs. simple	writing	heavy vs. light	dark/light	vs.	crimsy/feindlich	vs.	traditional vs. premium	business vs. private	sensitive to shock vs.	traditional vs. sunstn	irrect vs. direct	seratei-sensuive	vs.	traditional vs. modern	form	cold vs. warm material	unprecise vs. clear	deralat vs. intuitive	remmhe vs. masculine	dati/rebmy	vs.	bad	two-hand	vs.	one-hand	hand operation	playful vs. useful	un/orunary	vs.	bad vs. good	brand	limited	vs.	good	readability					
LG	1.	5.	2.	2.	3.	1.	3.	4.	2.	3.	4.	6.	3.	3.	3.	6.	6.	6.	1.	3.	3.	3.	3.	5.	1.	6.																			
Sony	1.	3.	2.	3.	3.	1.	2.	2.	2.	3.	3.	6.	5.	3.	4.	2.	5.	6.	1.	4.	2.	4.	2.	4.	2.	4.	5.																		
LG	6.	4.	6.	3.	4.	4.	4.	3.	6.	4.	1.	5.	5.	4.	5.	5.	6.	2.	5.	4.	6.	1.	4.	2.	4.	4.																			
Nokia E75	5.	5.	6.	6.	3.	3.	3.	3.	2.	6.	3.	2.	3.	1.	1.	4.	1.	4.	4.	2.	5.	4.	4.	4.	2.	5.	4.																		
HTC	5.	4.	5.	3.	5.	6.	5.	4.	5.	4.	5.	6.	6.	6.	5.	6.	6.	6.	1.	4.	4.	4.	4.	2.	5.	2.	5.																		
Samsung	1.	3.	2.	2.	3.	2.	2.	3.	2.	3.	3.	6.	3.	3.	1.	3.	5.	5.	1.	3.	2.	4.	2.	4.	2.	4.	5.																		
Blackberry	5.	5.	6.	6.	4.	1.	3.	3.	1.	6.	5.	3.	7.	4.	5.	4.	2.	3.	6.	5.	5.	5.	5.	3.	4.	2.																			
HTC	1.	4.	4.	6.	1.	1.	2.	1.	2.	5.	3.	3.	6.	2.	4.	3.	2.	6.	3.	1.	4.	5.	1.	2.	2.																				
Nokia C7	6.	4.	6.	3.	5.	5.	6.	5.	5.	4.	4.	6.	5.	2.	4.	5.	6.	1.	6.	5.	5.	4.	6.	4.	5.																				
Apple	3.	4.	5.	3.	3.	1.	5.	7.	2.	3.	7.	6.	4.	6.	2.	7.	6.	3.	3.	6.	3.	3.	7.	5.	6.																				

Table I: Application of the repertory grid technique to a cell phone market: For 10 cell phones 25 most often named characteristics are listed and mean ratings for the cell phones (scale: “1” = first level of the characteristic, “7” = second level is appropriate, e.g. “Sony Ericsson” is rated “angular”, “LG Optimus One” and “Nokia C7” are rated “round”)

Finally, the data matrix from Table I can be analyzed using principal components analysis and varimax rotation. It shows that the 25 found characteristics are highly redundant (at least in a statistical sense): five principal components (PC1, ..., PC5)

already explain 94.5 % of the variance in the data. Table II shows the loadings of each characteristic on each principal component, highest loadings for each characteristic across components is marked:

- PC1: “angular, unhandily, heavy, dark/unfriendly, clumsy, business look, masculine design, tall/roomily, two-hand-operation” vs. “round, handily, light, colored/friendly, sporty/slender, private look, feminine design, compact/harmonious, one-hand-operation” (39.5 % of the variance),
- PC2: “complicated handling, complicated writing, sensitive to shock, direct menus, intuitive control, playful, good readability” vs. “simple handling, simple writing, robust, indirect menus, default control, useful, limited readability” (27.7 %),
- PC3: “traditional materials, traditional image, unprecise display, bad workmanship, dull/ordinary” vs. “premium materials, stylish image, clear display, good workmanship, brilliant/elegant” (13.6 %),
- PC4: “scratch-sensitive, cold” vs. “scratch-unsensitive, warm material” (7.9 %),
- PC5: “bad brand experience” vs. “good brand experience” (5.7 %).

	angular vs. round	complicated vs. simple handling	unhandily vs. handily	complicated vs. simple writing	heavy vs. light	dark/unfriendly vs. colored/friendly	clumsy vs. sporty/slender	business vs. private	sensitive to shock vs. intuitive control	traditional vs. modern	imprecise vs. clear	bad workmanship vs. good workmanship	dull/ordinary vs. brilliant/elegant	scratch-sensitive vs. scratch-unsensitive	cold vs. warm material	bad brand experience vs. good brand experience									
PC1	0.9	0.0	0.7	-	0.8	0.8	0.8	0.3	0.7	0.2	-	0.0	0.1	0.1	0.3	0.4	0.1	-	0.8	0.4	0.7	-	0.4	0.0	0.0
PC2	0.2	0.8	0.5	0.9	-	-	-	-	0.9	0.1	-	0.2	-	0.0	-	-	0.1	0.4	-	0.4	0.6	-	0.0	-	-
PC3	0.2	0.5	0.2	-	0.3	-	0.5	0.7	-	-	0.9	0.3	0.0	0.7	0.0	0.8	0.3	-	0.2	0.6	-	-	0.7	0.1	0.4
PC4	0.0	-	0.1	0.1	0.1	-	0.0	-	0.0	0.1	0.0	0.9	0.2	0.9	-	-	-	-	0.2	0.2	0.1	-	0.1	-	-
PC5	0.0	-	0.1	0.1	0.1	-	0.0	0.2	-	-	0.2	-	0.0	-	-	-	-	-	0.1	0.3	-	0.5	-	0.9	0.0

Table II: Component loadings for the first five principal components after varimax rotation (PC1, ..., PC5); highest loadings for each characteristic across components is marked

Scores with respect to these principal components can be calculated in the usual way and are given in Table III. So, e.g., with respect to PC1 we can see that cell phone “HTC Touch Pro” fits best to “angular, unhandily, heavy, dark/unfriendly ...”, “Nokia C7” fits best to “round, handily, light, colored/friendly, sporty/slender ...”. Figure 3 gives the corresponding map.

	PC1	PC2	PC3	PC4	PC5
LG Optimus 7	-0.98	-0.24	0.85	-0.80	-1.72
Sony Ericsson Xperia X10	-1.07	-1.15	-0.94	0.99	0.80
LG Optimus One	1.40	-0.59	-0.75	0.52	-1.21

Nokia E75	0.45	1.50	-0.72	-1.76	0.20
HTC Desire	0.86	-0.52	0.64	0.47	-0.81
Samsung Wave II	-0.62	-0.90	-0.91	-1.14	0.73
Blackberry Bold 9780	0.01	1.58	0.64	1.30	0.67
HTC Touch Pro	-1.10	1.07	-0.83	0.83	-0.59
Nokia C7	1.49	-0.31	0.02	-0.02	1.09
Apple iPhone 4	-0.43	-0.43	2.00	-0.38	0.84

Table III: Positionings of the 10 cell phones with respect to the five principal components after varimax rotation (PC1, ..., PC5, low values indicate fitting to first levels of the component, high values fitting to second levels)

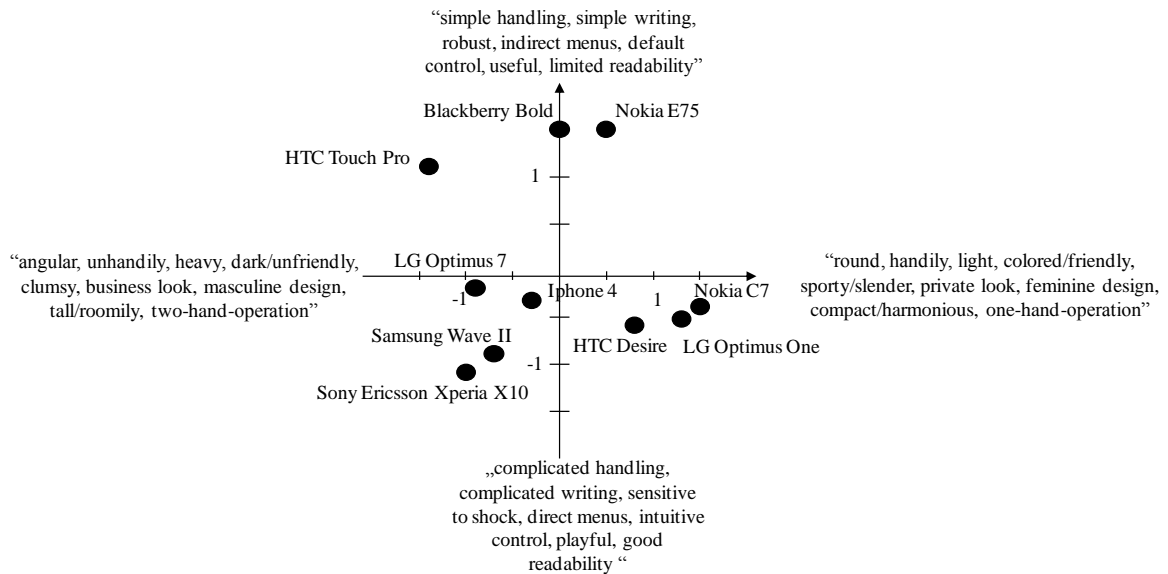


Figure 3: Positionings of the 10 cell phones with respect to the PC1 and PC2 (perceptual map)

Conclusion and outlook

From the first results of an application of the repertory grid technique for perceptual mapping we can see how the approach can be used to identify and evaluate characteristics that are difficult to quantify. A second, larger scale application in cooperation with a large German manufacturer of motorbikes is underway. This large-scale application will show whether the approach is viable in a real-world setting.

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Student suggestions for quality development of university operations

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Introduction

Systematic improvement work for increasing quality and competitiveness has long been of interest (Imai, 1986; Rapp and Eklund, 2002; Motwani, 2003; Weisbord, 2004; Spear, 2005). Also universities have been subject to studies on possible improvements. These include reports about improvement work on e.g. how to improve teaching and educational programs (Felder and Brent, 1999; Östlund et al, 2007), improve university performance (Numprasertchai and Poovarawan, 2008) or challenges to create sustainable development principles in university activities (Lukman and Glavic, 2007). There are several stakeholders for a university who have different needs and expectations of university operations, such as lecturing and research staff, administrative and service staff, students, graduates, employers, professional associations, other lecturing and/or research organizations, and society (Álvarez Suárez et al, 2009). However, from a consumer perspective, the students may be regarded as a primary customer of higher education service which is delivered by the universities (Hill, 1995). This service consists of, among other things, the teaching offered. Good teaching may be defined as "instruction that leads to effective learning, which in turn means thorough and lasting acquisition of the knowledge, skills, and values" (Felder and Brent, 1999). From an engineering perspective, this teaching should aim at preparing the engineering students to meet future challenges, why focus in their education should be professional practice, in which technical knowledge and skills of practice should be integrated (Sheppard et al, 2008).

With respect to preparing the students for future professional work, managing changes and improvement work is likely to be part of engineering tasks, no matter if employment will be in the private or public sector. Here, it is important that the students learn to look at change management from different perspectives. One way to prepare the students for this is to combine teaching about theories and supporting the students in applying this knowledge to a real case. This paper describes how students in a university course in operations management and control can combine theoretical studies and practical implementation by applying theories in quality management on their own school of engineering. A further aim of the paper is to highlight how a university course in operations management and control based on quality literature may be used to identify suggestions for improvements of university operations from a student perspective.

Change management and participation

Both private and public organizations nowadays face demands for frequent changes and improvements. These demands emanate from conditions in an organization's external

and internal environments. These contextual issues include external conditions such as governmental regulations, development of technology, and competition from other actors. The internal conditions include degree of work specialization due to existing technology, degree of organizational slack, and experiences with earlier changes (Armenakis and Bedeian, 1999). There are different means to manage changes and improvement work. Some organizational choices to manage improvement work must be made by management according to the following dimensions (Lillrank et al, 2001):

- Social dimension: whether improvement work should be carried out by individuals or groups
- Magnitude of issues: involvement by single or multiple functions, single hierarchy level or multiple hierarchy levels
- Organizational configuration: organized in parallel with or integrated in ordinary work
- Assurance of continuity: permanent organization or continuously evolving vision (or both)
- Goal setting and implementation of changes: centralized or decentralized

Involving “everybody” in improvement and development activities has been advocated from a quality and ergonomics perspective to improve motivation, increased learning and better quality solutions (Eklund, 2000). Advantages with participative change processes are for example that suggestions made by those performing tasks may be especially constructive since they have thorough knowledge about the situation which will be changed (Hackman and Oldham, 1980) and therefore they can contribute to higher quality of decision making (Wagner et al, 1997). One way of classifying participation is to define it according to the following operative dimensions (Haines and Wilson, 1998), see also Table 1:

- to what extent the participative initiative is applied
- whether participation is used for implementation, design or general work organization;
- whether it is used in everyday work or for specific change projects
- whether everyone is involved, sub-groups or representatives for groups
- whether it is formal participation in meetings, teams or committees or informal participation integrated in everyday work
- whether it is compulsory according to a management strategy or voluntarily
- to what extent the employees make or influence the decisions
- the extent of coupling; whether the employees influence their situation directly or remotely through questionnaires, statistics, etc.

Table 1. Operative dimensions of participation (Haines and Wilson, 1998)

Extent/level	Organization ----- Work system ----- Workplace----- Product
Purpose	Work organization ----- Design ----- Implementation
Continuity	Continuous ----- Discrete
Involvement	Direct (full/partial) ----- Representative
Formality	Formal ----- Informal
Requirement	Voluntary ----- Compulsory
Decision-making	Workers decide ----- Consensus----- Consultation
Coupling	Direct ----- Remote

There are thus a number of issues to take into consideration when managing changes and improvement work; first a number of organizational choices to make at an overall level, then a reflection of reasons behind the use of a possible participative approach, and if chosen, making a standpoint regarding the operative dimensions of participation.

Methods

The students' suggestions for improvement of the university operations were reported within the course "Operations management and control". There were 31 (24 male and 7 female) students attending the course at a School of Engineering. The students were third year Bachelor students majoring in Logistics.

The course consisted of eleven different topics related to theory on quality management and control (see further description in section 4.1), and the students were to apply these theories in a reflection on the school of engineering within their own university. The students elaborated each topic in group work (with groups of normally four students) and their results were reported verbally with the aid of large flipcharts and discussed with the other student groups. Data was collected through observation of these reporting sessions and analysis of the written documentation. Written documentation from students who could not participate at any reporting session was also analyzed.

Results

Description of the course "Operations Management and Control"

The course constituted 50% of full-time studies during one semester for third year Bachelor students in logistics at a school of engineering. In parallel with the course, the students also worked on their thesis projects in collaboration with different companies. It was the first time that the course was given.

The course consisted of four parts; the integrated company, change management, project management, and communication capabilities. The two first parts, the integrated company and change management, were based on literature about the Toyota way

(Liker and Meier, 2006) and change management from a quality perspective (Elg et al, 2007). These two course parts are focused in this paper and in subsequent parts named “the course”.

The students were organized into groups who elaborated eleven different topics related to quality management and control and applying these on their own university as a case study.

The course consisted of eleven topics related to quality management, see Table 2. Each topic was highlighted during one day according to the following procedure:

- In advance, the students were assigned to write a reflection (minimum 400 words) about specified literature related to the topic of the day.
- During each course day, the topic of the day was introduced in a morning lecture given by the teacher and group tasks were assigned to the student groups. The tasks consisted of a number of reflective questions regarding theory and/or application of the theory. The theory was to be applied either to the students’ own university (the school of engineering), its operations or the students’ study situation. This served as the case study used throughout the course.
- The student groups (normally four students) worked on the topic during approximately three hours (including lunch break).
- In a subsequent afternoon session the students reported and discussed the results of their group work.
- For those students who were not able to participate any course day or had not submitted a written reflection on the literature before the lecture, a reflection of at least 800 words was required for that specific topic.

Table 2. Course topics and examples of applied questions

Course topic	Examples of questions related to the university operations or the student situation
Customer orientation	<ul style="list-style-type: none"> • Which are the customers of the school of engineering and what are the customer needs? • How may customer needs be identified and how may knowledge about these needs be used to improve operations?
Improvement work	<ul style="list-style-type: none"> • Identify different improvement areas within the school of engineering. • How would you organize improvement work related to these areas?
ISO9000	<ul style="list-style-type: none"> • What are the main processes of the school of engineering? • How does the school of engineering work with quality assurance of its processes? • What documents exist that are related to quality issues?
Accidents	<ul style="list-style-type: none"> • What risks for accidents and illness are there within the school of engineering? • How is it possible to work with continuous improvements to mitigate these risks?
Production levelling	<ul style="list-style-type: none"> • Which are the value flows within the school of engineering from a student, teacher or other personnel's perspectives? • Identify non value activities in the identified flows. • How is it possible to work with value flows, standardized processes and production (work) leveling to improve the students' study process (including different groups within the school of engineering)?
Use of suitable technology	<ul style="list-style-type: none"> • Analyze the technology used within the school of engineering in relation to the overall process, possible wastes, possibility for flexibility, etc. • How is technology adapted to human work and what improvement possibilities can be identified?
Development of leaders and team associates	<ul style="list-style-type: none"> • What are motivating factors for you as students? • Is it possible to achieve team work among students and if so, how can that be achieved? • In what way may the leadership at the school of engineering influence the students' study results?
Measurement and evaluation	<ul style="list-style-type: none"> • What are the visions for the school of engineering and how are these related to the students' situation? • What may be measured in the university operations and how may measurements be used to control the students' results?
A culture that solves problems	<ul style="list-style-type: none"> • What characterized the culture at the school of engineering (among students and in other groups)? • How are problems handled within the school of engineering?
Problem solving	<ul style="list-style-type: none"> • Identify any problem related to your study situation and apply "5 why" to the problem. • Identify a problem on which 5S could be applied in practice. Reflect on any advantages/drawbacks for both methods.
Improvement tools	<ul style="list-style-type: none"> • Apply any improvement tool/s to analyze "Why do not students start studying for the exam a long time in advance"?

Results of the reporting sessions and individual written reflection

In the reporting sessions and the individual written reflection the students highlighted a number of areas which could be improved at the school of engineering. These suggestions were related to course evaluations, university integration with society, procedures for examination, student accommodation, integration between Swedish and foreign students, standardization of organization of courses, the teachers' use of IT-tools to administrate and organize courses, student information, etc., see Table 3.

Table 3. Areas for improvements suggested by the students

Improvement area	Examples of specific suggestions for improvements
Development of courses and teachers	<ul style="list-style-type: none">• Development of courses should be in collaboration between several teachers• Improved information and feedback to students about fundamental ideas behind different courses• Standardize course organization by for example developing a template for course start-ups, how to order course literature, etc. and include all teachers• Organize the education with the students only taking one course at the time and not several courses in parallel• More use of IT-support in a consistent way between all teachers. Clear instructions to teachers.• More didactic education to teachers
Student information and follow-up	<ul style="list-style-type: none">• Introduce individual discussions on progress, including future plans. Positive results include deepened contact between student and teachers and easy sharing of views.• Ensure that students receive feedback of measures taken based on the course evaluations
University integration with society	<ul style="list-style-type: none">• Adapt educational programs to the needs of industry• Perform research related to actual industry needs• Increase contacts with host companies throughout the education program
Course examination	<ul style="list-style-type: none">• Need to develop procedure for evaluation of course examinations• Develop electronic examination which will be more efficient for the student, less paper work and easier to mark for the teacher• Have minor but larger number of examinations
Conditions for students	<ul style="list-style-type: none">• Ensure that students who are accepted to any educational program also have accommodation and that there are sufficient number of teachers, study halls, restaurants, etc.• Make it possible for students to connect personal computers to the university network and print at the university printers
Integration between students	<ul style="list-style-type: none">• Increase integration between students from different nationalities through integrated accommodation and other arenas to meet

Evaluation of the course and input to improvement of university operations

The students thought that the course in Operation Management and Control united earlier courses in their educational program even if there was some overlap with earlier courses related to organizational management and lean production. Although necessary with some overlap to keep together the course, more coordination with earlier courses was recommended. The students approved of the course division into topics, which facilitated their own planning and applying theory related to the topics in specific group work. They also found the preparatory written assignments with personal reflection on the literature as suitable for their learning. The use of their own school of engineering as case study on which to apply the theories gave further insights beyond the student perspective. However, the students perceived that the use of one case study objects resulted in repeating some issues several times. The students believed the course would gain by applying the theories on some manufacturing company as well.

From a teacher perspective, the organization of the course into specific topics, one for each course day, worked out very well. Sometimes there was an initial challenge to avoid overlap between different topics, which appeared to be very closely related e.g. between “a culture that solves problems”, “problem solving”, and “improvement tools”. However, this was coped with by relating the specific topic to other theory outside the course literature, for example by relating the topic of “a culture that solves problems” to theories about organizational culture. By this, a deeper discussion could be achieved during the lectures and student group work. The students’ preparation of the literature by written assignment before the lectures was successful, as they had better understanding of the topic and therefore could participate more actively. The use of the school of engineering as case study was interesting. They directly had to apply the theoretical models in practice, which gave new insights. Furthermore, the students were encouraged to take on the perspective of other university stakeholders, which widened their perspective on their own study situation. However, the scope of the students’ group work depended to a large extent on their own personal motivation to go in depth with the different topics, search for official university documents, make short interviews of university personnel etc. Therefore the outcome of the group work varied between the groups.

The results of the students’ group work within the course included a number of suggestions for improvements of the school of engineering and the students’ work situation. These suggestions for improvements will be used at the school of engineering as a direct input to an ongoing investigation of how to strategically improve the education at the school of engineering. The suggestions will be very useful in a later stage when more specific suggestions for improvements will be identified and discussed.

Discussion

The identified number improvement suggestions were related to course evaluations, university integration with society, procedures for examination, student accommodation, integration between Swedish and foreign students, standardization of organization of courses, the teachers’ use of IT-tools to administrate and organize courses, student information, etc. Some of these were developments or increased use of already existing channels for communication or technology, while others were less

known improvement areas. The use of student suggestions as input to the ongoing investigation of how to strategically improve the educational programs constitutes one type of participation in improvement work. There are established sources, such as course evaluations, for the students to influence their study situation. These are integrated in their daily work (Lillrank et al, 2001), however remotely coupled (Haines and Wilson, 1998). The input from this course is another form of participation in improvement work. It is discrete for a change project, which will emanate from the ongoing investigation, and there are many possibilities to develop the dimensions (Haines and Wilson, *ibid*), in which the students may actively contribute to developing the future school of engineering.

Throughout the course the students actively worked with theory and applied it in practice to their own organization. Although having a natural focus on a student perspective, they were also encouraged to analyze the university operations from other perspectives, such as different groups of employees, future employers and society. The idea of integrating theory and practice fits well with desired aims for an engineering education (Sheppard et al, 2008). However, the students sometimes found it difficult to regard themselves as part of an organization, their studies as work, and that they were service consumers (Hill, 1995). Furthermore, being used to apply other courses on mainly manufacturing industry, it was sometimes challenging for the students to apply the theories to a service producing organization.

Being the first time the course was given, it resulted in a great deal of learning. The results of the students' group work were good. However, these could have reached a higher level for some of the groups. As described earlier, the results of the group work depended on the students' own work motivation, and it was sometimes difficult for them to find useful material for their group work during the few hours of group work. Possible improvements for future development of the course therefore include giving the students more time for group work within the different topics and possible integrate some topics into real mini-projects at the school of engineering. If chosen voluntarily by the student groups, it will strengthen their work motivation (Schein, 1996). Furthermore, it will give deeper knowledge and experience in how to carry out improvement work in practice. Other potential improvements include the development of the teacher role into more of a mentor role guiding the students regarding methodological issues and reflection about different perspectives in their projects.

Conclusion

The study showed that it is possible to use output from students' group work in a course in operations management and control as input from a student perspective to improvement work at a university. By this the students get the experience of analyzing their own organization, which will probably be a future task, they can directly contribute to the development of university operations, and they learn how to apply theoretical models in practice. By being forced to take an outside view of their own class, it also enhances the students' understanding of an operating work system with different interested parties. Furthermore, the study showed that challenges in offering such a course include how to guide the students to separate different topics in operations management and provide help in identifying and applying theoretical models in practice.

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Factors of influence in the loyalty of clients in Knowledge Intensive Business Services (KIBS): A Transaction Cost and Relational Marketing Approach

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Introduction

The structural change in the "service economy" has been facilitated by the development and establishment of new forms of work organization e.g. transition from stable permanent jobs to contingent or alternative positions (Neumark 2004), decentralization of decision making (Miles 1993) and outsourcing (OECD 2000; Schettkat & Yocarini 2006) among others. In this context, one of the most important outcomes is the emergence of Knowledge Intensive Business Services (KIBS). This is one of the sub-sectors of services with a high contribution to the productivity of countries.

Considering the importance of KIBS and the considerable increase of competency in this sector (Zhang & Zhu 2009), it becomes necessary to analyze the relations between these types of companies and their clients. Citing Bagdoniene et al. (2007, p.13): "*The relationships between providers and clients are the most important feature of services. When efficiently managed, they become an essential asset of organizations*". In this context, this study will take loyalty as a reference of measurement for the performance of the relationships between the KIBS and their clients.

This work comprises of a contribution to the call of Spath & Ganz (2008) to develop new models and methods for the efficient design of services through the definition of the factors of influence in client loyalty. In summary, the present work looks for the answer to the following questions:

“What are the factors of KIBS that affect the direct relationship with the client?”

“How do these factors interrelate to benefit and increase the loyalty of the clients of the KIBS?”

Literature Review and Hypothesis

Trust and Loyalty

The relationship between trust and customer loyalty has been frequently studied in the literature of business relationships (e.g. Doney & Cannon 1997; Ganesan 1994) as well as the services sector (e.g. Palmatier et al. 2006; Bendapudi & Berry 1997). From the point of view of the Theory of Transaction Costs, the relationship between loyalty and trust is based on the reduction of opportunistic behaviour between clients and service providers (Lee & Cunningham 2001; Doney & Cannon 1997). On the other side, from a

relationship marketing point of view, Berry (1983, p.1) believes that "*trust is the basis for loyalty.*" For business consulting services, which belong to KIBS, trust is one of the most effective means to improve the quality of customer relationships (Mitchell 1994). This relationship quality increment will be reflected in the formation of loyalty between the parties. Other authors affirm the importance of building trust to establish long-term relationships between KIBS and their clients (Miles 1993). Based on the statements given above, the following hypothesis is defined:

H₁: Trust of the clients with their KIBS-suppliers is positively related to customer loyalty.

Transaction Specific Assets (TSA) and Trust

According to Lohtia et al. (1994, p.261), "*A TSA is an asset, either tangible or intangible, that has little value outside of a particular relationship*". TSA is one of the main factors in making decisions in choosing forms of governance for the processes of production of goods and services. Vandaele et al. (2007) give us a TSA proposal closest to the special characteristics of services. These authors argue for the dimension of asset specificity in the case of services: "more emphasis should be placed on human and procedural asset specificity instead of physical aspects because of the intangible nature of services" (p. 254). Therefore, TSA in services is mainly represented by the company's investment in the training, knowledge acquisition and changes in service delivery processes for a specific customer.

Considering risk as a factor of analysis, if one party invests in a TSA, the danger of the emergence of opportunistic behavior places this party in a vulnerable position. However, this could be considered as an act of commitment to the relationship (Ganesan 1994). Bendapudi & Berry (1997) use the same reasoning to explain the relationship between TSA and trust in the case of services.

Taking this point of view, KIBS require TSA, especially with regard to knowledge. These investments are needed to adjust their services offered to clients' specific requirements. In relation to this, Handfield & Bechtel (2002) present a model, which assumes that investment in "*human specific assets*" for a particular client allows the generation of cooperative relations and trust between customers and suppliers. These positive effects of TSA are attributed to the relational orientation of the Relationship, in which these investments are seen as generating stronger links between the parties and that can enhance competitiveness (R. Mudambi & S. M. Mudambi 1995). This leads to the following hypothesis:

H_{1a}: TSA of a KIBS is positively related to the trust of the KIBS client's.

Contractual safeguards and Trust

The contractual Safeguards are considered as necessary tools for the protection of the parties against the possible emergence of opportunistic behavior in a relationship. Likewise, trust is viewed as a mechanism of protection against the risks of opportunism in inter-firm relationships (Judge & Dooley 2006). However, both factors need not necessarily be viewed as mutually exclusive, but may have supplemental characteristics (Das & Teng 1998). An empirical study by Bennett & Robson (2004) has shown that

both trust and contractual regulations may occur in parallel and their combination contributes to higher customer satisfaction levels. Other studies (e.g. Handfield & Bechtel 2002) confirm this statement wherein formal contracts could become elements that enhance the confidence that the customer deposits with the provider.

In the case of services, Berry (1995) confirms the influence of service guarantees in generating trust. In this context, trust and contractual safeguards function like mechanisms for increasing the control of service providers by clients. With these mechanisms the customer can ensure the results provided by the KIBS. The problems of control of the results, in the case of KIBS, generate the need to develop complex control mechanisms which allow a firm to decrease the uncertainty on the part of customers. The presence of trust based on social and personal relationships are often not enough to reduce this uncertainty. Therefore, the contractual safeguards can be a means for generating additional confidence to establish relations between KIBS and their clients. Based on this, this study proposes the following hypothesis:

H_{1b}: Defined contractual safeguards by the KIBS are positively related to the trust of the KIBS client.

Expertise and Trust

Another important factor that influences the buyer's trust of a service is the expertise of the service provider. Empirical evidence of this relationship in the commercial sector can be found in several studies (e.g. Palmatier et al. 2006; Doney & Cannon 1997). For example, through a meta-analysis study of literature of the factors that influence the effectiveness of RM, Palmatier et al. (2006) confirm a significant relationship between the expertise of the vendor and customer confidence. Similarly, there are also empirical studies based on surveys of retailers companies, which confirm that expertise is one of the antecedents of trust (Doney & Cannon 1997).

In the case of services, Bendapudi & Berry (1997) propose a model in which the expertise of the service provider directly influences client trust. The inclusion of expertise as an influential factor for the study of the relationship between KIBS and their clients is very important because the knowledge that houses this expertise is the main selling point of these businesses. Therefore:

H_{1c}: KIBS Employees' expertise is positively related to the trust of the KIBS client.

Information and Trust

Stump & Heide (1996) argue that the ability to monitor the activities of industrial suppliers is based on the availability of information held by the client to detect non-compliance of the agreements. The difficulty in performing these monitoring activities, in the case of services, raises the problem of performance ambiguity (Ouchi 1980). One of the causes of this problem is information asymmetries between clients and service providers (Bowen & Jones 1986). The reduction of these information asymmetries may reduce the problem of performance ambiguity and build customer trust with the service providers.

Gallouj (1997) affirms that trust can help reduce informational asymmetries between service providers and their customers. For instance, in the case of electronic banking

services, if customers have more information about these kind of services, it will increase the client's trust in electronic banking (Ba 2001). In the case of KIBS, providing the customer with details of your skills and experience is important. This is because making this type of information available to the client allows him to recognize the skills and capabilities of KIBS for the development of a project (Zhang & Zhu 2009). On this basis, we propose the following hypothesis:

H_{1d}: Information provided by the company to its customers is positively related to the trust of the KIBS client.

Level of Implementation of RM strategies and Loyalty

One of the basic assumptions of RM is that the interactions between buyers and suppliers are one of the main elements of marketing, because the nature and quality of management of these relationships will define the buying behavior of customers. (Grönroos 2000)

This theory is well suited to the case of KIBS where the customer does not just passively take part in the production process but is actively involved in service delivery. Roberts et al. (2003) illustrate a case study of medical and banking services where managing relationships with customers has a role, even more important than the quality of the service. This leads us to conclude that we must consider the strategies of building a proper relationship with clients as a major factor in maintaining customer loyalty. Therefore, selecting the right customers to achieve long-term relationship may be the best strategy for the development of a service company (Karantinou & Hogg 2001). Too et al. (2001) provide empirical support for a positive relationship between relationship marketing orientation of the organization and customer loyalty in the case of commercial companies. As a final conclusion we propose the following hypothesis:

H₂: Level of Implementation of RM strategies in KIBS is positively related to the customer loyalty of the KIBS' clients.

The assumptions listed above are summarized in the following model (see Figure 1)

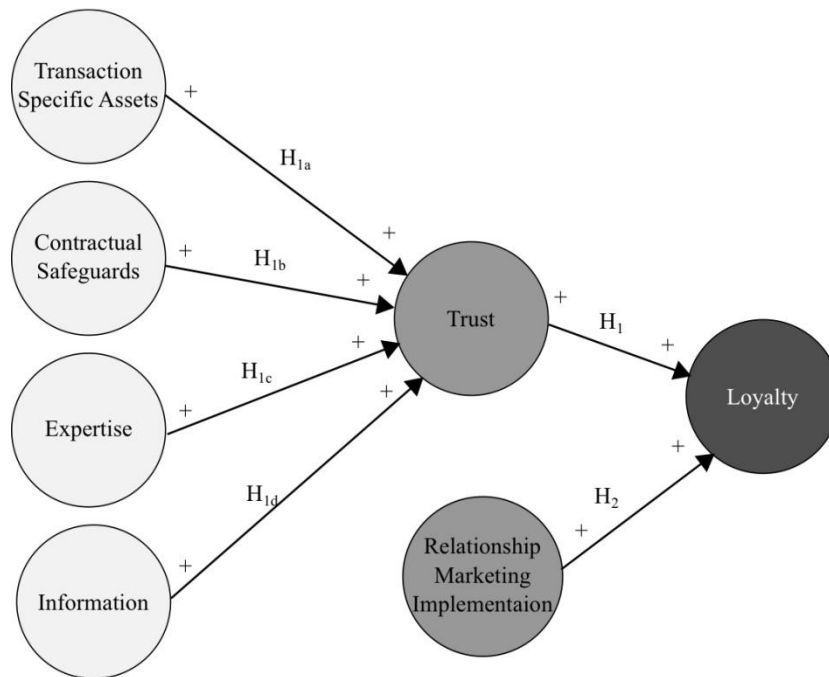


Figure 1. Proposed Model

Methodology

The field study was conducted in Lima, Peru. With average GDP growth rates of 6% between 2002 and 2006 and close to 9% and 10% in 2007 and 2008, Peru is one of the Latin American countries with more stable constant growth. This growth has been especially favored by the increase in mineral prices and, to a lesser extent, by the increase in exports of agricultural products. In this context of constant development, the number of business support services to the extractive industries and producing drivers increased.

In this context, between December 2007 and February 2008, 50 consulting service firms in the information technology and sanitary engineering sectors were surveyed in Lima (Peru). The data were collected either via face-to-face or web-based interviews. The research model is evaluated by a Partial Least Squares (PLS) regression analysis.

Results and Discussion

The model presented in Figure 1 was analyzed using the method of Partial Least Squares (PLS). The model used formative indicators to define constructs of TSA, Contractual Safeguards, Expertise and Information. Statistics relating to quality of these constructs is presented in Table I. In case of all of the constructs, multicollinearity of the indicators are below the prescribed limit ($VIF < 10$). Furthermore, the correlations among the indicators of formative constructs were below 0.9 and Communality was greater than 0. About the validity and quality of the reflective constructs (see Table II), all meet the condition of having an $AVE > 0.5$, $Composite Reliability > 0.7$ and $Communality > 0$.

Table I. Quality Criteria of the Formative Constructs

	VIF	Indicators Correlations	Communality
TSA	all<10	all< 0,9	0,40
Contractual safeguards	all<10	all< 0,9	0,25
Expertise	all<10	all< 0,9	0,36
Information	all<10	all< 0,9	0,30

Table II. Quality Criteria of the Reflective Constructs

	AVE	Composite Reliability	Communality
Customer Loyalty	0,88	0,93	0,88
RMS	0,59	0,80	0,59
Trust	0,74	0,85	0,74

The results for the acceptance of the hypothesis of the proposed model are presented in Table III. The hypotheses were accepted when they had a path coefficient > 0.1 with a significance level of $p < 0.10$. Following these parameters, we could accept the hypothesis about the positive effect of TSA in Trust. This result confirms the importance of the implementation of TSA in KIBS. Due to the complexity and variability of the requirements of consumers of such services, such investments are essential in order to provide clients with customized solution. The assumptions that define the Contractual Safeguards, Expertise and Information as forming factors of trust in KIBS could not be accepted due to the lack of significance of these relationships. R^2 values of 0.30, in the case of trust, show that the variance in trust could have been described in a moderate way by the expertise, information, contractual safeguards and TSA factors.

We can also accept the hypothesis of positive relationships between customer loyalty and trust, as well as customer loyalty and level of implementation of RM Strategies. However, R^2 values of 0.10 determined that the variability in customer loyalty can not be attributed to the influence of trust and level of implementation of RM strategies.

Table III. Summary PLS Results and Hypothesis Test

	β	T	Hypothesis Test
TSA->Trust	0,41**	3,9134	H _{1a} : accepted
Contractual safeguards -> Trust	0,17	1,4258	H _{1b} : declined
Expertise->Trust	0,14	1,3801	H _{1c} : declined
Information-> Trust	0,18	1,5426	H _{1d} : declined
Trust->Loyalty	0,19*	1,6931	H ₁ : accepted
RMS->Loyalty	0,21*	1,7493	H ₂ : accepted

** $< .05$, * $< .10$

Conclusions

The results of this study confirm the importance of the inclusion of transactional factors in the analysis of the relationships between KIBS and their clients. The inclusion of transactional factors, not only relational, it is necessary to explain the elements that contribute to the formation of trust. The predictors of trust based on factors like: contractual safeguards, expertise and information could not be verified. This could be explained because all of these factors were expected by the clients of KIBS as typical

characteristics of these kind of services. For this reason, these factors could not act as trust builders in the interviewed KIBS. However, the inclusion of Contractual Safeguards, Expertise and Information in future studies should not be discounted due to the varied literature that supports these relationships.

On data collected for the verification of the model, surveys of Peruvian KIBS were made in the initial period of the country's economic growth. The KIBS sectors surveyed had to face increases in demand and in the required quality of services they provided. This could have caused these firms to invest in training or staffing to cover the new requirements of its customers. Only in this way were the companies able to win the trust of customers and begin to establish long-term relationships with them. Another important external factor to consider is the relatively limited number of local KIBS that existed at that time in Peru. This factor may have had an influence on the variability of the customer loyalty and can not be attributed to the influence of trust and the Level of Implementation of RM strategies.

Among the main limitations are that the study did not consider surveys of customers or the analysis of dyads for analysis of relations between KIBS and their consumers. The inclusion of dyadic studies can provide a picture issues that may go unnoticed if you only take the perceptions of one part of the relationship (Samiee & Walters 2003).

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A qualitative study on management systems integration

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Introduction

The proliferation of management systems (MSs) standard certifications has experienced a continuous growth since their publication (see ISO, 2010). The most widespread international standards are those published by the International Organization for Standardization (ISO), ISO 9001 for quality management systems (QMSs) and ISO 14001 for environmental management systems (EMSs). The last available data provided by ISO, “*the ISO survey*”, show that the number of ISO 9001 certifications worldwide is higher than one million, 1,064,785 certifications in December 2009 (see ISO, 2010), representing an 8% growth from 2008. The number of ISO 14001 worldwide certifications has also dramatically increased, 223,149 certifications in December 2009, 22% more than the previous year (see ISO, 2010). Other management systems have also been widely implemented by the organizations, such as the occupational health and safety MSs (e.g., OHSAS 18001), corporate social responsibility (e.g., SA 8000, AA 1000, ISO 26000), food safety MSs (e.g., ISO 22000 with a 69% of growth from 2008) or customer satisfaction (e.g., ISO 10000 series).

In this context of great creation and proliferation of international standards, research about the diffusion of standards has appeared. The investigation about this phenomenon refers to the factors affecting this diffusion, such as direct foreign investment (Prakash and Potoski, 2007), the influence of having other standards implemented (Corbett and Kirsch, 2001 and 2004, Vastag, 2003), positive institutional environment (Delmas, 2002), geographical and cultural affinity (Albuquerque *et al.*, 2007), and supply chain (Corbett, 2006 and 2008). Other research deals with the diffusion models, where forecast about the future spreading of these standards is analyzed. Evidence shows the saturation level that will achieve these systems in the near future, mainly in European countries (see e.g., Franceschini *et al.*, 2004 and 2008, Marimon *et al.*, 2006, 2009 and 2010, Albuquerque *et al.*, 2007, Casadesus *et al.*, 2008). The majority of these studies about diffusion consider all sectors, but new research is analyzing the phenomenon by sectors (see Llach *et al.*, 2010).

In this situation, an organization may have multiple management systems implemented and has the option to manage them either separately or integrated. The result of the latter possibility is an Integrated Management System (IMS), that can be defined as a “*set of interconnected processes that share a pool of human, information, material, infrastructure, and financial resources in order to achieve a composite of goals related to the satisfaction of a variety of stakeholders*” (Karapetrovic and Willborn, 1998a). Several studies on integration conclude that an integrated management system means

becoming more efficient and taking profit of synergies among the management systems (see e.g., Karapetrovic and Willborn, 1998a, Zeng *et al.*, 2007, Karapetrovic and Casadesus, 2009, Asif *et al.*, 2010, Lopez-Fresno, 2010).

Taking the above into account, the main aim of this study is to analyze the integration process in organizations that have implemented and are certified to multiple management systems, through the analysis of each integration stages.

The structure of the paper is as follow. In the next section, the literature review is presented and in the third section, the methodology is described. Next, the results are detailed and discussed and finally, the conclusions are proposed.

Literature review

The process of integrating multiple management systems can be divided in four main issues or phases (see also Bernardo *et al.*, 2011), namely: a) integration strategy, b) integration methodology, c) integration level, and d) systems' auditing integration.

The “integration strategy” refers to the implementation order, because the first MS that is chosen to be implemented can provide the base for the integrated management system. The most common strategies, based on Karapetrovic and Wilborn (1998a), are to establish:

- (1) First the QMS and second the EMS
- (2) First the EMS and second the QMS
- (3) QMS and EMS simultaneously

According to the existing empirical research, the majority of organizations are establishing first the QMS and second the EMS, mainly because of its chronological publication (see, e.g., Douglas and Glen, 2000, Labodová, 2004, Karapetrovic *et al.*, 2006, Zeng *et al.*, 2007, Griffith and Bhutto, 2008, Salomone, 2008, Bernardo *et al.*, 2011). In Karapetrovic and Casadesus (2009), they present four different cases where companies applied different strategies and the IMS is based on: 1) QMS and EMS, 2) QMS, EMS and OHSMS; 3) QMS, EMS, OHSMS and corporate social responsibility MS; and 4) EMS and QMS.

The second issue refers to the “methodology” used in the integration process. This integration methodology may be based either on a guideline published by a standardization body (e.g., SAI Global, 1999, Dansk Standard, 2005, AENOR, 2005, BSI, 2006 and ISO, 2008), or on methods and frameworks proposed in the existing literature (e.g., Karapetrovic and Willborn, 1998a, Karapetrovic, 2003 and 2005, Labodová, 2004, Zeng *et al.*, 2007, Asif *et al.*, 2010, Lopez-Fresno, 2010). For example, in Asif *et al.* (2009), they present a methodology to achieve excellence composed by four stages: 1) core processes specifics of an organization, 2) excellence in operations, 3) integration within strategy and operations, and 4) business excellence.

The third issue refers to the “degree of integration” of the integrated management system (IMS). There are different levels of integration defined in the literature (such as Karapetrovic, 2002a and 2003, Kirkby, 2002). For example, in Bernardo *et al.* (2009) the authors analyzed a sample of 435 Spanish organizations where the 86% has

integrated their management systems. They classified the levels into four: (1) no integration, (2) initial partial integration, (3) advanced partial integration, and (4) full integration. In each of these groups, the processes are integrated at a higher level than the objectives and documentation resources.

The last issue refers to the “integration of systems’ audits”, both internal and external, that may result in benefits such as the optimized use of resources (e.g., Karapetrovic and Willborn, 1998b, Douglas and Glen, 2000, Karapetrovic, 2002b, Zeng *et al.*, 2007, Salomone, 2008), and reduction of time because of multidisciplinary auditors who have the capacity of auditing different management systems (Douglas and Glen, 2000, Kraus and Grosskopf, 2008). In Bernardo *et al.*, (2010), the results show three different groups according to the level of audit integration, where the internal audits are more integrated than the external audits and the most integrated aspect is that of human resources (auditors or auditor team).

Although the literature analyzing the integration process of ISO management systems is increasing, the existing empirical studies are not yet adequate to describe in-depth the integration process. It is for this reason that the main aim of this study is to analyze the integration process in organizations that have implemented and are certified to multiple management systems, through the analysis of each one of the above key integration issues.

The methodology applied is explained in the next section.

Methodology

The case-study approach is used in this study in order to effectively describe and analyze all basic issues related to the subject under study. More specifically, five extended case studies were conducted in selected Greek organizations that were implementing at least two ISO management systems and particularly ISO 9001:2008 and ISO 14001:2004. The research is descriptive in nature in order to provide a better insight and understanding of the integration process and to identify general propositions regarding the observed practices (Eisenhardt, 1989, Yin, 2009). This methodology was extensively used from several authors that have studied the same subject in order to analyze the complex process of adoption and internalization of management systems and its impact on the organizations (Labodová, 2004, Karapetrovic and Casadesus, 2009, Lopez-Fresno, 2010, Simon and Bernardo, 2010).

Internal validity was assured by the search for common patterns intended to explain the understanding of the phenomena under study, while the reliability is guaranteed with the use of structured interviews with the same order and number of questions and an assessment protocol cases against each factor. In-depth knowledge about each organization, as well as qualitative information from all interviewees was obtained.

The sample consists of five selected industrial organizations that were judged as normal, ordinary, and representative, and the only requirement for the organizations to participate was to be certified, at least, against the ISO 9001:2008 and ISO 14001:2004. The data gathering was carried out through extensive and in-depth interviews in all five organizations asking the organizations’ quality manager, using a semi-structured questionnaire with open-ended questions. The main purpose was to collect data and

produce basic information, enabling qualitative observations concerning organizations' management systems integration. Each site was written up as an integrated case study, with the focus on drawing out the commonalities of meaning and understanding each site. The data analysis provides some ground for generalizations, even though subjective judgments were also made from the analysis of the cases.

Interviews and visits were made in pairs and the members of the research team had a proper training in the subject under study. None of the interviews was recorded; notes were taken by two researchers then cross-contrasted, such as recommended in the literature (Maxwell, 1996). In the process of comparison between cases and inference aiming to achieve the objective, clearly exploratory, the grounded theory method was used, which integrates appropriately with the general methodology of case studies (Binder and Edwards, 2010). This is a content analysis method with a strong potential in complex social phenomena as the present one. According to a systematic process, qualitative evidences are categorized and grouped to try to interpret them more easily (Glaser and Strauss, 1967). To this end, all interviews were coded a posteriori. Atlas.ti (version 5.0) was applied to facilitate the structuring of information and the encoding process.

The questionnaire used was divided into three main parts: management systems, integration of MSs and future. In the first part, questions were about the implementation of each management system, the implementation reasons, advantages and disadvantages, etc. In the second part, interviewees were asked about the integration process, the level of integration, the difficulties faced during the process, the benefits, etc. The future certifications were the main questions in the last part. For this study, the first two parts regarding implemented and integrated management systems are used.

Results and Discussion

The results presented are based on the comparison among cases in order to ease the interpretation and readability. The within-cases are not presented because of space limitation.

The data analysis of the organizations under study follows the integration process' issues, as these were presented in the literature review section, and it is divided in the four main areas: a) the integration strategy, b) the integration methodology, c) the integration level, and d) integration of systems' auditing. This approach gives us the opportunity to have a better view of possible convergence, similarities, differences and overall deviations in our findings (Table II summarized the comparison).

In order to assure privacy and confidentiality, the names of the organizations will not be revealed. Instead, companies will be identified as C1, C2, C3, C4 and C5. A brief description of the characteristics of each company is presented in Table I.

Table I. Sample organizations' characteristics

Companies	Profile		
	Ownership	Size	Sector
C1	Family	Medium	Chemical
C2	Multinational	Large	Food and beverages

C3	Multinational	Large	Aluminum products for various applications
C4	Family	Medium	Flexible packaging converting
C5	No family	Large	Food

Integration strategy

All the organizations of the sample have at least, two standards implemented, as it was one of the conditions to participate in the study. Specifically, four out of five organizations have implemented more than two ISO management systems, while only one of them (company C1) had only the two required systems in place (ISO 9001 and ISO 14001).

Regarding the implementation order, three companies are following the most implemented order that is, implementing first the QMS, second the EMS and then other management systems. From these three, C2 and C3 have the OHSMS in the third place, while C4 has implemented the food safety management system (ISO 22000). This result is logical as these companies might follow the chronological publication of both standards (similar results are found in Bernardo *et al.*, 2011). It is noticeable that company C4 has implemented the second and third standards simultaneously, taking profit of the synergies between these two systems (see e.g., Karapetrovic and Willborn, 1998a, Karapetrovic, 2003, Zeng *et al.*, 2007, Karapetrovic and Casadesus, 2009, Asif *et al.*, 2010).

For the two companies following a different order, both have implemented first the EMS and secondly the QMS. The reason for this order, as commented by the interviewee in company C1, was the sector where it operates. Company C5 has implemented the third standard, food safety, simultaneously with the ISO 9001 standard. In this case, as this organization is not integrating its MSs, the synergies are probably not profitable as for organization C4.

It is specially the ISO 22000 the only standard that companies have implemented simultaneously both with ISO 14001 and ISO 9001. This situation can lead us thinking that this food safety system is compatible with both standards, and has no problems to be integrated with the rest of the systems implemented. Another important note is that Greece is in the top three in number of certifications according to ISO data, with 987 certifications (see ISO, 2010).

Table II. Comparison of the organizations' integration process

Org.	Ownership	Strategy	Methodology	Level	Audits	
C1	Family business	EMS+QMS	Common elements	Fully integrated	Internal and external	more than
C2	No family business	QMS+EMS+OHSMS+FMS	Common elements	Fully integrated	Same level internal and external	internal
C3	No family business	QMS+EMS+OHSMS+ sectoral	Common elements	Partially integrated	Not integrated	
C4	Family	QMS+EMS-	Common	Fully	Same level internal	internal

	business	FMS + sectoral	elements	integrate d	and external
C5	No family business	EMS+QMS- FMS	No integration	No integrate d	Not integrated

Integration methodology

Four organizations have integrated their management systems at a certain level. All of them have followed the same methodology, doing an analysis of the common elements of the MSs. Companies highlighted the difficulty of applying the process and the easiness of using this methodology. The organizations have compared the standard requirements and have adapted their own requirements to standards' requirements. There is only one difference, in company C4, they applied the analysis based on their internal procedures, not on the standards. In interviewee's words, we "*have adjusted the systems to our internal processes and try to make the standard fit for purpose*". This methodology has been seen as common in other studies, such as in Karapetrovic *et al.* (2006) and Bernardo *et al.* (2010b). In the latter, the authors found that for a Spanish sample of 362 organizations that have integrated the systems, the integration level is higher in those that are applying a combination of management models, being the most used tool the process approach (Bernardo *et al.*, 2010b).

Another common characteristic at this stage is the use of software. In companies C1 and C2, they highlighted the importance of using software to integrate the systems, that ease the integration and allows them to have the systems fully integrated.

Level of integrated system

Three companies of the sample have their management systems fully integrated, C1, C2 and C4. Company C3, has a partial integration of its MSs and finally, C5 has not integrated.

For the fully integrated companies, as company C2 interviewee said, "*the system is one*", and the reason in company C4 is that "*it makes it easier to manage them*" (similar results can be found in, e.g., Douglas and Glen, 2000, Karapetrovic *et al.*, 2006, Zeng *et al.*, 2007, Salomone, 2008, Bernardo *et al.*, 2009, Karapetrovic and Casadesús, 2009). They have all the objectives, resources and procedures fully integrated. However, in company C1, there are two people managing the system because they were two before integration and they cooperate to manage the IMS, as each has the specific knowledge for each implemented system and wanted to maintain it. A similar situation was found also in Bernardo *et al.* (2009), who found that the person or people managing the system is not significant in the integration, in other words, no matter who is managing the system if it is properly managed.

In company C3, the responsible of the MSs wants to integrate all the systems into one, but there are not enough resources to manage it. The integrated procedures are: training, evaluation of suppliers, specific measurements such as internal control, preventive and corrective actions and document control. They integrate partially because "*the function-specific part of each system makes the difficult to integrate*". Another added problem is

that the top management does not understand and share the necessity of institutionalizing the integration process.

Finally, in company C5, they declared not integrating their management systems, but they manage some aspects of management systems and human resources management in an integrated way.

Following the classification obtained in Bernardo *et al.* (2009), who found four groups of companies depending on the MSs level of integration: no integration, initial partial integration, partial integration and full integration, companies of this study can be classified accordingly. Companies C1, C2 and C4 would be in the last group, as they have fully integrated their MSs. Company C3 could be classified in the partial integration group and finally, company C5 is not in the first group, and might be grouped, timidly, in the initial partial integration cluster.

The main characteristics highlighted by the interviewees have been the availability of resources to apply the integration and the top management commitment. If these two elements are present in the organization, the integration process has ended with a fully integrated system.

Integration of systems' audits

The integration level of audits has been measured considering the integration of audit team, time, process, plan and report and results. Before explaining the cases, a brief explanation about these concepts will be given. In the interview, participants were asked to say if, e.g., the auditors team was the same for all norms (fully integrated), the same for some norms (partially integrated) or was different (no integration). The levels are based on Karapetrovic (2003) proposed levels: partial integration and full integration. In the case of time, if the audits were realized simultaneously for all norms, they were fully integrated; if they were simultaneously done for some norms, the level is partial; and finally, if the audits are carried out in different moments, it was not integrated. For the rest of the concepts, the same logic is applied (the same levels are considered in Bernardo *et al.*, 2010a and 2011, Simon and Bernardo, 2010).

This is the integration stage where more work can be done. Only company C2 has the internal and external audits fully integrated in terms of team, time, process, plan and report, and results.

Comparing the organizations with full integration of MSs, C1 and C2 have all the internal audit elements fully integrated. C4 have full integration in auditors' team and audit time, and has a unique audit plan and different final reports. This organization is not integrating the audit time or the results, as the internal audit only detects nonconformities. C3, that is integrating its systems partially, the internal audits are not integrated, only the audit plan is unique, but the final reports are different for each norm.

For the external audits, C1, C2 and C4 are not similar as they are in the internal audits. The common elements are the audit time and results. The audits are done simultaneously and in all three companies the external audits suggest opportunities to improve each norm and the integrated system. C2 have full integration in all the audit

elements, but C1 and C4 present different levels of integration. In C1, the auditors' team is different for each norm, the systems are audited as interrelated and the audit plan and final report are the same for all norms. In C4, the auditors are the same only for some norms, the systems are audited as separated and there is a unique audit plan but a final report for each norm.

Finally, C3 audit results suggest opportunities to improve each norm and the integrated system, but the other audit elements are not integrated, and C5 has the external audit team, process and results partially integrated, but the time and audit plan and final report are not integrated.

These companies can also be classified into the three groups find in Bernardo *et al.* (2010a), where companies were grouped according to the internal and external audits level of integration. Company C2 can be group in the third cluster, as it has the highest levels of integration in both internal and external audits. The other companies integrating the audits, cannot be classified exactly, as the level of integration does not fit with the study results, but, approximately, C1, C2 and C3 could be grouped in the first cluster, as internal audits are more integrated than the external (Bernardo *et al.*, 2010a). Company C5 cannot be classified because in the study, all the Spanish organizations were integrating the audits at a certain level, and this is not the case for this company.

Conclusions

The main objective of this study is to analyze the integration process in organizations with multiple management systems implemented, through the analysis of the different integration stages. This aim has been achieve as this paper presents how Greek organizations are realizing the integration process, in those that have integrated their management systems. After the analysis, five conclusions can be extracted.

First of all, the integration of management systems is a process applied in the majority of Greek companies. The main reason posed by the interviewees is the ease of management, allowing them to be more efficient and taking profit of synergies among the management systems (as found in, e.g., Karapetrovic and Willborn, 1998a, Zeng *et al.*, 2007, Karapetrovic and Casadesus, 2009, Asif *et al.*, 2010, Lopez-Fresno, 2010). Only one company is not integrating its systems.

The second conclusion is twofold. First, the majority of the organizations have more than two MSs, meaning the importance of these systems to make them competitive in the market, more important in the present economic situation (e.g., Karapetrovic and Willborn, 1998, Douglas and Glen, 2000, Karapetrovic, 2002a, Karapetrovic *et al.*, 2006, Zeng *et al.*, 2007, Griffith and Bhutto, 2008, Salomone, 2008, Karapetrovic and Casadesus, 2009). Second, also the majority of organizations are following the most common implementation order, namely, implementing first the quality management system and then the environmental. In this particular case, three out of five organizations are following it and the other two have implemented first the EMS and then the QMS (see e.g., Karapetrovic and Casadesus, 2009). This last strategy is justified for the sector of activity.

Thirdly, it can be stated that the most common methodology used to integrate the MSs in Greek companies is applying the analysis of the common elements, as it has been

applied for all the participant organizations (similar results in Karapetrovic *et al.*, 2006). The main reason highlighted has been the facility in its application.

Systems' audits are the weakest point in the majority of organizations in terms of integration. Only one company has the internal and external audits fully integrated, and the others have some aspects. In general, internal audits are more integrated than the external (as in Bernardo *et al.*, 2010a), and the most integrated aspects are audit time, plan and results. In this aspect, Greek companies can be helped by the next publication of the ISO 19011 as it will expand the MSs considered not only to quality an environment, also to all the MSs that a company can have implemented (ISO, 2011).

Finally, no conclusions can be made about if the size and ownership are conditionings of the integration process. In the present study, the only situation that can be said is that two out of three companies that have fully integrated their MSs are medium-size and family business.

Managerial implications are for those companies that have not integrated their management systems, because integration can make them becoming more efficient (see Karapetrovic, 2003, Zeng *et al.*, 2007 and 2011), an important point in the present situation. Governments and certification bodies should take an initiative to help these organizations promoting the integration as a way of reducing costs and having a better understanding of both the management systems and the entire organization.

The main limitation in this paper is the sample size; however the authors strongly believe that the subject under study –MSs integration– typically follows certain patterns in terms of adaptation and implementation (Wilkinson and Dale, 2001). According to Beckmerhagen *et al.* (2003), “*the integration of management system standards will continue to be a part of future research in the area of IMS, not only because minor differences among the standards still exist, but also because new standards that will stretch the boundaries of what we currently consider as “management systems” will appear*”. The future research will be focused on analyzing the differences between the integration process depending on the sector of activity and the ownership.

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Recovering from the Crisis: Is an Excellence Approach a Reference Point for LearnAbility, InnovAbility and SustainAbility?

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Keywords: Excellence, LearnAbility, InnovAbility, SustainAbility, EFQM Excellence Model

Introduction

LearnAbility, SustainAbility and InnovAbility as concepts for companies should be pervasive, and all embracing especially during the economic downturn where companies have to do more with less resource. However, these concepts appear not to have necessarily been very well thought through or applied by companies. Furthermore, historically, companies have been poor at learning from failures in relation to new product development, an essential building block for ‘innovability.’ (Antoni et al, 2005). Whilst it is still early-days post ‘boom’ times, perhaps this lack of clarity and application can be attributed to the possible ambiguity surrounding the ‘real’ meaning, and potential of LearnAbility, SustainAbility and InnovAbility, as well as having no clear framework either for their application nor for fostering a culture to build Learnability, Sustainability and Innovability.

Dahlgaard-Park and Dahlgaard (2010) lend much clarity to the concepts of LearnAbility, SustainAbility and InnovAbility. They define the three concepts in the following way:

LearnAbility is ability/ capability to study and to learn while *InnovAbility* is about ability/ capability to innovate. Both are Meta competences because it’s not about to learn and innovate for a certain, single project. They are a way of life and a way of being for people and organizations. *SustainAbility* is ability/ capability to sustain which will be assured through continuous innovations which are based on continuous study and learning. Hence, the three words or concepts are interdependent and together they form a powerful system for recovery and progress. For recovery from the recent economic crisis we need to be able to build such powerful systems; as individuals, organisations, nations, communities as the European Community.

Further, Bendell et al (2010) put forward axioms for LearnAbility, InnovAbility and SustainAbility as follows:

- Thinking short-term is insufficient; we need also to think long-term
- We must not ignore shareholders; a balanced stakeholder approach is superior to a narrow shareholder-focused one
- We need to be responsible as an organisation
- Everything in our organisation is joined up and interrelated, and our organisation is joined up with everything (the System Thinking paradigm)
- You may never achieve perfection, but you can always get better and approach perfection
- You have to keep working at improving everything – People, Partnerships, Processes and Products (the “4P”).

- A result facilitates more of the same action: so success builds on success, failure on failure (the virtuous and the vicious circles).
- Sometimes when obstacles, that act as barriers to us, improving are all in the mind; we need to have the right attitudes, we have to want to do it
- We all have to live and drive the desired culture
- There is no Failure other than in Giving Up

These axioms are described by the authors as being ‘speculative’ and being ‘based on the authors’ combined experience in the field over many years. In spite of this speculative interpretation, however, it is clear that the axioms that are put forward by the authors embrace some of the fundamental principles upon which the European Foundation for Quality Management Excellence model is founded. The European Foundation for Quality Management (EFQM) Excellence Model (Figure 1.0) is a tool and method that helps organisations achieve business success by measuring where they are on the path to excellence; helping them understand the gaps; identifying potential solutions for bridging the gap; and providing an approach for implementing the gap-bridging solutions.

The EFQM Excellence Model was introduced in 1992 as the framework for assessing applications for The European Quality Award. Today, the EFQM Excellence Model is widely used throughout Europe and has become the basis for national and regional awards in Europe and other parts of the world. The EFQM Excellence Model is recognised as an effective business performance management system. (Van der Wiele, 1996a, 1996b; Bemowski & Stratton, 1995; Coulabidou & Dale, 1995; Godd et-all, 1996; Teo & Dale, 1997; Van de Wiele et. al., 1999; and Vos and Blackmon, 1996).

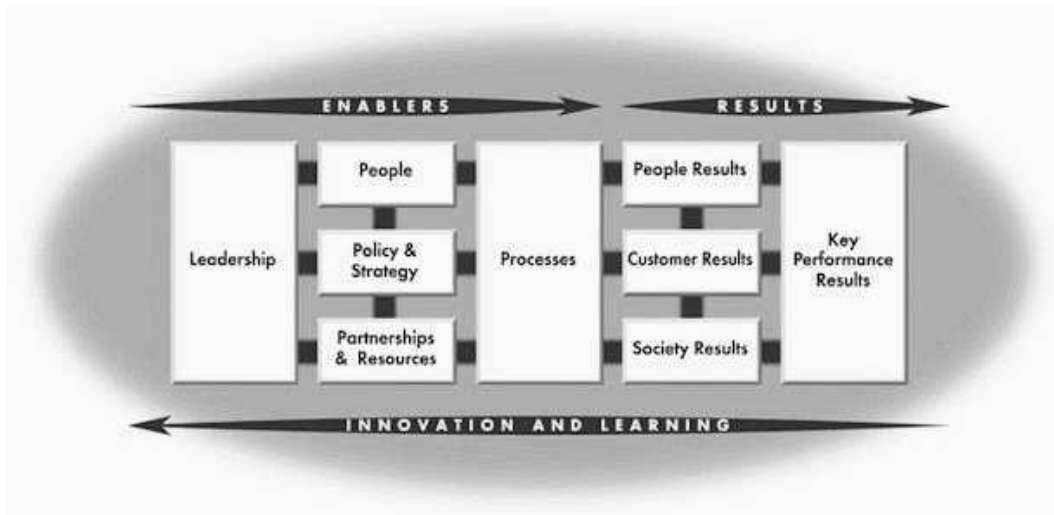


Figure 1.0 The EFQM Excellence Model (copyright EFQM)

The next section of this paper considers a study of companies that have successfully implemented the principles of Excellence in terms of TQM planning, implementation, learning and improving. These companies that have been recognised as achieving excellent levels of performance in view of having received an Excellence award.

A Study of the Successful – Key Performance Measures

Whilst in the US a comprehensive study has been conducted by Singhal and Hendriks (1997, 2001) that clearly demonstrates a positive link between the adoption of principles of Excellence such as embedded in the Malcolm Baldrige National Quality Award and improved organisational results, there has been little systematic study of the impact of the principles of the EFQM Excellence Model on business performance in Europe. Many of the previous research studies in Europe on the link between the effective implementation of organisational excellence strategies and improved financial performance have used survey methodology or case studies to collect data. Whilst these studies have provided valuable information on how the EFQM Excellence Model is perceived, and implemented, these studies have a number of shortcomings with the most serious one being the inability to independently assess the effectiveness of the implementation of the EFQM Excellence Model and its impact on financial performance.

Two sets of performance measures have been used for the study; these are share value and accounting based measures, with share price performance being a primary measure of performance. Share price performance is important to various stakeholders including senior management, employees, suppliers, mutual fund managers, institutional and individual investors. The return on shares that an investor would have earned by investing in companies that have effectively implemented the principles of the EFQM Excellence Model have been calculated. The share returns include capital gains, regular dividends and special dividends.

Time Period for Analysing Performance

Any attempt to identify the correlation between the effective implementation of the principles of the EFQM Excellence Model and improved financial performance needs to examine performance over a reasonably long period of time. This is because the principles of the EFQM Excellence Model require a suitably long horizon to be fully absorbed and integrated in the normal operating mode of how things are done at a company.

Existing literature does not provide much theoretical guidance regarding the appropriate time of analysis (Hendriks and Singhal, 2001). However by determining the date when the company won its first award we can at least establish a date for when the company had an effective programme in place. In this study where data has been available, the change in the performance of companies has been analysed over an 11 year time period anchored around the year when a company received its first award. To measure the net benefits from the effective implementation of the principles of the EFQM Excellence Model share value and accounting based performance measures have been computed before and after a company has received a first award. The first period of time, “the implementation period” starts 5 years before and ends one year before a company received a first award. The second period of time, “the post implementation period” starts one year before and ends 5 years after a company received a first award.

Industry and economic conditions, whether prevailing in a specific country at a particular point in time or a specific industry impact upon the performance of all

companies, and this will be true whether or not a company has effectively implemented the principles of the EFQM Excellence Model. To compare the performance of companies that have effectively implemented the principles of the EFQM Excellence Model and to adjust for country and industry economic conditions, comparison companies have been selected.

For each award winning company a comparison company was selected based on key criteria. This is that the comparison company;

- i. Has the same country of incorporation of the parent company
- ii. Has the same accounting data available over at least the same time period
- iii. Has at least the same first digit industry code as classified by Datastream
- iv. Is closest in size as measured by total assets at the fiscal year end before the winning of a first award, with the constraint that the ratio of value of assets is always less than a factor of 3

Key results that are reported in the next section of this paper are based on 120 award winners and 120 comparison companies. The key overall results report the average difference in percentage change in performance between each of the award winning companies and its comparison company.

Overview of Findings

The study found that compared to the comparison companies award winning companies experience significant higher increases in share value within a short period of time after having received a first award.

Results for the post implementation period indicate that generally the award winning companies outperform the comparison companies up to 3 years after first winning an award and sometimes this is statistically significant. Whilst the comparison companies generally outperform the award winning companies in the implementation period, this is not statistically significant.

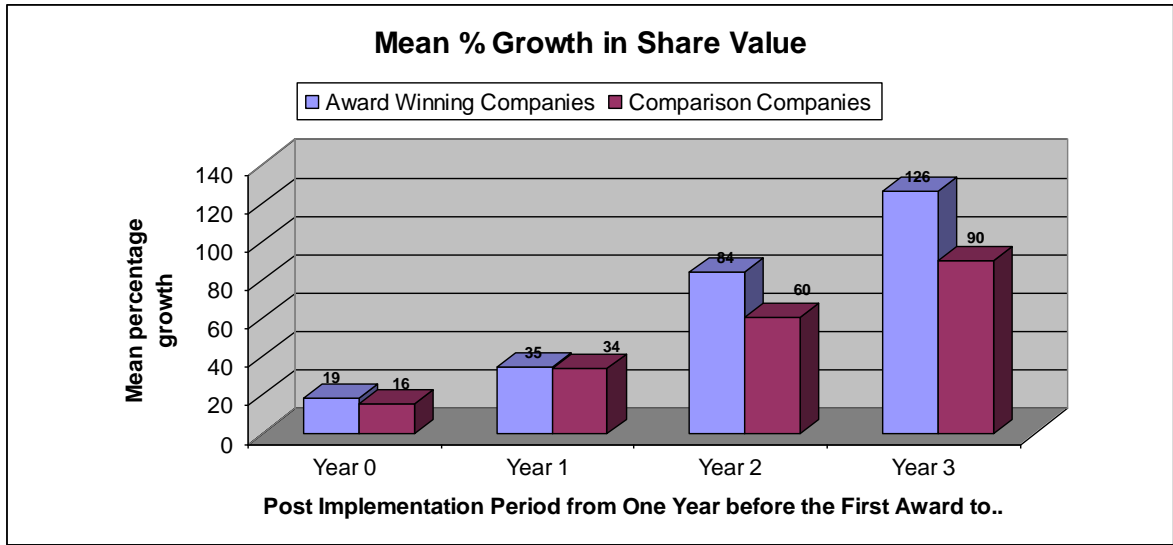


Figure 2.0 Mean percentage change in the performance of the award winning companies compared to the comparison companies for Share Value

An analysis of the share price performance for the award winning companies reveals some interesting results. In the year that the award winning companies receive a first award, they experience on average a 3% higher return in share value compared to the comparison companies. Additionally, the award winning companies experience higher increases in share value up to three years after having received a first award compared to the comparison companies. By two years after having received a first award the award winning companies have experienced a higher return in share value by an average of 24%, and by three years after having received a first award the award winning companies have experienced a higher return by an average of 36%. The last two average differences of 24% and 36% are statistically significant.

Overall, the study found that compared to the comparison companies award winning companies experience higher increases in share value, sales, capital expenditure over assets and capital expenditure over sales, higher growth in assets and further reduction in costs over sales within a short period of time after having received a first award. (Figure 3.0)

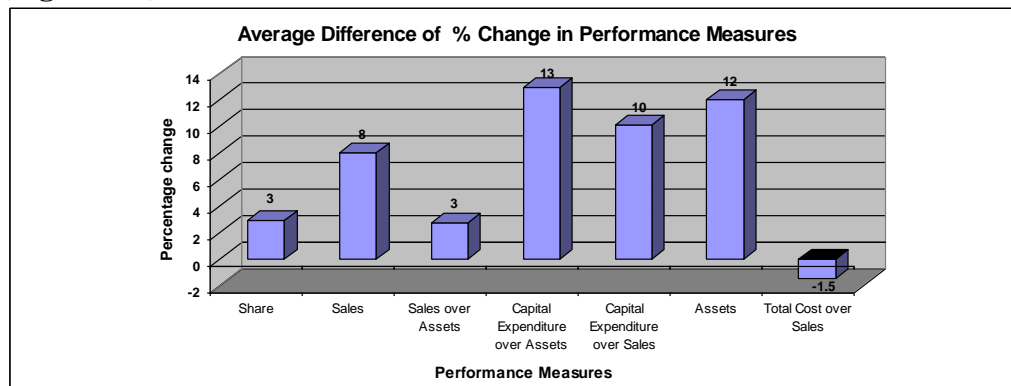


Figure 3.0 Award Winners: One Year Improvements in Financial Performance

Three years after receiving an award, the award winning companies outperform the comparison companies by an average of 36% for share value, 17% for sales, 5% for

sales over assets, 4% for capital expenditure over sales, 20% in assets and a better reduction in costs by 1.4%. (See Figure 4.0).

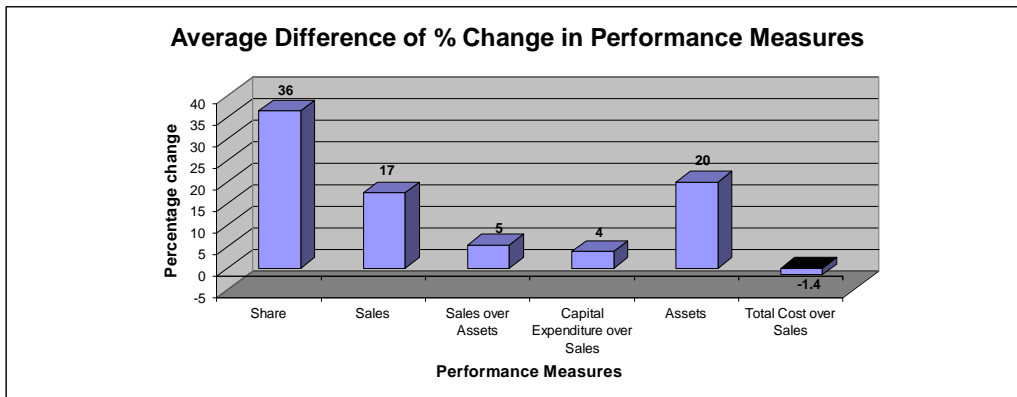


Figure 4.0 Award Winners: Three Years Improvements in Financial Performance

For the final year that performance was tracked, the award winners experienced even greater increases. Compared to the comparison companies, the award winning companies experienced higher growth in sales by an average of 77%, higher increases in operating income by an average of 18%, higher increases in capital expenditure over assets by an average of 28% and capital expenditure over sales by an average of 30%, higher growth in assets by an average of 44% and further decrease in costs over sales by 4.5%. (See Figure 5.0)

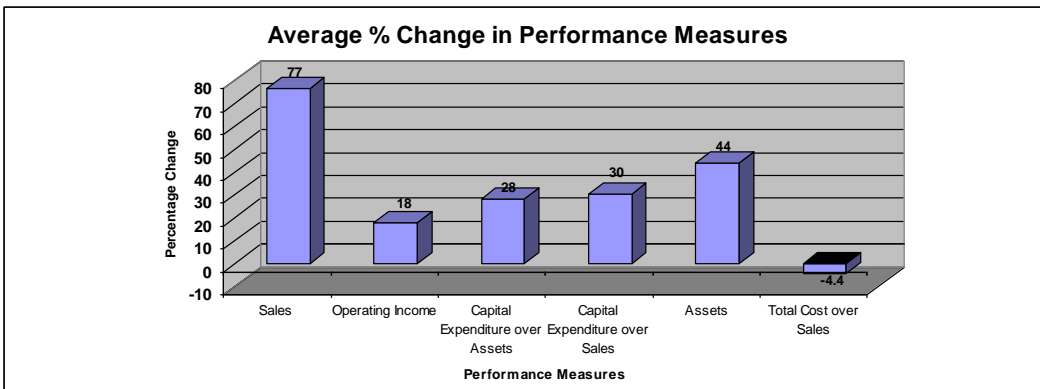


Figure 5.0 Award Winners: Five Years Improvements in Financial Performance

Concluding Comments

The Award Winner’s superior performance appears to be linked to the characteristics of these companies that made them Award Winners. Since all the award winners’ frameworks used were based directly, or indirectly, on the EFQM Excellence Model criteria, a natural conclusion is that these companies were taking seriously the axioms of *LearnAbility*, *InnovAbility* and *SustainAbility*. Apparently, the comparison companies were not, and they fared much worse. Interestingly, the study also gave evidence that the superior performance was not primarily due to the efficiency and cost performance of the Award Winners, but rather to their superior speed of growth (for example in relation to sales, See Figure 2.2) that appears to be directly linked to their implicit emphasis through the EFQM framework on the *LearnAbility*, *InnovAbility* and *SustainAbility* axioms. To conclude, the overall evidence indicates that when the principles of the EFQM Excellence Model have been implemented effectively, performance improves in both short and long periods of time. This should prove to be

reassuring for those companies that have made an investment and long-term commitment to the principles of the EFQM Excellence Model, and it provides evidence to support the continued commitment to the principles of the EFQM Excellence Model for those companies that might be thinking of replacing their Excellence strategy with something else. Furthermore, it provides positive evidence to those companies that are contemplating implementing the principles of the EFQM Excellence Model of the benefits that their company can reap from its effective implementation. Finally, the results provide evidence that the EFQM Excellence Model is a valid framework and reference point for LearnAbility, InnovAbility and SustainAbility.

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Evaluation of Success Factors for Innovation- and Competitive Strategy

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Introduction

The increase of competitive pressure while ongoing globalization and labor division is well known and still an actual phenomena. Short production cycles, individualized product demands as well as continuously changing customers' requirements characterize the competitive environment. Enterprises are subjected to a high innovation pressure caused by a powerful dynamic including permanently changing demands and conditions. According to Bullinger (2008) the global competition has to be seen as an innovation competition. In between this global competition enterprises are forced to align their innovation strategy strategically to assure their competitive position.

Innovation strategy and the existing innovation potential assure an enterprise's competitive position. 'The innovation ability of an enterprise is nowadays not just safeguarding the future, but as well often a condition to get a successful position at the market and to reach a superior market position' (Spielkamp, Rammert 2006). Nevertheless, the estimation and evaluation of the innovation potential is difficult. It is a dynamic development process. Even to manage an innovation process at all, means to plan something non-predictable. Plans cannot be drawn on routines, because innovations are projects having an open end.

According to Stern and Jaberg (2010) innovation is the process of transferring an invention to market use. This hypothesis is going along with Schumpeter's assumptions. And it underlines that the invention of a product is not yet sufficient. Therefore, innovation success has to be put on the same level as economic success. Innovation itself can refer to a product, a process, an organization, a market or to social and cultural aspects.

Retrospectively success factors for already successfully driven innovation strategies can be derived and analyzed. It is important to deal with the success factors off innovation and competition strategies to ascertain the current position of an enterprise prospectively. By deriving specific success factors the innovation strategy can be re-designed and re-aligned towards future competition requirements.

This paper offers as a first step a short overview of the current state of the art concerning success factors and innovation strategies as well as a critical evaluation. Further on, a derivation of the most important success factors, their classification and the development of guidance for innovation strategy alignment is presented. As a third

step the success factors and the guidance are implemented into the NetInnoCheck model (Bredtmann 2009). The paper ends up with a summary of the most important results and an outlook.

Success Factors for Innovation Strategy

Success factors are factors and values or ratings which have a significant impact on the achievement of the overall goal of an enterprise. According to Rehkugler (1989) success factors are, in general, the main influencing variables of success of an enterprise (or a smaller module), these factors are long-term effective and they cause the competitive advantage. Success factors are therefore seen as success variables whose use influences the achieved profits sustainably. As Steinle, C.; Schmidt, C.; Lawa, D. (1995) phrase it they are ‘characteristics [...] having a significant impact on the success of an enterprise’. The success factors research was developed in view of the question what drives enterprises being successful and what characterizes them (see Rehkugler, H. 1989, page 626). The starting point of success factors research was the qualitative analysis ‘In Search of Excellence’ by Tom Peters and Peters Waterman (McKinsey consultants) in 1982, where they analyzed 62 American enterprises concerning their business success. This analysis was based on the concept of the 7 S-factors according to McKinsey, which had already been described in 1980 in an article called ‘Structure is not Organization’. Peters and Waterman developed -based on this concept- 8 attributes which describe an excellent organization.

The 7 Ss and their connections are illustrated in figure 1.

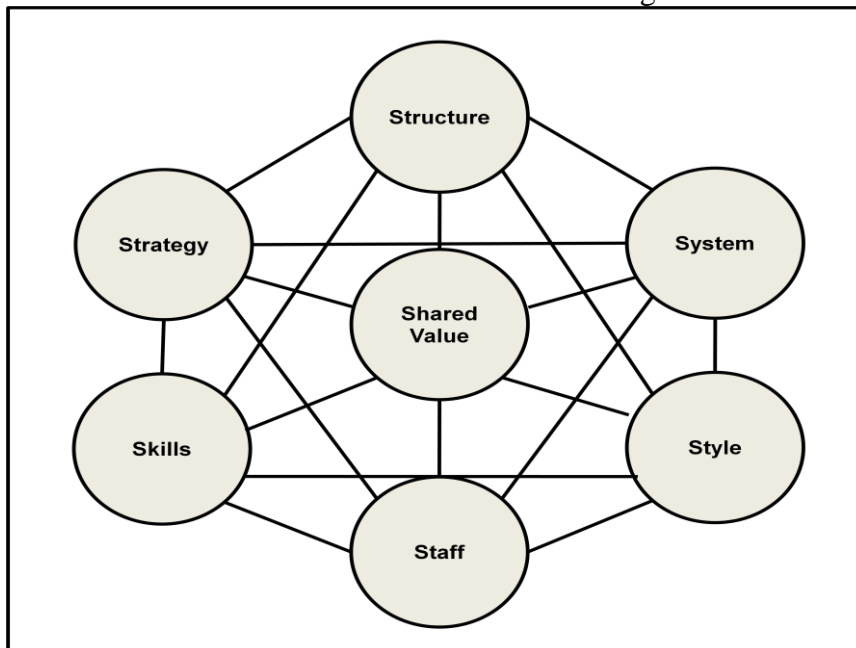


Figure1. : Concept of 7S according to McKinsey/ (Peters/ Waterman 1982)

The perspective, that an enterprise includes more than just its structure, was taken for the very first time with the 7S-model. This concept creates a new approach by taking hard aspects as well as soft aspects into consideration. The S-factors strategy, structure, and system are so called hard aspects.

Quoting Irwin/Zwick/Sutton 1999 p. 316-317 (related to Peters / Waterman 1982) the 7 S are defined the following way

‘Strategy – The strategy of an enterprise embraces all measures which generate a competitive advantage.

Structure – The structure of an enterprise is the condition for any possible specialization and co-operation. The structure is defined by strategy, size of enterprise, and product and service performances of the enterprise.

Systems – The systems of an enterprise include all formal and informal processes of strategy in between the given structures.

The soft aspects of the 7 S- model are the style, staff, skills und shared values.

Style – The style of enterprise is related to the enterprise culture. This concerns values and standards as well as management culture and leadership.

Staff – Staff are the employees of the enterprise. But this S also includes the structuring of the human resource development and the participation of the employees.

Skills – Skills are the summation of the abilities and competencies of the enterprise as well as any measure towards expansion and further development.

Shared Values –Shared values are related to the fundamental and essential ideas on which the enterprise is based and to all connected visions. Additionally shared values define the alignment of the enterprise.’

Based on the analysis of 62 enterprises by the 7 S- model Peters and Waterman (1982) developed 8 attributes which characterize excellent organizations:

(1) **A bias for action** - getting on with it and overcoming the inertia that often occurs with size.

(2) **Close to the customer** - understanding the needs of ‘lead’ users and providing the desired levels of service, quality and reliability.

(3) **Autonomy and entrepreneurship** - devolution, providing space and support for creative ideas that lead to innovative product and service launches.

(4) **Productivity through people** - people is seen as the primary source of productivity gains.

(5) **Hands on, value driven** - the organization's values result in a distinct and binding culture which gives direction to action by all members.

(6) **Stick to the knitting** - concentration on and development of the organization's areas of distinctive competence.

(7) **Simple form, lean staff** - simple organization structures, with efficient management supported by small staff teams.

(8) **Simultaneous loose-tight properties** - an effective balance between central direction and individual authority.

The scientific discussion evaluated the results of Peters and Waterman as being too subjective due to the fact that they are based on expert interviews on the one hand. And on the other hand these interviews just offered a snapshot of the enterprises. Nevertheless, the 7 S-model and the 8 attributes are one of the first approaches to identify success factors of enterprises.

The analysis of success factors has always been criticized. Dellmann (1991) criticized that enterprises were analyzed which had been successful in the past. The extracted success factors were projected into future by universally valid success rules. The current dynamic of exterior influences was not taken into consideration. Just a consideration of these influences can generate success potentials according to Dellmann. It is necessary to recognize such signs at an early stage to remain at market successfully (Dellmann, 1991, p. 433; Burgstahler 2001).

Parallel to the further development of the success factors research the point of view changes from the all embracing success factors to so-called critical success factors. This reduction to the critical success factors should point out the factors having a significant influence on the business success. A further division towards success factors which influence business success long-term (Daschmann 1994, p. 13, Rehkugler 1989, p. 627). This leads to an overwhelming number of papers dealing with the identification of success factors.

This paper deals with the current state of the art of the success factors research concerning success factors for innovation strategies. A literature research concerning success factors of innovation strategies -based on the last three years to assure actuality- just leads to two relevant sources which offer a specific context of success factors of innovation strategies.

The first source is the project KompNet2011 'Strategical Alignment and Innovation Activity of SMEs in the area of Jena (Germany)' (Sauer and Stoetzer 2010) and second source is 'Manual Successful Innovation Management; Success Factors – Basic Patterns – Case Studies' (Stern and Jaberg 2010).

The project KompNet2011 investigated on the success factors of regional innovation networks. 225 enterprises having at least 5 employees were interviewed to gather the relevance of different innovation kinds, innovation barriers, and innovation supporter. Data gathering was carried out through personal standardized expert interviews. As a central element and, therefore, as a success factor 'strategy definition' was identified within KompNet2011. The strategy definition affects the base for long-term goals. Secondly the importance of the customer who is central for an innovation was exposed followed by the current competitors, who enhance the innovation pressure. It turned out that barriers are not driven by financial aspects but by negative attitudes of employees and of the management. This means that the employees as well as the entire management are success factors for innovation strategies.

Stern and Jaberg (2010) offer guidelines for enterprises to fix innovation successfully at the market. The tasks of an innovation management according Stern/Jaberg are offered by table 1.

Table1: Tasks of Innovation Management according to Stern/Jaberg 2010

Tasks of Innovation Management
1. Determination and persistence of innovation goals and innovation strategies.
2. Proper recognition of costumers' requirements in time and adequate response in kind of market conform products and performances.

3. Decision concerning realization of innovation.
4. Targeted designing and steering of innovation processes to ascertain a faster and better transfer of business ideas than competitors do to assure market success.
5. Generating an innovation supportive enterprise structure and enterprise culture.

The main problems occurring are the uniqueness of innovation processes, the great number of influencing factors, and the uncertain results. Innovation processes are complex and hardly controllable. It is difficult to generalize these processes and to apply them on different enterprises. The solution for this problem offered by Stern and Jaberg is the creation of a basic pattern out of similarities which has to be aligned with the characteristics of the specific enterprise. Stern and Jaberg developed out of 53 success factors 11 basic patterns. The basic patterns are transferred to checklists applicable on each enterprise.

Table 2: patterns and success factors according Stern/ Jaberg 2010

Basic Pattern	Success Factor
<i>Driving/Motivation</i>	Innovation driving at high enterprise level Existing aim system Aim system is well known to all employees (aim system ‘arrived’) Vision based strategy is persisted (aim system is basis of actions) Innovation is an enterprise aim and an assignment
<i>Leadership</i>	Leadership concerning target agreement (MbO – Management by Objectives), innovation aim in target agreement Reward of innovation activity Supervisors as coaches Employees as intra-preneurs Flexible, react able, responsible small units (fractals) Flat hierarchy, short distances
<i>Enterprise Culture</i>	Open communication Clime Free passing of knowledge (no retaining of knowledge due to power considerations) Participation and information of employees concerning all important decision at an early time
<i>Area of Priorities based on customers, competition and enterprise</i>	Knowledge management: Does external information reach the enterprise and does it reach all internal participants? Customer orientation of all employees Competition orientation of all employees Basic pattern success factor All employees are aware of aims and resources of the enterprise

<i>Closeness to customers</i>	<p>Acceptance of customer's wish concerning innovation process</p> <p>Application of different methodologies of closeness to customers</p> <p>Active co-operation with customers</p>
<i>Innovation team</i>	<p>Participation of employees of all units of the enterprise (interdisciplinary brainstorming team)</p> <p>Adequate priority of innovation activity for all employees (harmonization of events of the day)</p> <p>Exhaustion of all resources for brainstorming</p> <p>Application of brainstorming methodologies (creative methodologies)</p> <p>Co-ordination of brainstorming process by innovation manager</p>
<i>Value Innovation</i>	<p>Development team aim at focus of customer's wish</p> <p>Focusing on most important factors for ordering</p> <p>Team pursues unit selling points/ is willing to leave conventional paths</p> <p>Competition orientation of team: Monitoring and beating the competition</p> <p>Courage towards persistent development/ early recognition of future customer's wish</p>
<i>Chance and Risk Analysis</i>	<p>Clear criteria to evaluate ideas</p> <p>Priorisation of ideas by criteria and development of measures</p> <p>Interdisciplinary preparation of decision</p> <p>Application of strategy portfolios or comparable tools</p> <p>Financial scenarios</p>
<i>Process organization</i>	<p>Flexible project organization, participation of employees of all enterprise units</p> <p>Responsibility for the team (delivering responsibility top down, empowerment)</p> <p>Adequate equipment of resources</p> <p>Adequate priority of innovation activity for all employees (harmonization of events of the day)</p> <p>Adequate existing of motivation, experience and qualification in between the team</p> <p>Application of project management methodologies like goal setting, Gantt chart methods, scenario methodologies</p> <p>Application of development methodologies (e. g. QFD, FMEA, Target Costing, Simulation, Rapid Prototyping)</p> <p>Learning enterprise: fruitful retrospective view</p>
<i>Core competence management</i>	<p>Awareness of core competencies</p> <p>Focusing on core competencies</p> <p>Conscious development (knowledge management)/ task</p>

	of core competencies (cc-strategy) Openness for alliances/buying-in Development of synergies (platform concept, use of same parts)
<i>Internal Marketing</i>	Participation of employees of all areas of activity starting early (interdisciplinary) Participation/information of all employees starting early Participation/information of additional enterprise fields/companies starting early Application of different methodologies of internal marketing (e. g. postings, innovation adoption)

Beside these basic patterns the innovation process has to be considered due to its phases. The following four phases are estimated:

1. Brainstorming
2. Evaluation of ideas
3. Internal Implementation
4. External Transfer

Additionally the project points out the existence of two different basic patterns. The first basic patterns appear in all four phases of the innovation process, they are called permanent basic patterns. They are related to interpersonal dealings, the soft skills. The second kind of basic patterns includes all of those which just appear during one or two phases of the innovation process. They are called variable basic patterns.

Soft skills contain driving/motivation, leadership, enterprise culture, and area of priorities based on customers, competition and enterprise. These four basic patterns can only be changed by long-term run due to their long-term growth and because they reflect the thought and activity patterns of the concerned people.

The basic patterns lead to seven tools being needed by an enterprise to carry on innovation successfully.

1. Innovation manager and innovation team
2. Establishing of customers' requirements by closeness to customers
3. Value innovation
4. Management of core competencies
5. Chance and risk analysis
6. Internal Marketing
7. Process organization
- 8.

The basic patterns influence each other and they develop their total impact by interacting. The interaction of the basic patterns and the chosen classifications are similar to the 7S-model and the 8 derived attributes. A parallel to the 7S-model -which started the success factor research- can be shown. The results of the approaches are implemented to the methodology of the NetInnoCheck by Bredtmann to extend the InnoCube.

Comparison of Approaches and Implementation in NetInnoCheck

The main focus of this chapter is gathering clusters by analyzing success factors and innovation strategies. The demonstrated approaches by Peters/Waterman (7S-model) and Stern/Jaberg (11 basic patterns) are compared and lead to scheme describing the actual success factors and innovation strategies. These results are implemented in the NetInnoCheck to evaluate the innovation potential of an enterprise.

Table 3: Comparison of 7S-model and 11 basic patterns:

7 S – Peters and Waterman 1982	11 basic patterns – Stern and Jaberg 2010
Strategy	Driving/Motivation
Structure	Leadership
Systems	Enterprise Culture
Style	Area of Priorities based on customers, competition and enterprise
Staff	Closeness to customer
Skills	Innovation team
Shared Values	Value Innovation
	Chance and Risk Analysis
	Process organization
	Core competence management
	Internal Marketing

Areas being relevant concerning the estimation of the innovation potential of an enterprise are directly compared in table3. The combination of these areas assures an all-embracing estimation of the innovation potential. The following fields come out which conceive the areas of the success factors concerning innovation potential estimation by combining the two approaches.

Table 4: Combination results

7 S – Peters and Waterman 1982	11 basic patterns – Stern and Jaberg 2010	combination
strategy	Driving/motivation (aim system)/ incentive aim	strategy aim
structure	leadership / direction leadership	structure and leadership
systems	enterprise culture	systems and process organisation
style	<u>area of priority</u> between customer, competition and enterprise	enterprise culture
staff	<u>closeness to customers</u>	(innovation) staff
skills	innovation team	skills and core competencies
shared values	value Innovation	shared innovation values
	opportunities and risk analyse	customer and customer involvement
	process organisation	opportunities and risks analyse - focus competition
	core competencies management	
	internal marketing	

The comparison and combination of the two approaches lead to 9 fields in which success factors can be identified.

- strategy aim
- structure and leadership
- systems and process organisation
- enterprise culture
- (innovation) staff
- skills and core competencies
- shared innovation values
- customer and customer involvement
- opportunities and risks – focus competition

By combining the different fields the new developed areas having an alignment towards innovation and innovation management offer the possibility to extend the InnoCube concerning the estimation of the innovation potential of an enterprise.

The methodology of the NetInnoCheck is summarized shortly in the following chapter, for detailed information see (Bredtmann 2009, Hoeborn/Bredtmann 2009; Bredtmann 2010a; Bredtmann 2010b, Bredtmann/Hoeborn 2010).

NetInnoCheck

The approach and methodology of the NetInnoCheck (Bredtmann 2009/2010) evaluates the ability and competence of innovation and at the same time the ability and competence of joining a network. Both competencies are determined each by three dimensions such as ability, volition, and permission. In between the NetInnoCube these three dimensions describe the shaping related to innovation (InnoCheck) and related to networks (NetCheck).

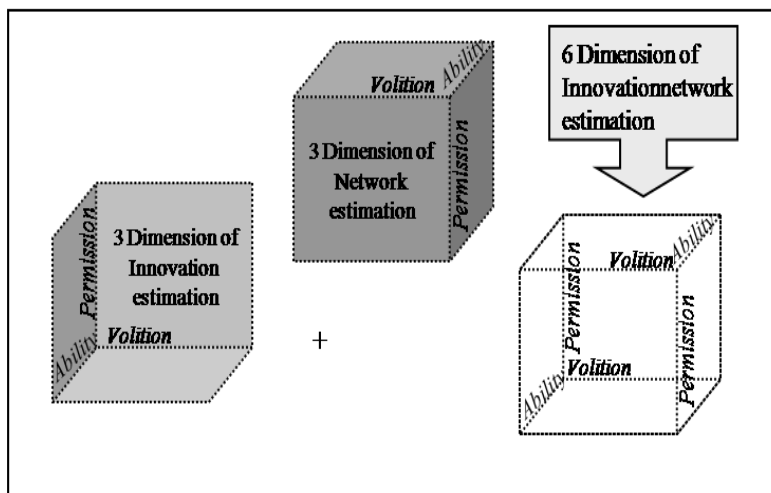


Figure 2: The six dimensions of the NetInnoCheck /Bredtmann 2009/

The process of evaluation of the total NetInnoCube is divided into the two steps InnoCheck and NetCheck. Both steps have to be passed to carry out a total evaluation and grading. This grading is concerned to the status quo concerning the abilities of generating innovation and joining a cross-company network. Each enterprise is estimated, assessed through the parameters being included in the three dimensions particularly. After passing successfully the application of the NetInnoCube the enterprise specific position is worked out.

To implement the derived results of success factors areas of innovation strategies the InnoCube is considered more closely. In between the InnoCube a division into the three levels ability, permission and volition is carried according to the Netcube. Further on this 3 levels are divided into three categories /Bredtmann 2010a/:

- staff related;
- related to project group or department
- related to company

This leads to a specific subdivision as mentioned below quoted from /Bredtmann 2010a/:

‘Ability – Innovation Potential:

Staff related:

- experience
- age
- education and training
- length of service with a company
- individual knowledge and experience of methodologies
- individual skilled knowledge and experience
- additional – not job related- abilities (hobbies, volunteers)
- social competencies

Related to project group or department:

- work and environment conditions
- involvement and participation of employees
- space and time for creativity
- life-long-learning, further education

Related to company:

- culture of company
- company policies
- style of leadership
- organisational environment conditions
- involvement and participation of employees concerning strategic decisions

Dimension of volition concerning innovation potential evaluates the position of the enterprise concerning will and motivation towards innovation. Therefore, it leads to the following subdivisions:

Volition – Innovation Potential

Staff related:

- individual motivation

Related to project group or department:

- support
- incentive systems
- motivation

Related to company:

- motivation
- policy guidelines
- company culture
- external economic situation
- funding programmes and access to

The dimension permission concerning innovation potential evaluates and mirrors the position of the enterprise; it describes the shaping of the enterprise of being financially and formally able to generate innovation. This leads to a subdivision as mentioned below:

Permission – Innovation Potential

Staff related:

- financial resources
- objective resources – technology, machines, plants
- allowance, empowerment

Related to project group or department:

- financial resources
- number of employees
- objective resources - technology, machines, plants
- allowance, empowerment

Related to company:

- financial resources
- number of employees
- objective resources - technology, machines, plants
- allowance, empowerment

A comparison between the quoted aspects of InnoCube /Bredtmann 2010a/ and the results of the comparison and combination of 7S-model as well as of the approach of Stern/Jasberg shows that the aspects of InnoCube go along with the 9 derived areas of success factors concerning innovation strategy but areas as strategy aim, enterprise culture and customer involvement have to be extended.

The aspect strategy aim is an addition of the level permission related to all three categories staff related, related to project group or department and related to company. This complement is very important for the InnoCube because it is precondition for the existence of innovation potential.

The aspect enterprise culture complements the level of volition. Just if innovation culture was aimed at and lived at all levels of an enterprise the basis of innovation potential is given.

The aspect of customer involvement complements two levels of InnoCube, the levels ability und volition. Again this aspect customer involvement considers all three sub-fields.

Structure and leadership can be found in the InnoCube level ability related to company.

The part systems and process organisations is by volition related to project group or department.

The part staff or innovation staff and although the part skills and core competencies are at all levels of the InnoCube – ability, volition and permission considered.

The aspect shared innovation values can be found at the level permission related to all 3 categories staff, related to project group or department and related to company with the aspect of allowance, empowerment.

The part opportunities and risks – with the focus competition are an immanent aspects and part of the NetInnoCheck approach.

Conclusion and Outlook

The success factors are critically discussed due to their past based derivation and the derived activity. The forecast of success is a critical point.

To carry out an estimation of the innovation potential and to extend the NetInnoCheck the success factors are an excellent complement. By combining and adding of general enterprise success factors of innovation strategy aspects to analyze and evaluate the innovation potential could be derived.

Due to the extension of the InnoCube by aspects of strategy aim, enterprise culture and customer /customer involvement a detailed ascertainment of the innovation potential by InnoCube can be assured. At the same time this offers the possibility to specify an extension of the NetCube concerning success factors.

Concerning a further development of the NetInnoCheck it has to be taken into consideration that the detection of a success factor just leads to success itself if the competition has not anticipated it yet /Nicolai/Kieser2002/. Nevertheless, the NetCheck can further developed by taking success factors network and co-operation strategies into consideration. This is even more important because ‘future ... belongs more and more powerful networks of enterprises which optimize their innovation processes mutually’ /Duschek 2002, p. 2/. A parallel consideration of network and innovation potential is therefore requested, particularly because they can influence each other. This further development of the NetInnoCheck and its application will be the next research aim.

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Operationalization of market orientation concept in higher education institutions

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Keywords: Market Orientation, Higher Education, Stakeholder Orientation, Competitive Orientation, Collaborative orientation, Inter-functional Coordination, Responsiveness, Scale Measure..

Introduction

The market orientation philosophy began to be conceptualized in the 1980s, through the seminal papers of Narver and Slater (1990), and Kohli and Jaworski (1990). The strategy is still a present-day topic in marketing research, and has been extended to different sectors: charities (Balabanis et al., 1997; Cervera, et al., 2001; Ignacio et al., 2002), healthcare: (Bhuan and Abdul-Ghader, 1997; Wood et al., 2000; Tsai, 2003), arts and culture: (Sorjonen, 2002; Gainer and Padanyi, 2002).

In higher education, which is the focus of the present paper, two trends can be pinpointed: The first merely suggests that Market Orientation is necessary if institutions are to face successfully their changing environment. Braun and Merrien (1999) hold for example that: “...market orientation is one of the ways the governance of higher education is to evolve” (cf. figure1). De Jonghe and Vloeberghs (2001) suggest also that «A market orientation is supposed to take place in universities, but this does not always happen in the optimal way.” According to Davies (2001), the introduction of quality systems that recognize Customer Orientation and Market Orientation is an important step towards sustaining entrepreneurial endeavour in higher education. Haug (2001) adds that competition between national institutions and trans-national suppliers of education and formation, coupled with a greater freedom of choice among institutions, may affect institutional strategy. He contends that *institutions which recognise new demands and adapt their supply will be more likely to develop and overcome challenges.*

The second trend is that of scholars who transpose, in empirical studies on higher education, the Kohli and Jaworski's or Narver and Slater's models of Market Orientation. (Caruana, et al., 1998a, 1998b; Wasmer and Bruner, 1999; Flavian and Lozano, 2006; Webster, Hammond and Harmon, 2006).

From then on, it is clear that Market Orientation is either implicitly or explicitly seen as a potential managerial solution to the changes undergone by higher education institutions.

In a recent study published in the International Journal of Quality and Service Sciences, Bugandwa Mungu-Akonkwa (2009) highlights the way market orientation rhetoric or research is emerging as a new management paradigm in higher education, and provides a relevant critic in the way market orientation is being introduced into the sector. The point in his work is not to dismiss the relevance of the above strategy for higher

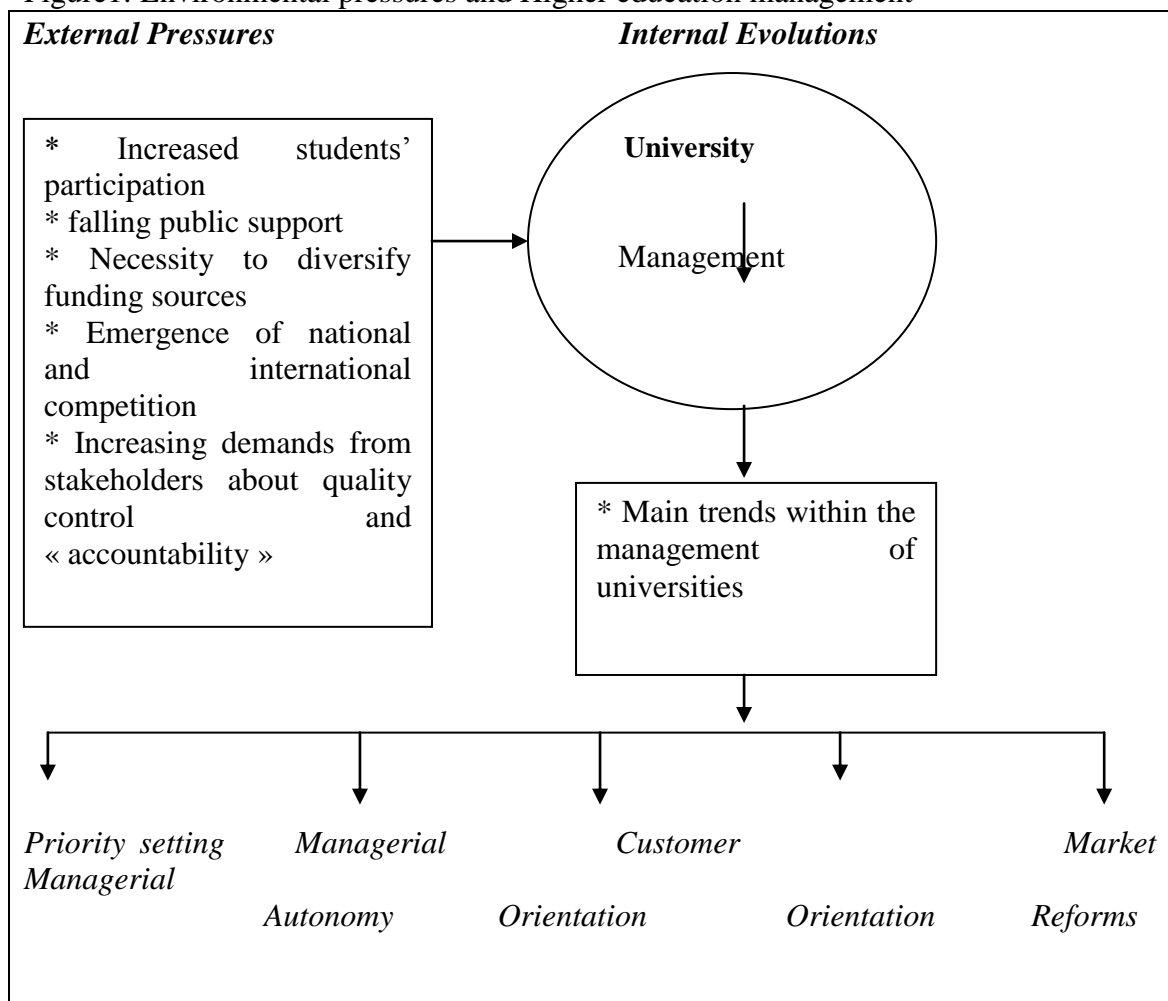
education. Rather, while criticizing its theoretical transpositions in such a particular sector, he contends that market orientation is to be implemented in higher education to face the changing environment.

This paper goes further in purporting to identify the key dimensions for an operational definition of the market orientation concept in higher education. After discussing the literature on market orientation and its extension to a non-profit organization, a scale is proposed, containing items which attempts to capture the complexity of marketing in higher education. The novelty of this outcome is its reliance on a stakeholder perspective and the fact that it adds the Collaboration dimension which has been missing in current conceptualizations of market orientation in higher education.

The context of higher education

The changing context of higher education and its confrontation with market forces are exerting intense pressures on the management of these institutions. Bugandwa-Mungu-Akonkwa (2009) has used the New Public Management framework to understand the link between higher education context and Market Orientation. This theory allowed him to delineate the changes undergone by institutions, and the ways the latter could adapt to these changes. From a broad managerial literature on higher education, figure1 below sums up the institutional adaptations to directions that institutions are likely to follow:

Figure1: Environmental pressures and Higher education management



Source: Bugandwa Mungu Akonkwa (2008).

Market orientation concept in managerial literature

The Market Orientation concept is at the heart of modern marketing and strategy (Narver and Slater, 1990; Lambin, 2000), through the attention paid to it by academic textbooks and scholarly papers.

Two broad perspectives entangle the conceptualization of Market orientation: cultural and behavioural perspectives. The first stresses organizational values and beliefs. It is rooted in the cognitive sphere and influenced by personal factors which determine the organizational characteristics: goals, strategies, systems and structures. According to Deshpandé and Webster (1989), the marketing concept defines an organizational culture constituted by a set of shared beliefs and values putting the customer at the heart of the organization, its strategies and operations. Researchers and practitioners contend that this perspective implies that the effective implementation of marketing strategies relies on a set of dynamic and flexible values, founded in the organizational culture (Bonoma, 1984; Webster, 1991; Gonzalez-Benito and Gonzalez-Benito, 2005). The basis of cultural perspective is the researches that demonstrate a positive relation between organizational culture and efficiency in marketing actions (Dunn, et al., 1985) A number of researches on the development of Market orientation have stressed that this orientation is the necessary outcome of explicit and/or implicit cultural values (Webster, 1990; Mavondo and Farrell, 2003).

The behavioural perspective focuses on activities that are supposed to be conducted in a market oriented organization, and the behaviour that the strategy assumes from all organizational members. It is the assessment of these activities which will allow to conclude whether an organization is market orientated or not, and even to measure the extent of this orientation. This perspective prevails in empirical researches on market orientation and thus, can be seen as a new paradigm in the marketing literature (Kohli, Jaworski, and Kumar 1993; Ruekert, 1993; Greenley and Foxall, 1998; Asmat-Nizam, et al., 2006; etc).

The coexistence of these two perspectives while defining Market orientation can be frustrating and source of problems both for researchers and practitioners. Actually, practitioners need concrete information to effectively implement this strategy. Hence, it is necessary to integrate the two perspectives, because they are so enmeshed that it would be difficult to dissociate them. On the one hand, values that are shared by organizational members are the basis for the different conceivable strategies and can influence their implementation (Detrie, 1999). On the other hand, the implementation of specific market oriented activities can illustrate their gain and thus determine the emergence of marketing culture in the organization (Kotler and Fox (1985, Gainer and Padanyi (2005; Carr and Lopez, 2007). Matsuno, Mentzer and Rentz (2005) have confronted the two perspectives and found that market oriented behaviour is the source of organizational performance. Their finding is consistent with Wasmer and Bruner II (1999) and Gainer and Padanyi (2005) for whom market oriented behaviour explained organizational performance, and which, as a consequence, explains the emergence of a market oriented culture in the organization.

This paper focuses on the behavioural perspective to develop operational items for the Market orientation concept in higher education. The next paragraphs present the main conceptualizations of Market Orientation, whatever the perspective considered, and will

show the predominance of behaviour and its link with cultural perspective. Two main approaches are considered, which are the cornerstones of other conceptualizations and the pillars of empirical research.

First, Kohli and Jaworski (1990), Jaworski and Kohli (1993) have defined Market Orientation through three behavioural dimensions:

“Market Orientation refers to the organization-wide generation of market intelligence pertaining to current and future needs of customers, dissemination of intelligence within the organization, and responsiveness to it”.

Market intelligence generation refers to the collection and assessment of customers' *current and future needs/expectations, and the understanding of exogenous factors such as competition, political regulation, technology, economic and political constraints, etc.* that influence the development and refinement of those needs. Market oriented organizations endeavour to get a clear knowledge of customers' needs from a number of perspectives. Market intelligence generation implies systemic methods of organizing, storing, and retrieving current information, an intelligence network for gathering new data through qualitative and quantitative methods, and a process for analyzing this information for decision making purposes. However, this activity is not often conducted in a systematic and integrated approach in universities. It is possible for universities to carry out surveys and obtain feedback from informal observation and discussion. As such, intelligence/information generation in the model is a broader concept than simply customers' stated needs and preferences.

Intelligence Dissemination refers to the process and extent of market information exchange within different units of a given organization. This dissemination of intelligence occurs both formally and informally and involves sharing information with everyone in the organization. Responsiveness is the action taken in response to intelligence that is generated and disseminated. Action on the basis of market intelligence captures the speed and coordination with which marketing programs are implemented to respond to customers' needs. Jaworski and Kohli have defined responsiveness component as comprising two sets of activities: (1) response design (using market intelligence to develop plans) and (2) response implementation (executing such plans). This means that responsiveness involves developing, designing, implementing and altering products and services in response to customers' current and future needs.

In order to measure the extent of market orientation in an organization, the authors used the “Markor” which is a Likert's scale with 5 points: 6 items for « Market Intelligence Generation», 5 items for “Market Intelligence Dissemination” and 9 items for “Responsiveness”.

Narver and Slater (1990), Slater and Narver (1994; 2000) provide the second conceptualization of Market Orientation. According to them, *“Market orientation is a business culture that most effectively and efficiently creates superior value for customers. It is the organization culture that most effectively and efficiently creates the necessary behaviours for the creation of superior value for buyers and, thus, continuous superior performance for the business”.*

Three behavioural components (Customer orientation, Competitor orientation, and Inter-functional coordination) and two decision criteria (long-term focus and

profitability) are suggested to operationalize their definition. Hereunder, we focus on the first three dimensions.

(1) Customer orientation is the sufficient understanding of one's target buyers in order to continuously create superior value for them. It implies the organizational endeavour to always work to improve customer's satisfaction.

(2) Competitor's orientation means that a seller understands the short-term strengths and weaknesses and effect of a long-term capability and strategy of both the key current and potential competitors (Porter, 1985).

(3) Inter-functional coordination is based on information about stakeholders' expectations and on competitors. It entails business's coordinated efforts, involving not only the marketing department, but all departments and organizations' resources to create superior value for stakeholders. Hence, creating value for stakeholders is more than just a marketing function; it is a job for the whole organization. Every organizational function is concerned with the sharing of information in order to improve customer's satisfaction; and every organizational member is supposed to adopt the behaviour that is positively linked to higher value for stakeholders. The key indicator of this component is the total commitment of all members to a marketing philosophy and the integration of marketing activities to provide value to stakeholders. Typical behaviour would include: departments and teams working together to meet student's needs; departments and teams sharing market information; teams and departments integrating strategies; all sections working together to offer value to students; and teams willing to share resources, etc.

Theoretical integration of the two definitions

Although the two definitions actually differ, they can be shown to converge towards the main dimensions of Market Orientation strategy. In attempting to sum these up, **Wood and Bhuian** analyze the concept from different perspectives and present a model including four key elements that are common to them: customer emphasis, intelligence generation, intelligence dissemination/inter-functional coordination and intelligence responsiveness/taking action. In his ongoing research which attempts to adapt the market orientation concept to Higher Education, Bugandwa Mungu-Akonkwa (2008; 2009) has suggested the following integrating definition:

Market orientation is a culture and a set of behaviour or activities oriented towards current and latent customers' needs, the analysis and understanding of both competitors and the macro-environment in order to adapt the organization's supply to the requirements of customers and external environment, and hence, to improve the organizational performance in terms of market-shares, customers' loyalty and retention, return on investment...

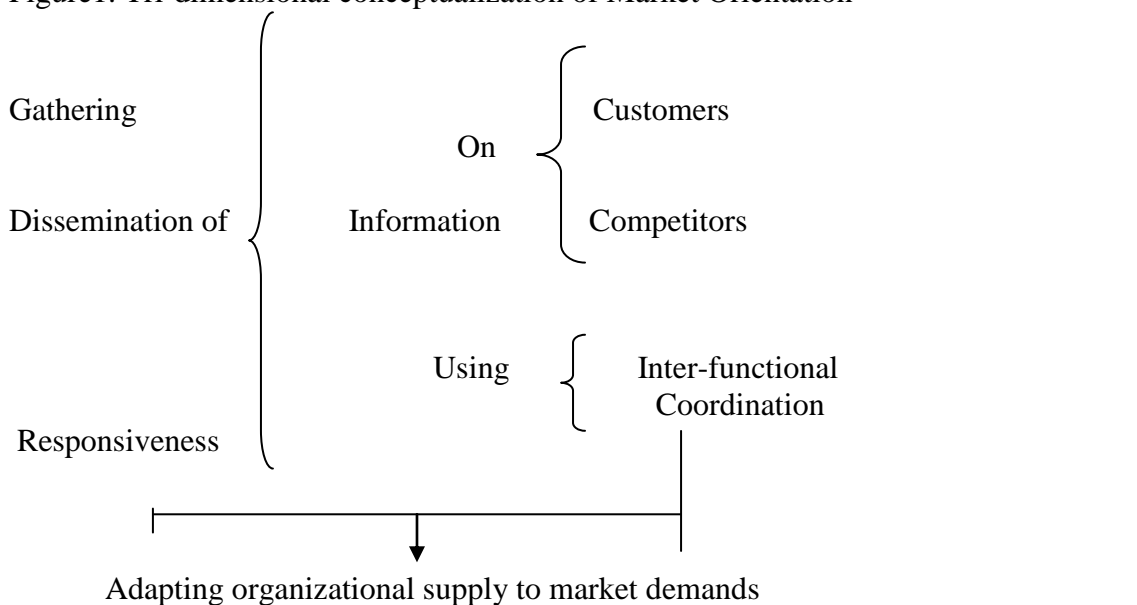
According to the author, whose argumentation partly relies on Cadogan and Diamantopoulos (1995), in spite of the differences between Narver and Slater and Kohli and Jaworski's approaches (for example the absence of inter-functional coordination in Kohli and Jaworski's conceptualization), the general philosophy of Market Orientation implies *"the understanding of markets' developments, sharing gathered information*

with all personnel, and adapting the organizational supply to these changing market (Jaworski, Kohli et Sahay, 2000).

Actually, Bugandwa Mungu-Akonkwa (2009) realizes that all existing market orientation approaches stress the role of information at the heart of marketing activity. For instance, dimensions such as “Market Intelligence Generation” and “Market Intelligence Dissemination” focus information about customers, competitors as well as social, economic and political environment (what Lambin, 2000 call « the Macro-environment »). Hence, these activities from Kohli and Jaworski meet Narver and Slater’s « Customer Orientation » and « Competitor orientation », while focusing on activities about *acquiring information about customers, competitors, and macro-environment* as well as the *dissemination of this information towards different organizational departments*. Further, the dissemination of both formal and informal information implies participation of all organizational members to be effective. According to Cadogan and Diamantopoulos (1995), this activity, to which they add intrapersonal relations (organizational members’ cohesion), allows not only an easy circulation of information towards different functions, but also an effective organizational response to the gathered information (this is “responsiveness dimension in Kohli and Jaworski’s conceptualization). Differently stated, the more effective the inter and intra functional mechanisms, the more effective the organizational response.

Based on this analysis, Bugandwa Mungu-Akonkwa (2009) has suggested the following figure to sum up different conceptualizations of Market Orientation:

Figure1. Tri-dimensional conceptualization of Market Orientation



Source: Bugandwa Mungu-Akonkwa (2009).

This figure highlights the place information occupies in both Kohli and Jaworski and Narver and Slater’s conceptualizations. Indeed, all the activities involved in acquiring information about customers and competitors in target market and disseminating it throughout businesses are included in the Customer orientation and Competitor orientation dimensions. Inter-functional coordination is an invaluable tool for the efficient responsiveness to information gathered and disseminated. It entails a fluid

circulation of intelligence within departments and between organizational members. So the following variables can be retained from the conceptualization of Market Orientation:

Customer orientation;

Competitor orientation;

Inter-functional Coordination.

Responsiveness: Assuming that all the organizational members, through different functions, have access to the organizational information, they have in return to respond to stakeholders' demands by adapting the organizational offer to these demands and requirements. .

The dimensions above-mentioned have been extensively used in empirical research. Following recommendations from Jaworski and Kohli (1993), Kohli, Jaworski and Kumar (1993) and Narver and Slater (1990), Market Orientation models have been extended to non-profit organizations, including higher education institutions.

Empirical research on Market orientation in higher education

Several researches have been conducted on the market orientation strategy in higher education. We have shown that most of them are from Anglo-Saxon countries, as illustrated by the works quoted below: Caruana et al. (1998) and Keneley and Hellier (2002) for Australia; Liu and Wilson (1998); Liao, Foreman and Sargeant (2000); Sargeant, Foreman and Liao (2002) for the UK; Wasmer and Bruner (1999), Webster, Hammond and Harmon (2006), and Hammond, Webster and Harmon (2006) for the United-States. Few works have been encountered in the Continental Europe; the work from Flavian and Lozano (2006) in Spain, and more recently from Bugandwa-Mungu-Akonkwa (2008, 2009).

Developing a Market orientation scale for higher education institutions

As discussed in Bugandwa Mungu-Akonkwa (2009), there are enough reasons for the market orientation strategy to be effectively applied to higher education. Kotler and Fox (1985), in their masterpiece on "Strategic Marketing for Higher Education institutions", demonstrate that Higher education institutions resort to marketing when their "markets" or more globally their environment undergoes changes such as massification and change in the quantitative and qualitative nature of the demand for higher education, need to diversify funds, rise of stakeholder control in terms of quality control and accountability, professionalization, crumbling public funding, increasing competition, technological changes, increasing requirements from students and other stakeholders, etc. The same trends have been stressed by other researchers who sought to uncover different contexts: Slaughter and Leslie (1999) in their seminar work on Academic Capitalism (Australia, Canada, the UK, the USA), Thys-Clement (2001) for Belgium and Europe, Kaiser et al. (1999) and Salerno (2004) for the Netherlands, Theisens (2003) and William (2004) for the UK, Kaiser (2003) and Chevallier (2004) for the French Republic. To face these changes, institutions have adopted different responses: some of them have increased recruitments budgets as is the case in Australian institutions (Coaldrake, 2002); others prefer to implement a sustainable strategic marketing (analyze their macro-environment, their markets, their strengths and

weaknesses; develop a clear sense of mission, etc.) Thus, higher education institutions are increasingly feeling the need to ensure that they are flexible and dynamic in their structures and strategies and are implicitly adopting market orientation concept. The following section deals with operationalization of this concept and tries to analyze items that should be considered in this process.

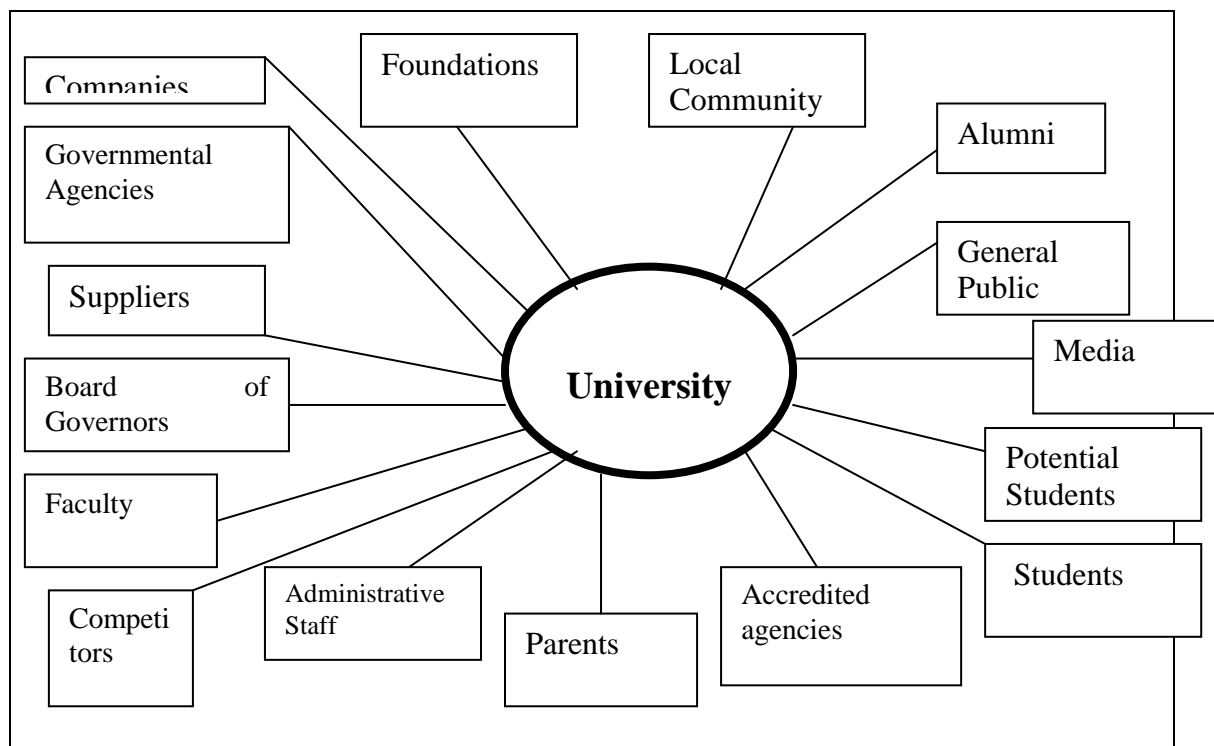
Stakeholder Orientation vs. Customer Orientation

Although the “Customer Orientation” dimension has been used by several researchers in their analysis of Market Orientation strategy in higher education (Siu and Wilson, 1998; Caruana, Ramaseshan and Ewing 1998a; 1998b; Wasmer and Bruner 1999; Smith, 2003); it still raises controversies in the marketing literature (Driscoll and Wicks, 1995; Franz, 1998; Lowe, 2004). The debate can be synthesized as being both ideological – is the “customer” concept semantically the right one to design students? – and operational (who are customers in Higher Education, and how to satisfy their multiple and conflicting needs?). This problem led a number of authors to reject the dimension “Customer Orientation” in the conceptualization of Market orientation, preferring that of “Stakeholder Orientation” (Sargeant, Foreman and Liao, 2002; Gainer and Padanyi, 2002; 2005; Greenley and Foxall, 1998). This paper supports these authors’ point of view and hereunder, justifies such a position through three points: (1) increasing role of stakeholders in higher education, (2) necessity to identify these stakeholders, (3) presentation of theories that can help operationalize this concept as a dimension of Market orientation.

About the first aspect, the issue of stakeholders in higher education has become so acute that authorities in Academia⁽ⁱ⁾ as well as researchers⁽ⁱⁱ⁾ are consecrating to it a growing importance. This trend is probably rooted in the fact that institutions are required to demonstrate effectiveness and efficiency through service provision, to compete with private providers in the endeavour to diversify their sources of funding (Gürüz, 2003); a trend which is likely to continue. This requires institutions to be open to their external environment and create structures aiming at managing complex relationships with their stakeholders.

The issue of “whose these stakeholders are” can seem trivial. Yet, several studies have looked into it without finding a consensus (Kotler and Fox, 1985; Conway, Mackay and Yorke, 1994; Newby, 1999; Raanan, 2003). Some of them have wrongly treated the student as the unique customer of higher education (Caruana et al. 1998; Keneley and Hellier, 2002). In a more recent paper, a list of stakeholders from Kotler and Fox’s (1985) perspective has been considered as more complete (Bugandwa Mungu-Akonkwa, 2009). It is used here as the unifying thread (see figure below):

Figure: Multiple stakeholders in higher education



Source: Kotler and Fox (1985).

This diagram defines the area of possible exchanges between higher education institutions and their public or stakeholders. Among these, it is important to mention the specific and complex role played by students, and which is at the heart of a heated controversy. We chose to address this debate following the angle of the Malcolm Baldrige National Quality Award Education pilot Criteria. Indeed, while dealing with “customers” of higher education, the MBNQA distinguishes, on the one hand, students, and on the other the “other stakeholders”. And replacing the concepts “customer focus” and “satisfaction” respectively by “student focus” and “students and stakeholder satisfaction”, the MBNQA recognizes not only the diversity of stakeholders but also the peculiarity of students among these. The scale of measure we suggest will reflect this by including items that capture the aspects of students’ learning as well as support services. The two aspects, according to the existing literature in education, constitute the two dimensions of students’ satisfaction (Dweck and Elliot, 1983; Bowden and Marton, 1998; Halbesleben et al., 2003; Sirvanci, 2004; Lammers et al., 2005; Eagle and Brennan, 2007). The other items will attempt to reflect the links between higher education institutions and firms (through research contracts, life-long learning, receiving students for internships, and organization of profession formation by institutions). Also will be considered the relation between decision makers and higher education institutions.

The third issue is then “how to take account of this stakeholder orientation for the operationalization of Market Orientation in Higher education”. This question entails a search for a relevant theory which is likely to underlie the inclusion of stakeholder orientation. Two sets of research are seen here as able to provide such a framework: The first categorizes stakeholders in different types and suggests possible strategies for their management (Savage et al., 1991; Donaldson and Preston, 1995). The second is more normative in suggesting items which should be considered to operationalize the stakeholder orientation (Greeley and Foxall, 1998). Bugandwa Mungu-Akonkwa (2008)

has analyzed these researches in every detail and his analysis has highlighted the possible items that can operate the stakeholder orientation. The key behaviour of a stakeholder-centred approach include not exhaustively: researching needs; commitment to students and other stakeholders; providing services of value; focusing on student and stakeholder satisfaction; measuring and reporting satisfaction, encouraging stakeholders' comments and complaints.

Competitor orientation

In a Nonprofit organization, competitors are groups, organizations or any other alternatives which attempt to attract the attention and loyalty of funders and beneficiaries (Kotler and Andreasen, 1996). In higher education, Meek and Wood (1997), Mok (2000), Thys-Clément (2001), and Bugandwa Mungu-Akonkwa (2008; 2009) have explained how competition is emerging and becoming fierce, both at national and international levels. Competitor orientation can be defined as any activity aiming at understanding the strengths and weaknesses of the main organization's competitors (current and/or potential), and the way the organization reacts to these competitors' strategies and actions (Narver and Slater, 2000; Liao, Foreman and Sargeant, 2000). Although Nonprofit and public organizations such as universities generally balk at seeing similar organizations as competitors (Kotler and Andreasen, 1996), they are aware that competition is a major step of marketing implementation process (Kotler and Fox, 1985; Wood, Bhuian and Kiecker, 2000).

Collaboration as a new dimension of the market orientation concept in higher education

Vazquez, Ignacio and Santo (2002) show that the attitude of Nonprofit organizations vis-à-vis competition and the nature of the latter varies according to whether the organizations act in the user's perspective or the backer's perspective. In the users' perspective, the institutions providing the same public utility are to be considered, not as mutual threats, but as partners and thereby, source of collaboration. So institutions will engage in efforts to increase capacities to maintain a more effective provision of social benefits for all parts. Thereby, it is clear that beyond competition, collaboration is a dimension to be included in any conceptualization of market orientation for higher education institutions. Trim (2003), quoting Guzkowka and Kent (1999), defines collaboration as "a shared unity of purpose". Liao, Foreman and Sargeant (2000) define "collaborative orientation" as the extent to which an organization focuses its efforts on the exploitation of the whole potential of collaboration with other organizations, for both resources acquisition and mutual provision of non commercial goods and services. This paper has taken advantage of the above contributions to include the "Collaborative dimension" in the operation of market orientation in higher education.

Inter-functional Coordination

It covers all activities – information transmission, processing and control – aiming to insure that different functions constitute a coherent set to contribute to the organizational endeavour to improve its products/services. The very first publications about coordination go back to Lawrence and Lorsch (1967), Khandwalla (1972), Mintzberg (1979), and Ford, Armandi and Heaton (1988) who supported that when environment uncertainty and complexity grow, coordination or integration of different

organizational parts become very important. Inter-functional coordination implies the degree to which information on stakeholders and macro-environment is shared in the whole organization. It also refers to the sense of common values and beliefs and their relation with reaching organizational objectives. This supposes that the process of creating value for stakeholders is not the matter of only one function, but the whole organization (Porter, 1985; Kohli and Jaworski, 1990). Inter-functional coordination implies a clear understanding and fluid circulation of information about customers' expectations and organizational beliefs, and their communication through formal and informal means (meetings, brainstorming, etc.) to all organizational members (Shapiro, 1988; Cadogan and Diamantopoulos, 1995). It mainly purports to improve the way the organization is supposed to respond to its market.

Responsiveness

Universities are increasingly required to be responsive to multiple societal demands (OCDE, 2002). The responsiveness dimension as defined by Kohli and Jaworski (1990), Jaworski and Kohli (1993) and Kohli, Jaworski and Kumar (1993) consists in organizations' actions to respond to their markets. It implies development, adaptation and implementation of organizations' services, programs, systems and structures to meet their stakeholders' requirements. According to Kohli and Jaworski (1990), an adequate response to the market includes: selection of target markets, supply of products/services for current markets, conception of new products/services for potential markets; production, distribution and promotion of products/services in a way conducive to a positive feedback from customers. Applying this to higher education, Mora (2001), quoting Neave and Van Vught (1996), states that a higher level of market orientation is an excellent way to increase the institutional response to social demands. It is very necessary to clarify that more than any other organizations, higher education institutions should not limit their actions to responding to external pressures. In spite of staying under such pressure, they are called to act proactively on their environment. This is especially important for higher education institutions since students and other stakeholders can misunderstand their needs or institutions' actions. The scientific approach called "Driving the markets" (Jaworski, Kohli and Sahay, 2000) or the marketing of supply creation can help them find valuable solutions to non articulated needs. These approaches refine the theory of market orientation to show that this strategy goes beyond reacting to environmental changes – which could be dangerous for organizational survival and missions. Instead it includes making effort to modify stakeholders' behaviours: (explaining to students the requirements of quality in higher education, helping them to inward their role in learning process, discussing with policy-makers and enterprises, on different issues concerning higher education, etc.).

The major outcome of this literature review is a set of 71 items which we suggest to operationalize the market orientation concept in higher education (see Annexe table1).

Concluding remarks and future research perspectives

This research is part of a more general ongoing endeavour to develop relevant scale for the measure of market orientation in higher education. The underlying assumption that although higher education sector is evolving towards market mechanisms, it keeps specific features that make it different from other organizations of commercial sector. For that reason, we have deemed it important that a different and more adapted scale be

envisaged when it comes to measure the extent of market orientation in these institutions. This paper contributes to that objective in discussing the main dimensions of market orientation in higher education. It reviews the context in which higher education institutions evolve in order to justify why the concept has emerged as a relevant strategy for the management of higher education. Confronting the different existing conceptualizations, we highlighted the main dimensions of the concept as evidenced in the literature on commercial sector, and as applied in several empirical researches. The present paper skims through the empirical research on market orientation in higher education and presents them through a synthetic table. The main finding in this table is that some empirical studies have plugged in the model of market orientation developed in commercial settings, and have relied on a simplifying assumption that the model developed by either Kohli and Jaworski or Narver and Slater can be transposed to higher education institutions. Although it is my contention that market orientation can be a relevant strategy for the management of higher education institutions, I uphold that such transpositions are irrelevant and meaningless since higher education is quite different from commercial enterprises. Thereby, its peculiarities may resist any attempt to transpose it; models that have been developed in and for commercial sector. To fill this gap, we have discussed the use of market orientation concept and suggested that two concepts be added in the prevailing model: these are “stakeholder orientation” and “collaborative orientation”. We support that a more relevant model of market orientation for higher education should consider these two dimensions to take account of the peculiarities of higher education. Henceforth, we suggest a model of market orientation that includes 5 dimensions: Stakeholder orientation, Competitor orientation, Collaborative orientation, Inter-functional coordination, and Responsiveness. After splitting the stakeholder dimension into 3 sub-dimensions (Students, Enterprises, and Policymakers), the whole model comprises 71 items which, in further research, should be refined through a factor analytical procedure. The operationalization we suggest for the “responsiveness” dimension as shown through the items, is particularly interesting as it considers the necessary proactive role higher education institutions are supposed to play. Indeed, they should not passively confine themselves in undergoing their external environment’s pressures.

The main contribution of this paper is that it has generated from a multidisciplinary literature, a more relevant tool to measure the market orientation concept without neglecting higher education’s complexity. However, and that is the main limit, the suggested tool (scale) is still a crude one and needs be refined to become an accepted and usable measure. This refinement is an important track for further research. Conducting such a research will be a major contribution to the endeavours to the development and extension of marketing research to other fields.

Students’ orientation

Number	Items	
1	The institution gathers information on current and future needs of current and potential students.	
2	Conducts activities aiming at attracting and retaining students	
3	Complaints and remarks formulated by students are analyzed in order to find solutions.	
4	Students’ satisfaction towards university facilities is assessed on a regular basis.	

5	Perceived service quality is regularly assessed	
6	Teaching methods stress dynamic students' learning.	
7	Programmes are set with the aim to stimulate active learning	
8	The institution uses information technology to improve teaching and students' learning.	
9	Individual information is gathered from students and their needs to improve their success.	
10	The institution uses all available techniques and experiences to stimulate students' commitment.	
11	The institution creates a social, participative and welcoming environment for students.	
12	Teacher – Students' interactions are encouraged and stimulated	

Stakeholder Orientation « Enterprises » (7 items)

Numbers	Items	/7
1.	The institution believes formal and informal research is important to understand enterprises stakes.	
2.	The institution believes that managers' judgement is important to understand enterprises' stakes	
3.	The institution discusses the importance of different constituencies engaged in different debates within the institution.	
4.	Enterprises are stated to be important in the institution's mission statement.	
5.	Strategies are planned to face the interest of enterprises.	
6.	Endeavour is done to reduce institutional dependence towards enterprises.	
7.	Enterprises are encouraged to participate in the decision-making process of the institution.	

Orientation towards Policy-makers (7 items)

Numbers	Items	/7
1.	Formal and informal research is seen as important to understand policy-makers.	
2.	The importance of responsible people for the judgement in order to understand the policy of decision-making people's interests as concerned parties.	
3.	Internal discussions see policy-makers as important actors in the institution.	
4.	Policy-makers are stated as being important in the institution's mission statement.	
5.	Strategies are planned to face policy-makers' stakes.	
6.	Endeavour is done to reduce dependence to policy-makers.	
7.	The institutions' stakeholders are encouraged to participate in decision making.	

Competitor Orientation (10 items)

Numbers	Items	/7
1	The institution knows its main competitors	
2	Competitive strategies of other institutions are an issue for the institution.	
3	The institution searches information from competitors' programmes and services.	
4	Strategies are developed to gain a competitive advantage towards competitors.	
5	The institutions survey its stakeholders' perception towards its programmes and services.	
6	The institution knows how its stakeholders perceive competitors' programmes and services.	
7	The institution anticipates competitors' actions in order to gain a competitive advantage.	
8	An effective and rapid information system is set to gather data about the evolution of competition.	
9	The institution knows its strengths vis-à-vis its main competitors.	
10	The institution takes opportunities which are likely to improve its competitive position.	

Orientation collaboration (10 items)

Numbers	Items	/7
1	The institution believes it participates with other institutions to the achievement of same objectives.	
2	The institution develops partnerships and collaboration with other institutions.	
3	The institution collaborates with other institutions to interpret higher education policy.	
4	The institution searches the means to influence higher education policy	
5	The institution informs its stakeholders about its plans and priorities.	
6	The institution participates in alliances with other institutions in order to improve quality of teaching and research.	
7	The institution collaborates with enterprises to determine their needs and expectations vis-à-vis different faculties/departments/units	
8	The institution shares resources to provide some teaching and research	
9	The institution collaborates with other institutions, enterprises and governments for economic, cultural and social development.	

Coordination inter/intra-functional (17 items)

Numbers	Items	/7
1	The institution work in synergy with different faculties and departments to meet the needs of stakeholders.	
2	Discussions are organized on missions, values, and beliefs shared by	

	employees.	
3	Information collected on stakeholders is disseminated towards all departments.	
4	Institutional resources are shared to all departments to realize the missions.	
5	Team spirit is a value shared by the whole members. The institution reinforces as shared value	
6	A feedback is sent to departments about their contribution to the achievement of institutional mission.	
7	The institution organizes meetings to discuss major changes in external environment.	
8	Institutional members work together to improve students' learning	
9	Institutional members are committed together to improve the way services are perceived by all stakeholders	
10	Formal and informal exchanges are encouraged between the different departments.	
11	Marketing strategies are built in concert with all departments.	
12	The objective of satisfying students is accepted by all members of the institution.	
13	The objective of satisfying stakeholders is shared by all institutional members.	
14	The institutional members' knowledge and experiences are shared with departments to sustain organizational learning and innovation.	
15	A memory group records ideas raised in meetings, to be used in the strategies.	

Responsiveness (12 items)

N°	Items	/7
1	Programs and services are developed on the basis of information gathered	
2	Quality of programmes and services is defined in terms of stakeholder satisfaction.	
3	The institution reacts to the evaluation done by students about its functioning.	
4	The institution reacts to the evaluation done by other stakeholders about its functioning.	
5	Students' complaints are treated effectively and rapidly.	
6	The information collected is used to identify new segments of funders and their expectations.	
7	Information gathered is used to identify new segments of students, new needs and expectations.	
8	Students' feedbacks are used to improve the learning process	
9	Students' feedbacks are used to improve their satisfaction.	
10	Strategies are developed to modify the rules of the socioeconomic and political environments.	

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Endogenous and exogenous drivers of customer satisfaction: a case study on shopping centres services

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Introduction

This paper is part of a broad research stream about the drivers of service quality and its perception by customers. The study focuses on the services supplied in a shopping mall environment.

Shopping malls' structure has substantially changed over the years, leading to widen the offer to a broad variety of services (Crawford, 2000). Those changes are pulled by a latent demand for services expressed by different segments of customers (Bloch et al., 1994) who want to expand their experience of the malls beyond just shopping (Crawford, 2000).

Customer satisfaction towards the shopping experience in the malls is therefore linked both to the quality of products and the quality of services provided (Anselmesson, 2006; El-Adly, 2007). The latter is often decisive for a number of issues the management is interested in. On one hand, there is evidence that the perceived quality of the services provided is able to influence the willingness of customers to spend money in the mall (Laroche et al., 2005). On the other hand, customer satisfaction for services is highly related to loyalty (Fullerton and Taylor, 2002).

In a competitive environment the offer of services can play a very important role for competition, as it may act as an element of differentiation between shopping malls (Allard et al., 2009).

This paper fits this research field, focusing on the factors affecting the customer perception of service quality in shopping malls. Some of these factors are directly related to the features of the services and to the characteristics of the customer who is evaluating them. Some other are related to the comparative assessment based on previous experiences in other malls.

The aim of the paper is to analyse the importance of these different drivers for the construction of an overall customers' judgement about the mall quality.

To this purpose, the paper is organized as follows: in the first part some general issues about consumer perception of service quality are discussed; then the empirical research is presented through the description of the methodology used and the results; in the

following part, results are discussed and interpreted in order to draw some conclusions at the end of the paper.

Consumer perception of service quality

Researchers interest towards service quality dates back in the 1980s, when Parasuraman and his colleagues started reviewing the literature on the topic with the aim of developing a multi-item scale resulting in a quantitative assessment of service quality (Parasuraman et al., 1985), whose first version appeared in 1988 (Parasuraman et al., 1988). This effort raised a vibrant debate about the value and limitations of the scale, and its applicability to different sort of services.

Service quality is clearly more difficult to evaluate than product quality (Parasuraman et al., 1985). This is due to the intrinsic characteristics of the services, namely intangibility, heterogeneity, and inseparability (Parasuraman et al., 1985). Services are intangible because they are performances rather than objects, so their quality cannot be measured, tested or verified before delivery. They also are heterogeneous because the performance varies from producer to producer, from customer to customer and from day to day. It is due, on one hand, to the role of the personnel whose behaviour can change in different situations and, on the other hand, to the customer participation which is able to highly affect the service delivery. Moreover, the moments of production and consumption of services are inseparable, so that no quality control is possible before delivery, as it is the case for products.

Due to these specific features of the services it is likely that consumer evaluation process differs between goods and services (Zeithaml, 1981). This led to a big research effort to understand the drivers of consumers' perception of service quality. Parasuraman et al. (1988) found five fundamental dimensions for service quality perception: tangibles, reliability, responsiveness, assurance, empathy. In their model, customers' quality judgement comes out from a comparison between the perceptions and the expectations on these dimensions. Critical remarks and improvement to this model have first been made by Cronin and Taylor (1994) and later by Brady and Cronin (2001). In the latter a new model of service quality perception is proposed, basing on a hierarchical approach in which interaction, physical dimensions and outcome quality are the drivers of the customer perception. Such dimensions are then further specified through a set of sub-issues related to ambient conditions, social factors, personnel behaviour and expertise, which are evaluated in their level of reliability, responsiveness and empathy (Brady and Cronin, 2001).

The role of comparative evaluation in the formation of the overall quality judgement is demonstrated for goods (Olsen, 2002) while this element is not directly taken into account in the case of services. Indeed, the inclusion of customers' expectations in the multi-item scale for quality evaluation (Parasuraman et al., 1988) refers only indirectly to previous experience with similar services. This study represents an attempt to explicitly include the influence of comparative assessment on customers overall quality appraisal of a mall.

Methodology

The empirical analysis is part of a broader survey planned by the management of the shopping centre located in the town of Viterbo (central Italy) in partnership with the University of Tuscia. The mall includes 42 shops, a hypermarket and some fast-foods and bars. It is typically structured in order to benefit of cumulative attraction (Nelson, 1958) from different types of stores: one large-surface food store, specialized retail shops and public services.

The general objective of the survey was to study the profile and motivations of the mall's customers. To this purpose, a questionnaire has been administered to the customers in the shopping mall's premises. Six interviewers have been involved in the survey. They stood at three different entrances of the mall – one for pedestrians, one from the underground parking lot, one side entrance - asking customers to take part in the survey. As it was very difficult to identify the size of the customer population of the shopping centre, a non-probabilistic sampling was adopted, namely an accidental sampling as it is widely accepted in marketing research. The survey was carried out within one week in November 2010 trying to avoid distortions due to a longer lasting data collection. Different days and hours have been scheduled for interviews in order to get the best representation of different types of mall customers.

A total of 500 consumers has been interviewed in the survey.

The questionnaire is made up of three sections. The first is focused on customers' motivations to visit the shopping centre. In the second section customer satisfaction for the services offered within the mall is investigated. The final section is devoted to collect socio-demographic and behavioural information about respondents.

Out of the 34 questions included in the questionnaire, 17 are considered in this paper. This is because in the construction of the database for our research we only take into account the questions whose answers are more relevant for the analysis of the drivers of customer satisfaction towards the shopping centre in the overall.

The selected questions, listed in table I, refer to different issues related to customer satisfaction for the services offered at the mall.

Table I – Selected questions from the questionnaire used in the survey

Question code	Question type *	Question text	List of answers
Q2	MC	How often do you visit the shopping centre “Tuscia”?	Every day; Two/three times a week; Once a week; Once/twice a month.
Q3	MC	In which days of the week do you usually visit the shopping centre “Tuscia”?	Monday; Tuesday; Wednesday; Thursday; Friday Saturday; Sunday; no preference.
Q7	MC	In which time slot do you usually visit the shopping centre “Tuscia”?	Morning; Lunchtime; Afternoon; Evening.
Q10	MC	How often do you visit other malls of the town?	Every day; 2/3 times a week; once a week; once/twice a month.
Q11	MC	Which other shopping centres outside the town of Viterbo do you usually visit ?	Soratte (65 km); Valdichiana (125 km); Porta di Roma (75 km); Roma est (95 km); Other.
Q14	MC	What are the two more important motivations for you to go in other malls?	More choice; Leisure; Convenience; Other.
Q15	LS	How important are the following reasons for you to visit the shopping centre “Tuscia”?	Purchases in the hypermarket; Purchases in the shops; Meeting place; Leisure; Eating in the restaurants.
Q17	LS	How would you rate the courtesy of the staff in the shops of the mall “Tuscia”?	-
Q19	LS	How would you rate the quality of the following services of the mall “Tuscia”?	Parking lots; Surveillance; Events.
Q20	LS	How would you rate the cleanliness of the following areas of the mall “Tuscia”?	Shops; Parking lots; Toilette; Lobby and corridors.
Q21	LS	How would you rate the assortment in the offer of products and services at the mall “Tuscia”?	-
Q24	LS	How would you rate the value for money of products and services at the mall “Tuscia”?	-
Q27	LS	How would you rate the services offered at the mall “Tuscia” with respect to other malls?	-
Q28	LS	How would you judge your satisfaction for the shopping centre “Tuscia”?	-
Q29	MC	Gender	Male; Female
Q30	MC	Age	Younger than 18; 18-25; 26-33; 34-41; 42-49; 50-57; 58-64; 64-70; Older than 70.

Q32	MC	Area of origin	Town of Viterbo; Province of Viterbo; Outside the province.
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* MC: multiple choice question; LS: Likert scale from 0 (not important/very bad) to 6 (very important/very good)

Four questions (Q2, Q3, Q7, Q15) address some consumers' characteristics that might have an influence on their satisfaction. We refer to this category of variables as Intrinsic Quality related to consumer behaviour (IQcons).

Five questions (Q17, Q19, Q20, Q21, Q24) directly refer to customer satisfaction for individual services offered in the mall. Therefore, we set these variables together in a group named Intrinsic Quality of Services (IQserv).

The third category of variables is made up of four questions (Q10, Q11, Q14, Q27) related to consumers' perception of the shopping centre involved in the survey in comparison with other malls they usually visit. We refer to this group of variables as comparative Assessment (CA).

Three more questions (Q29, Q30, Q32) refer to demographic characteristics of the respondents, such as gender, age and area of origin. They are coded in a further category named Demographics (DEMO).

Finally, question number 28 (Q28) detects consumers' overall quality judgement about the shopping centre "Tuscia", so it is not coded in any group but it represents a summary of all the issues raised by the above categories.

The selected questions have been used as the base to investigate the drivers of customers' overall judgement, with a specific focus on the different role that variables related to intrinsic quality and comparative assessment can play. A linear multiple regression analysis (Montgomery et al., 2006) is used as a statistical tool to accomplish this objective. Indeed, through the regression we are able to analyse the contribution of the 16 explanatory independent variables (X_i) to the values of the customers' overall judgement dependent variable (Y).

Before running the regression model some variables have been processed in order to turn them to a quantitative scale (where possible) or to summarize very correlated items in a single variable. Specifically, questions number Q11, Q14, Q27 and Q29 have been turned to dummy variables; questions Q2, Q3 and Q10 have been changed to a numeric scale; some multi-items questions (Q11, Q20, Q25) have been reduced to a single variables when a high correlation was detected among the original items. The final set of variables used for the statistical analysis is listed in Table II; it includes one dependent variable and 21 independent variables.

The ANCOVA model (Rutherford, 2001) is used for the regression analysis in a XLSTAT software. This model allows for the inclusion of categorical data among the explanatory variables. The outputs include indicators of the quality of the analysis, such as r-squared and a Fischer test to assess the significance of the model, together with parameters and significance of the selected explanatory variables.

Table II – Variables included in the selected for the regression model analysis

Variable code	Question code	Scale	Description
Y	Q28	0 - 6	Overall customer satisfaction.
IQcons_1	Q2	0 - 20	Frequency (days per month) with which customers visit the shopping centre.
IQcons_2	Q3	1 - 5	Customers preference for specific days within the week: 1 (just one day) to 5 (5 of more days preferred).
IQcons_3	Q7	A; B; C; D	Time slots in which customers usually visit the mall. A: morning; B: lunchtime; C: afternoon; D: evening.
IQcons_4	Q15A	0 - 6	Customer's evaluation of the motivation "purchases in the hypermarket".
IQcons_5	Q15B-E	0 - 6	Average of customer's evaluation of the motivations: "purchases in the shops"; "meeting place"; "leisure"; "eating in the restaurants".
IQserv_1	Q17	0 - 6	Customer's evaluation of the courtesy of the staff in the shops.
IQserv_2	Q19A	0 - 6	Customer's evaluation of the parking lots offered at the shopping centre.
IQserv_3	Q19B	0 - 6	Customer's evaluation of the surveillance offered at the shopping centre.
IQserv_4	Q19C	0 - 6	Customer's evaluation of the events organized at the shopping centre.
IQserv_5	Q20A-D	0 - 6	Customer's evaluation of the cleanliness in the shopping centre premises.
IQserv_6	Q21	0 - 6	Customer's evaluation of the value for money of products and services.
IQserv_7	Q24	0 - 6	Customer's evaluation of the assortment in the offer of products and services at the shopping centre.
CA_1	Q10	0 - 20	Frequency (days per month) with which customers visit other malls of the town.
CA_2	Q11A-E	0 - 1	Customer's attendance of other shopping centres outside the town. 0: no; 1: yes.
CA_3	Q14A	0 - 1	Motivation "more choice" for visiting other shopping centres outside the town 0: not mentioned; 1: mentioned.
CA_4	Q14B	0 - 1	Motivation "leisure" for visiting other shopping centres outside the town 0: not mentioned; 1: mentioned.
CA_5	Q14C	0 - 1	Motivation "convenience" for visiting other shopping centres outside the town 0: not mentioned; 1: mentioned.
CA_6	Q27	0 - 6	Customer's evaluation of the services offered in the shopping centre "Tuscia" in comparison with other malls.
DEMO_1	Q29	0 - 1	Gender. 0: male; 1: female.
DEMO_2	Q30	A; B; C	Age. A: younger than 25; B: 26 to 50 years old; C: older than 51.
DEMO_3	Q32	C; D; E	Area of origin.

Results

Out of 500 questionnaires completed during the survey, 489 have been considered for the regression analysis with the ANCOVA model. This is because 2 respondents were not able to express an overall judgement, thus having missing values in the dependent variable (Q28), while 9 of them had missing values in one or more of the explanatory variables. Data referring to these customers have therefore been excluded from the analysis.

Table III displays the quality of the regression model explaining the overall customers' judgement with the 21 selected variables. The model seems to fit the data well enough as evidenced by the R^2 values, which are both around 0,4. The quality of the model is also tested through a F test, which shows a very high significance.

Table III – Quality of the model

Goodness of fit	Value
Observations	489
Sum of the weights	489
Degrees of freedom	463
R^2	0,426
Adjusted R^2	0,395
Mean Standard Error	0,604
Analysis of variance	Value
F	13,757
Pr > F	< 0,0001

In table IV the parameters of the model are reported. The contribution to customers' overall judgement about the shopping centre is calculated for each variable and it is tested with a t test.

The intercept and five of the selected explanatory variables are significant at a 99% level of confidence. The significant variables are:

- IQserv_1, referring to customers' evaluation of the courtesy of the staff in the shops;
- IQserv_9, IQserv_10 and IQserv_11, reporting customers' rating of cleanliness, assortment and value for money;
- CA_3, which is related to the comparison between the surveyed shopping mall and other competitors in the same area for what regards the choice of products and services.

The four issues related to the intrinsic quality of services all show a regression coefficient greater than zero, meaning that their contribution in determining the overall quality judgement is positive. The fifth significant variable (CA_3) shows a negative contribution to the evaluation of the shopping centre by customers.

The variable DEMO2, referring to the age classes of respondents, shows negative coefficients, only one being significant at a 90% level of confidence. This led to further investigate on this issue, using an analysis of variance with the aim to check the

existence of a relationship between the age of the respondents and their overall assessment of the quality of the services in the shopping centre. The model used for such analysis is an ANOVA (Rutherford, 2001), where the mean overall judgement is compared among the age classes of customers. The goodness of fit of the model, reported in table V, shows that the analysis is significant at a 99% level of confidence.

Table IV – Parameters of the model

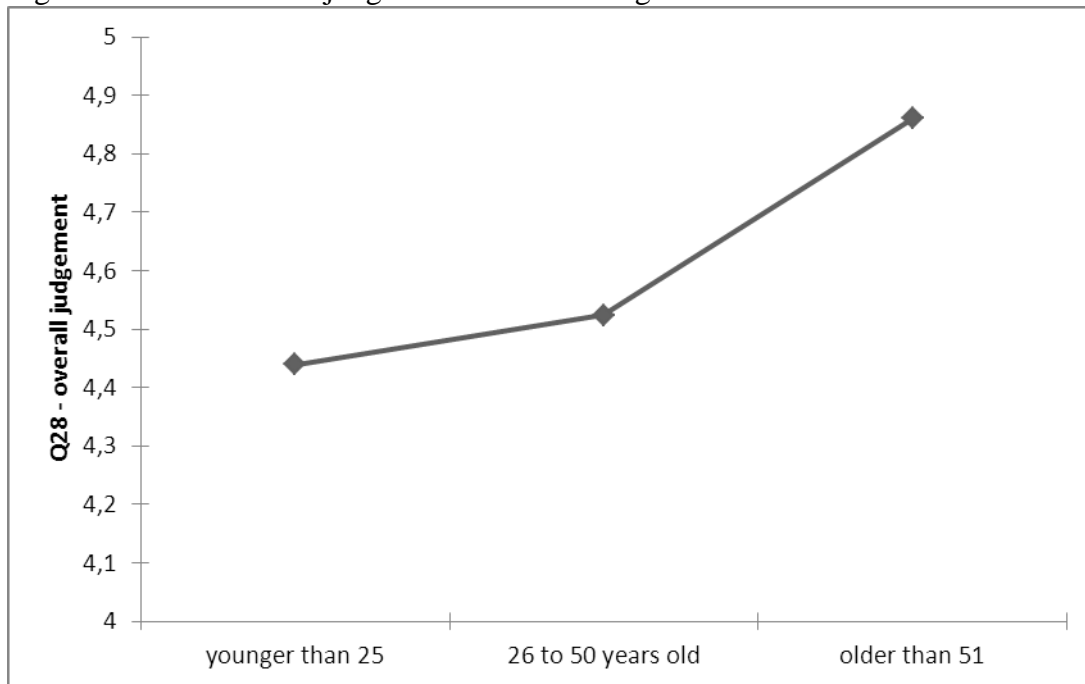
Variable code	Question code	Parameter	Standard deviation	t	Pr > t	Lower limit (95%)	Upper limit (95%)
Intercept	-	1,343	0,312	4,299	< 0,0001	0,729	1,956
IQcons_1	Q2	0,009	0,008	1,178	0,239	-0,006	0,024
IQcons_2	Q3	-0,014	0,021	-0,632	0,528	-0,056	0,029
IQcons_4	Q15A	-0,010	0,023	-0,447	0,655	-0,056	0,035
IQcons_5	Q15B-E	0,048	0,031	1,581	0,115	-0,012	0,108
IQserv_1	Q17	0,099	0,035	2,819	0,005	0,030	0,168
IQserv_2	Q19A	0,020	0,033	0,588	0,557	-0,046	0,085
IQserv_3	Q19B	0,028	0,025	1,097	0,273	-0,022	0,077
IQserv_4	Q19C	0,018	0,024	0,748	0,455	-0,030	0,066
IQserv_5	Q20A-D	0,132	0,034	3,864	0,000	0,065	0,199
IQserv_6	Q21	0,175	0,041	4,312	< 0,0001	0,095	0,255
IQserv_7	Q24	0,210	0,039	5,434	< 0,0001	0,134	0,286
CA_1	Q10	0,003	0,009	0,315	0,753	-0,016	0,022
CA_2	Q11A-E	0,039	0,134	0,295	0,768	-0,223	0,302
CA_3	Q14A	-0,331	0,100	-3,321	0,001	-0,527	-0,135
CA_4	Q14B	-0,110	0,103	-1,071	0,285	-0,313	0,092
CA_5	Q14C	-0,075	0,112	-0,676	0,500	-0,295	0,144
CA_6	Q27	0,030	0,023	1,310	0,191	-0,015	0,075
DEMO_1	Q29	0,043	0,075	0,574	0,567	-0,104	0,190
DEMO_2 – A	Q30	-0,210	0,118	-1,777	0,076	-0,441	0,022
DEMO_2 – B	Q30	-0,161	0,108	-1,501	0,134	-0,373	0,050
DEMO_2 – C	Q30	0,000	0,000				
DEMO_3 – C	Q32	-0,069	0,120	-0,570	0,569	-0,305	0,168
DEMO_3 – D	Q32	0,122	0,080	1,522	0,129	-0,035	0,279
DEMO_3 – E	Q32	0,000	0,000				
IQcons_3 – A	Q7	0,148	0,156	0,949	0,343	-0,159	0,455
IQcons_3 – B	Q7	0,161	0,150	1,077	0,282	-0,133	0,455
IQcons_3 – C	Q7	0,159	0,135	1,179	0,239	-0,106	0,424
IQcons_3 - D	Q7	0,000	0,000				

Table V – Outputs of ANOVA

Source	Degrees of freedom	Sum of squares	Average of the squares	F	Pr > F
Model	2	10,757	5,379	5,489	0,0044
Error	486	476,265	0,980		
Adjusted total	488	487,022			

Figure 1 shows the mean overall judgement about the shopping centre by customers belonging to different age classes. Young respondents show a lower evaluation, under 4,5 on average (on a scale from 0 to 6), while older respondents' judgement goes up to nearly 4,9.

Figure 1 – Mean overall judgement of different age classes



A Tuckey test run on these results detects a significant difference between the judgement of the “older than 51” class with respect to the other two age categories. It means that older customers rate higher than the other ones the overall quality of the shopping centre “Tuscia”.

Table 6 – Outputs of Tuckey test

Categories compared	Difference	Standardized difference	Critical values	Pr > Diff	Significance (95%)
older than 51 <u>vs.</u> younger than 25	0,421	3,272	2,344	0,003	Yes
older than 51 <u>vs.</u> 26 to 50 years old	0,337	2,662	2,344	0,021	Yes
26 to 50 years old <u>vs.</u> younger than 25	0,084	0,848	2,344	0,673	No
Category	Estimated means	Groups			
older than 51	4,860	A			
26 to 50 years old	4,524	B			
younger than 25	4,440	B			

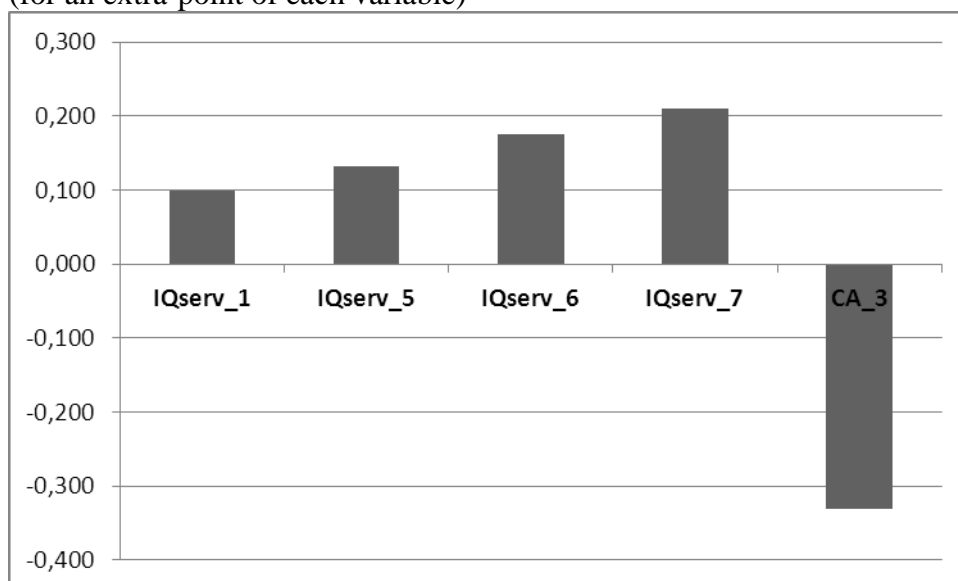
Discussion

As pointed out in the results, 5 out of 21 explanatory variables are significant. They can be considered as major drivers of customers' overall judgement about the shopping centre.

The value of the intercept in the regression analysis shows that, before considering any driver influencing the customers' rating of the mall, the judgement levels to 1,34. Indeed, the judgement increases or decreases as more information is considered, depending on which variables are added to the analysis. The interpretation of the regression coefficients helps to understand what kind of influence each variable plays in shaping the overall judgement value. In particular, this effect can be highlighted for the significant variables (Figure 2).

Four of them, referring to the intrinsic cues of the quality of services, have a positive influence on customers' overall satisfaction. The most notable is the value for money of products and services offered in the shopping mall (IQserv_7): each extra-point in the evaluation of this issue is able to increase by 0,210 the final score. To enhance the value for money of products and services offered is then a chance for the shopping mall management to increase customers overall satisfaction up to 1,26 points in a 0 to 6 scale. Nearly the same effect can be noticed for the assortment of products and services (IQserv_6), which seems very important to achieve a positive perception of the mall among the customers. Less strong but still remarkable, the perception of cleanliness (IQserv_5) and the courtesy of the staff (IQserv_1) are able to improve the overall judgement by, respectively, 0,79 and 0,60 points if the maximum evaluation for these variables is achieved. On the contrary, the overall score of the mall services might be negatively affected by customers' perception of a wider variety of products and services in other shopping centres located in the same area. Customers' negative appraisal due to a lack of variety in the surveyed shopping centre compared with other malls could lower the overall judgement by 0,33 points.

Figure 2 – Contribution of the significant variables to the overall judgement (for an extra-point of each variable)



On the whole, it is probably useful to highlight that the perceived quality of the services offered in the shopping centre is the main driver for the construction of an overall

judgement in the mind of consumers. One issue that clearly emerges in this analysis is the importance of assortment in the offer of products and services to improve the evaluation of the mall by the customers. It is especially true when customers base their evaluation also on experiences they had in other malls of the area: when it is the case there is a high risk that the judgement on the mall is negatively affected by the comparison with other shopping centres. This is less likely when customers' appreciation for other shopping centres revolves around other issues like spending leisure time and achieving more convenience.

None of the issues related to habitudes in visiting the mall (frequency, days of the week, time slots within the day, motivations) nor the demographic profile seem to affect customers' overall judgement about the shopping centre: the significance of these explanatory variables is very low and the coefficients' values are negligible. Therefore, it might seem that the customers' profile is not relevant in the explanation of their appraisal of the mall. Nevertheless it is worth to further investigate on the variable describing the age of the customers, because it shows a slight significance in one coefficient. As reported in the results, we run an analysis of variance with the aim to check the similarity in the overall judgement of respondents belonging to different age categories. The results show a significant difference between the judgements, namely older customers have the tendency to rate higher the shopping centre. Such greater satisfaction might be due to the lack of experience in other malls. As table VII clearly highlights, 90% of the young customers and 80% of the respondents belonging to the 26-50 years old category usually visit other shopping centres in the surroundings of Viterbo. This is not the case for the older customers, as only 56% of them usually go out of town to travel to other shopping centres. Therefore, it seems likely that the younger customers' judgement is negatively affected by the comparison with other structures.

Table VII – Experience in other malls by age

Category	Usually visits other malls in the area
Younger than 25	90%
26 to 50 years old	82%
Older than 51	56%

Conclusions

In this paper the internal and external drivers of customer judgement about services quality is investigated, basing on the data gathered in a survey at a shopping mall in central Italy. The large database provided allows to set up a methodology to investigate the drivers of the customer overall judgement about the services offered in the mall. This type of analysis is of great interest when considering the lively debate on the dimensions of service quality.

The model chosen for this analysis fits the data well enough and the results seem robust thanks to the large size of the sample. We were able to explain the overall opinion of the customers through a set of variables related to the behavioural and demographic characteristics of the consumers, the intrinsic quality of the services offered in the mall and the comparative appraisal with other malls.

Findings suggest that the characteristics of the consumers are not very relevant in the construction of the overall quality judgement, even though significantly different opinions have been expressed by consumers belonging to different age categories. Customer perception of the single services is the dimension which is able to explain most of the overall opinion. The role of the assortment in the product and services is very significant, both in absolute terms and in comparison with other shopping malls.

Some limitations of the analysis should be noted, mainly the representativeness of the sample and the choice of the explanatory variables in the model: both are affected by the objective and the organization of the survey, originally suited for a different purpose. Another limitation is the large number of explanatory variables selected for the regression model, which affect the significance of the analysis and the contribution of the single variables to the explanation of the overall judgement.

Nevertheless the findings of the research might be useful for managers in order to improve the consumers' perception of the shopping mall image. To this purpose increasing the variety of products and the quality of some specific dimensions of the services provided results as a key issues to gain a favourable comparison with other shopping centres.

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Creating benchmarks for high performing

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Key words: winning organisations, benchmarking, measuring performance, organisational excellence

Category: Research Paper

Introduction and background

The original research (Hubbard et al., 2007) that produced the Winning Framework has been well received but increasingly decision makers have been challenged with questions about how to emulate the practices of winning organisations and in so doing, improve their own managerial practices. This paper summarises recent initiatives to address these questions through a benchmarking process driven by the organisation itself – one that can be best described as self assessment in which the organisation undertakes a rigorous and objective review of its internal characteristics, strengths and weaknesses rather than relying on an external consultant’s analysis. This creates a deep understanding of issues and ownership of the survey outcomes.

The quest for excellence usually commences with choosing an appropriate framework that defines “excellence” and then benchmarking the organisation against that framework. This measures and diagnoses the current performance of the organisation and when done rigorously, should lead to a number of logical opportunities for change and improvement. There are numerous frameworks available. Arguably some of the most popular and best documented versions are embodied in the Business Excellence Award frameworks in different countries (e.g. Malcolm Baldrige Awards in the USA, EFQM Excellence Model in Europe and Business Excellence Awards in Australia). All of these are legitimate choices but the one chosen for this work is the Winning Framework that has been previously described by the author (Cocks, 2009). This framework has been widely acknowledged by executives in Australian organisations because of its focus on the role of leadership, the pragmatic message and recent publication date. For these reasons it was selected for this study as an appropriate business excellence framework. The elements in the Winning Framework were used to construct survey questions that could be used by organisations to benchmark their performance. Relevant insights into the original research that generated the Winning Framework are summarised in Section 2.

The winning framework for benchmarking performance

The diagnostic tools and survey instruments discussed in this paper are based on the extensive research by the author into the characteristics of long term high performing organisations in Australia (Hubbard et al., 2007). This research commenced with a survey of 1000 senior executives who were asked to nominate successful organizations against a set of criteria that included taking a balanced scorecard perspective, internal efficiency and long term growth, financial and market performance, innovation and productivity measures. Following detailed analysis, the final number of organisations was narrowed to eleven and their performance was studied in depth over a 25-year period from 1982 to 2007. Where possible, data were used to compare their

performance with other organisations in similar industries to confirm their winning status. Over this period these winning organisations outperformed the stock market index by almost three times, although financial performance was only one of the criteria and several organisations were not publicly listed for at least half the period.

Annual reports for the 25 year period and other published material were researched and summarised according to key events and drivers of success. The study included interviews with several executives from each organisation, selected for their extensive knowledge and experience about their organisation's strategies and evolution, to gather additional unique insights into the specific causes of success. The causes were analysed for each organisation by the research team to determine common themes that were subsequently classified into nine key elements for success.

The research dispels several current myths about the characteristics of winning organisations. Being a winning organisation in Australia has little to do with charismatic leaders, seeking great breakthrough ideas, setting stretch goals, rolling out precise mission and vision statements or creating the perfect organisational structure. More significantly, nine key elements for long-term success have been identified from the eleven organisations:

1. *Effective Execution.* Winning organisations do what they say. They announce what they plan to do, they plan and budget for it and they meet the plans and budgets. To do this, they have clear processes that are accepted within the organisation. They have good control systems, use quality management principles, people take personal responsibility for their work and they rigorously measure performance. They learn from mistakes and do not cross subsidise under performing business units. Winning starts with effective execution which forms the pivotal element in the framework.
2. *Perfect Alignment.* Practising a culture of continuous improvement, winning organisations use measurement and systems as the critical foundations for alignment. They seek to align culture, leadership, people and perceptions to strategy. Alignment is to external needs as well as internal forces.
3. *Adapt Rapidly.* Times change so that even if perfect alignment is achieved, it will have to be changed, and changed rapidly. Flexibility is a key but change comes with control. Innovation is sought in process as well as in products and services.
4. *Clear and Fuzzy Strategy.* Winning organisations have a clear strategy, though it can be expressed in many ways and does not necessarily exist through a vision or mission statement. But there is fuzziness at the edges of the strategy. Winning organisations are always seeking to take advantage of incremental opportunities, even if they lie just outside their current clear strategy.
5. *Leadership, Not Leaders.* Leadership is about teams of leaders. Leaders set up an emotional 'cause' for the organisation, a reason for existence. Leaders exhibit 'captain-coach' styles and are players on the field, showing captaincy skills and sharing the work. They are available, egalitarian, supporting their people from close by, not setting difficult challenges from afar. The vast majority of leaders come from within winning organisations and have been with the organisation for nearly twice the industry average.

6. *Looking Out, Looking In.* Winning organisations are externally focused. They are aware not just of customers, but also of their environment, community, international industry and international trends.
7. *Right People.* Winning organisations hire people who believe in their ‘cause’, whose values and attitudes fit, not the ‘best’ people who demand the highest pay. People who do not fit are actively managed out of the organisation quickly by a measurement system that balances performance with adherence to values.
8. *Manage the Downside.* Despite rapid growth, innovation and looking outwards, winning organisations are conservative. They plan carefully beforehand, considering the downside, not just the upside, of major decisions. They measure risk and seek to share risks with other organisations, customers and their people.
9. *Balance Everything.* Rather than trying to choose between alternatives, winning organisations choose both. For instance, while they are conservative, they are also entrepreneurial. While focusing on the long term, they also focus on the short term. While focusing on financials, they also focus on delivering value to customers, employees and the community.

The Winning Wheel Framework (Figure 1) shows how these nine elements fit together and are interconnected – all elements are important and change in one element precipitates change to others.

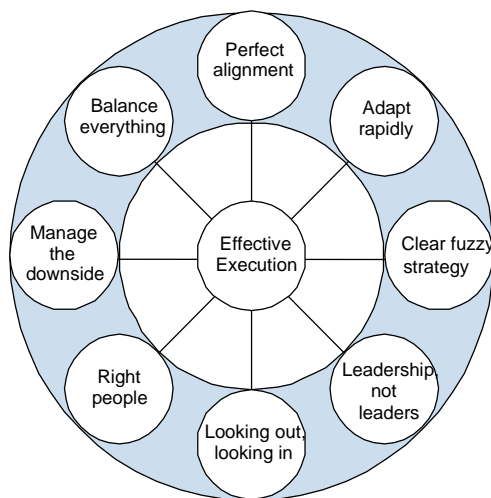


Figure 1 The Winning Framework for Organisational Excellence

It shows the critical role of effective execution that is depicted as both an element of the framework and as representing the outcome of the total framework. Organisations that effectively execute their strategic plans are defined as winners. These nine timeless elements of success are highly relevant to listed companies in the private sector in a wide range of industry sectors together with service, not-for-profit and public sector organisations of all sizes.

Research design and the benchmarking process

Benchmarking Objectives

The concept of benchmarking originally described by Camp (1989) has now taken on a myriad of definitions. Arguably there are three generic forms:

1. Internal - comparing between groups or units within the same organisation
2. External - comparing key metrics against competitors in the same industry
3. Best Practice - comparing against the best that can be found world-wide, irrespective of industry type.

The concepts in this paper are intended to address internal benchmarking but future work should see potential to embrace all three popular forms of benchmarking.

The journey commences by first understanding exactly what the organisation is trying to achieve (the strategic plan) and what its current position and performance levels are. It should also include an analysis of the external environment using models described in strategy texts such as Forster and Browne (1996) and Hubbard et al. (1996). The next step involves defining the capabilities of the organisation and what it has (or plans to have) to give a sustainable competitive advantage. To this end, business models such as that proposed by Tracey and Wiersma (1993) are highly relevant – questions such as whether the advantage is to be derived from process effectiveness, customer intimacy or product innovation? Then the organisation needs to know its current performance level in key parameters such as financial, market/customer, internal efficiency performance and long term growth and development initiatives. At this point the executive team is in good shape to assess its overall strategic position and articulate what needs to be improved. The journey of improvement can then commence by assessing how the organisation performs against the nine elements in the Winning Framework. The survey instruments described in this research are applied at this stage as part of the benchmarking process. This logic and methodology is presented in Figure 2.

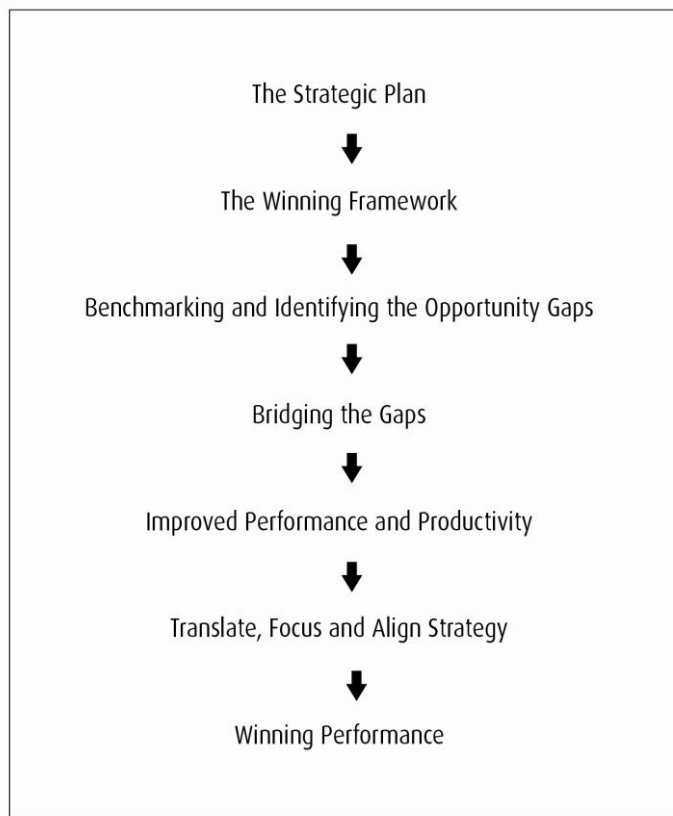


Figure 2 The Pathway to a Winning Performance

The Diagnostic Survey

The web- based diagnostic survey consists of 90 core questions built around the 9 elements in the Winning Framework. The survey uses a bi-variant approach in which respondents rank each question on a scale 1 to 7 according to their views on both “Performance” and “Importance” to their organisation. This structure allows for simultaneous rankings and gives more granularity to the final analysis. The survey also allows for qualitative feedback from respondents in addition to the structured diagnostic questions. The on-line diagnostic approach is explained further by Taylored Assessments UK Ltd. (TAUK 2011).

Outputs from the survey can be compared to the practices that have been identified from the research into winning organisations in Australia - those that lead to sustainable and above average performances. This allows organisations to rapidly and effectively benchmark their own performance and drive improvement in a targeted way. Statistical data analysis is carried out on the quantitative responses and presented automatically in reports that are highly visual and simple to understand by using priority matrices, heat maps, color coding and radar diagrams. Most importantly, individual responses and comments are treated confidentially.

Designing the Approach

A significant number of participants is needed to complete the diagnostic survey and they are encouraged to take an organisational view rather than a functional or personal view and consider the ‘normal’ response to each question, not the odd or unusual

response. The questions are targeted at those people who should know most about how their organisation is currently performing and where they might need to focus for future success. Typically the diagnostics are completed by the CEO, direct reports to the CEO and the next level of management and (optionally) members of the Board of Directors. Collectively these executives are in the best position to provide objective input for the organisational - wide performance analysis.

The survey should also engage people from throughout the organisation to provide more accurate information about where to focus attention for future success. Therefore it should ideally be run with multiple levels of management and operational personnel in numerous departments and business units and in different locations where appropriate. Where an organizational-wide survey is not realistic, benefits can still be derived by applying the benchmarking process to discrete divisions of the organisation. Indeed, experience to date is that a useful approach is to select a pilot project where the initial gains and demonstrated success should capture the attention of management so the process gains momentum and is progressively rolled out across the entire organisation.

Analysing the Data

The data can be sorted in a wide range of alternatives such as by organisational level, location, areas of most concern, elements in the Winning Framework and variations within responses to each question in the survey. The starting point is to plot the results on the Winning Wheel and include the benchmarks from the winning organisations in the original research. Further detailed analysis then follows – for example a powerful indicator is the “opportunity gap” which is defined as the difference between the “Performance” and “Importance” percentages. These gaps are then presented in matrix form, ranked and prioritised. The objective is to identify the largest gaps which in the spirit of continuous improvement should be treated as the most significant opportunities rather than viewed as major problem areas.

Initial Trials

The diagnostic is designed for use across all industry sectors and can be regarded as a generic model for all types of organisations. Initial benchmarking applications have included health authorities, government bodies and not-for-profit organisations, an educational institution and manufacturing enterprises. Potential sponsors and end users include Boards, CEO’s, CFO’s, HR practitioners, senior change agents, quality and improvement managers and consultants.

To date the process has only been designed to facilitate internal benchmarking by participating organisations. As the number of organisations increases over time, more accurate and extensive benchmarking data will be revealed such as by industry sector, organisational size and geographic location. More sophisticated forms of benchmarking will be then possible.

Findings and discussion

The Overall Picture

Figure 3 shows typical results from an organisational survey plotted against the Winning Wheel and presented as a radar map. This gives an immediate view of how the

organisation is performing relative to all nine elements and locates major imbalances around the Wheel. It identifies “whole of organisation” strengths, weaknesses and gaps. The overall averages for each element are included. Considerably more value is derived with deeper analysis and Figure 3 also compares the results for both the executive team and front line operators and these are plotted against the benchmarks for the winning organisations. Many conclusions can be drawn – not only is this organisation under-performing against all the benchmarks, there are significant differences between the executive and front line levels. The overall averages indicate that “People” and “Alignment” are the worst performing elements (51-54%) with “Outlook”, “Execution” and “Managing the Downside” showing the best results (61-62%).

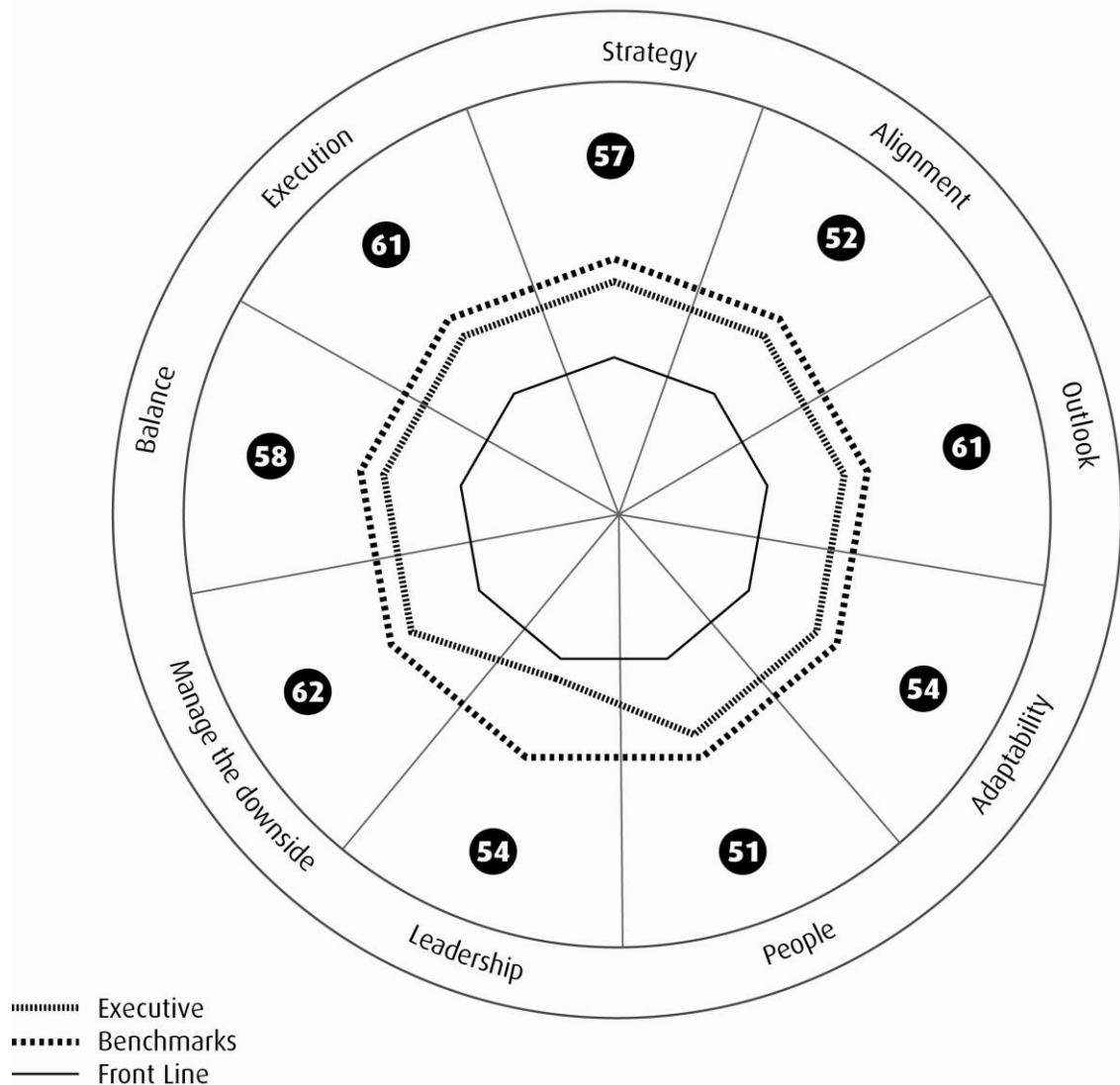


Figure 3 The Winning Wheel as an Organisational Radar Map

Segmenting and Reporting the Data

There are many alternative ways of reporting the survey results. One interesting approach has been to plot the range (variation) of results for individual questions or element in the Winning Framework (Figure 4).

Clearly, the variations between the highest and lowest score ranges are quite large and different for each element – in this example from 40 respondents “Alignment” is reasonably consistent but there are major differences in the way respondents judge “Execution”. This spread of data can be used to encourage discussion and debate around the reasons why some people in the same organisation or business unit respond to the same question in quite different ways. Consensus and unique insights into the root causes of problems are often the result. This positive outcome is less likely to be achieved if averages alone are considered.

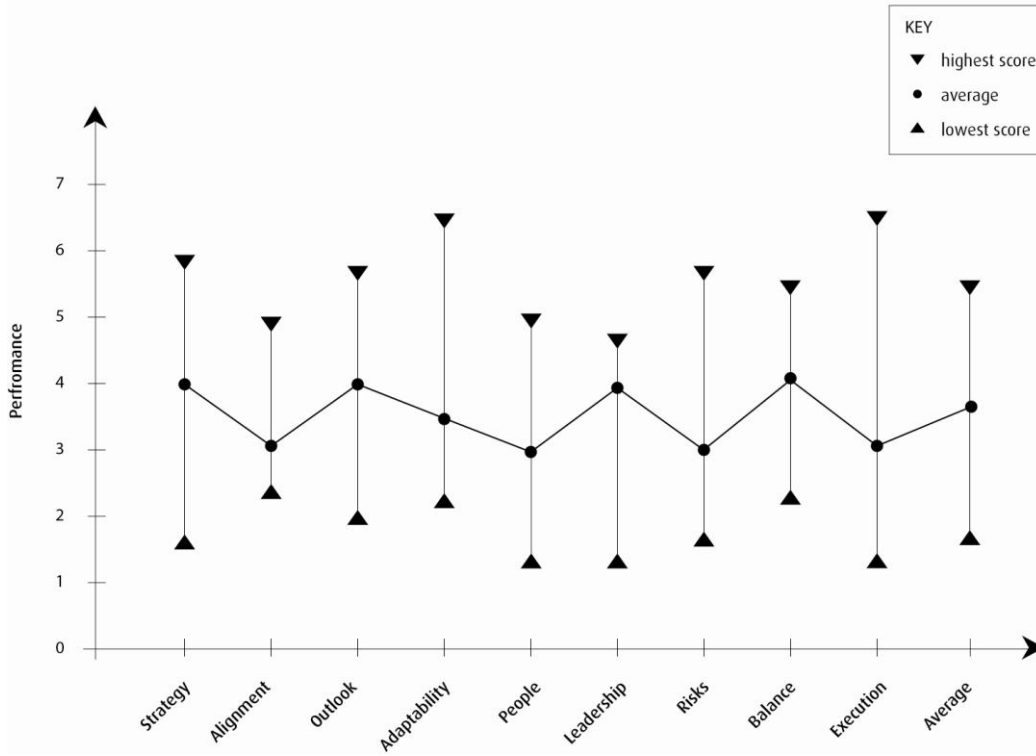


Figure 4 Performance Ranges and Averages

Another approach is to sort the data according to organisational level (Figure 5) which brings more granularity to the action planning stage than using the overall data in Figure 3.

Level	Strategy	Alignment	Outlook	Adaptability	People	Leadership	Risks	Balance	Execution	Average
1.1	71	77	79	78	79	80	75	75	84	78
1.2	81	75	75	65	65	78	70	76	75	73
2	68	57	62	60	54	50	63	63	62	60
3	48	46	65	46	40	45	56	67	52	53
4	27	39	65	24	16	20	46	27	33	33

1 Executive Team
 2 General Managers
 3 Supervisors / Team Leaders
 4 Front Line Operators

Figure 5 Typical Survey Results Sorted by Organisational Level

It has been found that most executive levels consistently rate higher than their direct reports and the gaps between their results and those from the supervisor and front line operators is major – in this example the average difference range up to a huge 45%. The implications of this gap are numerous but may imply management hubris or over confidence, lack of feedback, poor communication, low alignment or little or no understanding of the organisational strategy within the organisation. These are all the responsibility of the executive team and such gaps need to be addressed to become a winning organisation.

Some additional alternatives available in the Winning Wheel benchmarking process to present the data include:

1. Performance Gaps – this involves calculating the difference between the “Performance” and “Importance” data. Further work is currently being undertaken to interpret the significance of these gaps and how they can be used to develop action plans.
2. Geography, gender, maturity, tenure with the organisation all help to fine tune future initiatives.

Trends and First Impressions

Although the survey is in its infancy some initial trends are emerging:

1. All survey results fall below the benchmarks from the organisations that were researched to generate the Winning Framework.
2. The executive team ranks their organisation consistently higher than front line operators especially in the “Leadership” element. This implies poor communication and alignment throughout the organisation, concerns about leadership style and lack of support for the needs of operational personnel.
3. The “softer” issues around right people and leadership appear to be the most difficult ones to address in Australian organisations. By comparison the “harder” issues such as alignment are more manageable and of less concern.
4. The gap between those that formulate strategy and those that execute strategy implement strategy is substantial and suggests that major barriers to the execution of strategic plans are ongoing and difficult to resolve (Cocks, 2010).

At the more macro level, the survey and benchmarking process provides a robust platform to create and implement structured and targeted action plans to drive improvement at the deepest level of the organisation. Rather than adopting a broad analytical approach to improvement and change by resorting to management fads and acronyms, the Winning Wheel survey has been commended by its users to date for bringing clarity and focus to organisational improvement by identifying the critical areas that need immediate attention. The reporting process identifies the opportunity gaps within the organisation to locate areas that require specific attention to improve management, systems, processes and operating performance.

The initial trials indicate that methodology is both rapid and effective. It avoids the more tedious alternatives of interviewing, gathering, sorting and analysing data that characterise more traditional consulting processes. Some organisations have already

discovered that it also offers a pathway to continuously improve by using the Winning Framework as the standard on an ongoing basis. Annual surveys can be used to monitor and quantify improvements thereby maintaining momentum and motivation to teams and individuals. This might eventually culminate in the approach being used to systematically measure team and individual performance and using it as a basis for performance management systems and staff appraisals.

Conclusions

The principles and success factors identified in the Winning Framework, coupled with the benchmarking and diagnostic processes that are described in this paper, have been shown to provide leadership teams and individual leaders with a practical methodology to boost their organisation's productivity and business performance.

The diagnostic surveys have successfully identified "whole of organisation" characteristics and provide objective data rather than subjective opinions. The options for detailed analysis to determine the opportunity gaps and to segment the data help to define the critical opportunities to improve. Resources and management attention can then be targeted on these opportunities rather than simply adopting a broadly based approach to improvement and change management.

Over time, it is anticipated that a benchmarking data base will be developed which should allow organisations to measure their performance against competitors or to extrapolate into best practice benchmarking where comparisons can be made irrespective of industry sector, location or business model.

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Going shopping for independent directors: the make-up of the ideal external board member

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Background of the Development of Demand for Independent Directors

The traditional view of the board of directors is of a group of individuals (traditionally middle-aged men) with significant experience in the market within which that company operates and with significant experience of the workings of that company. Consequently, the membership of such boards was also traditionally and overwhelmingly constituted by insiders, who might include family members (if a family company) friends, professional advisors (lawyers or accountants) or substantial shareholders or their nominees. Even as late as the 1980s when the idea was more likely to be debated in political and business circles, the very notion that outsiders should be included was to some conservative thinkers an anathema. After all, what could such individuals possibly contribute to a company they didn't understand?

Consequently, such a presence was resisted in some other jurisdictions dominated by the Anglo-American model of a unitary board (having the roles of both supervision and management), as in Australia and New Zealand as well as the United States and the UK. Critics of the idea cited a range of reasons for their position. Inter alia, those include the fact that for many such directors their interests are artificial (lacking strong links between the company's wellbeing and their own); a characteristic that reduces their motivation to maximise performance; they may lack experience and understanding of the business environment; they may well have a seat on a range of boards, reducing loyalty and adversely affecting their focus on the company and its wellbeing.

Despite such objections, however, and as stated earlier, the independent director is a must for the boards of public companies in a range of jurisdictions, increasingly mandated or encouraged by legal and quasi-legal rules. In order to provide an overview, three exemplar legal/regulatory frameworks will be considered, these being in turn the UK, United States and Europe.

In 1991 in the UK, the Financial Reporting Council, London Stock Exchange and the accountancy profession moved to address low levels of confidence in financial reporting, control and standards and investor disillusionment after some enormous and

unexpected company failures. These included that of the Bank of Credit and Commerce International (BCCI) that failed owing billions after an international investigation into lending practices and lack of regulation of its activities, the Maxwell group of companies where investigations revealed millions of dollars worth of fraud and misappropriation of pension funds and Polly Peck Ltd where for years financial records had been falsified. Consequently they set up a committee headed by Adrian Cadbury to report on how to improve corporate governance practices. This committee's report (Report of the Committee on the Financial Aspects of Corporate Governance (the Cadbury Report, 1992) included a range of recommendations, one being the inclusion of independent directors principally to fulfil a control function in relation to decisions being made by the executive directors (Cadbury, 1992, p.21).

However, by 2002 some major financial scandals, including those of Enron, WorldCom and Tyco, put the issues of corporate misfeasance back into the sights of regulatory bodies in the UK. As the root cause for many of these was identified as poor corporate governance practices the Government initiated another report (the Higgs Report, 19xx) that, while supporting the maintenance of the "comply or explain" (Pass, 2008, p. 291) approach instigated by the Cadbury Report, also advocated that Boards should be responsible for ensuring a proportion (at least 50%) of members are independent. It is important to note that this code refers to non-executive directors but clearly includes independent ones. A similar approach has been adopted by the Australian Stock Exchange. While the New Zealand code (New Zealand Exchange, 2010) requires that at least 25% of directors should be independent (rule 3.3.1) it leaves it to the company to identify those who fall into that category.

In America, the trajectory and outcome of initiatives to improve corporate governance through the participation of independent directors has been somewhat different. Despite a lack of any requirement or strong recommendation, their presence was already well established by the turn of the century. Bhagat and Black (1998) estimated that in 1991 more than two-thirds of the 957 largest United States companies had a majority of independent directors on the Board while also making reference to the fact that Spencer Stuart in their survey of 100 of the largest companies in 1996 reported that no fewer than 50% had a maximum of two insiders on the board. Gordon (2007, p. 1476) cites studies that put the proportion much higher than that – in a study conducted by Korn/Ferry in 2003 65% of respondent companies reported fewer than three insider directors. One year later that had increased to 91%.

However, the financial and confidence shock sparked by the Enron and similar collapses were to spark a fundamental shift in the mechanisms used in the United States to assure good corporate governance. One of the first steps taken by the Federal Congress post Enron was the passage of the Sarbanes-Oxley Act 2002. One of its main provisions (s301(2)) is the requirement that audit committees be composed entirely of independent directors, and it also by analogy mandates the membership of such directors on the board. Consequently, and shortly after the passage of this legislation, both the New York Stock Exchange and Nasdaq moved to require boards of listed companies to have a majority of independent directors (Wallison, 2006, p. 1; Ritchie, 2007).

Insofar as continental Europe is concerned, the historical background is again different. This is largely due to the use of a two-tier board structure as found in the Netherlands,

Germany, Austria, Finland and Denmark (Jungmann, 2006). With a management board (made up of those with industry and company experience and often working in the firm) and a supervisory (of those representing stakeholder interests) there was far more room and logic for the inclusion of independent directors).

These various initiatives, be they recommendations, code, rules and law, all reflect acceptance of, and enthusiasm for, independent directors on the boards of companies. However, the jury is still out on the question of whether this move has improved corporate governance practices in affected companies. This question, and the debate that surrounds it, is documented in the following section.

Contribution of Independent Directors

By way of introduction to this section we refer to the role of the board of directors more generally: The OECD states “The corporate governance framework should ensure the strategic guidance of the company, the effective monitoring of management by the board, and the board’s accountability to the company and the shareholders” (2004, p.24). Clearly then, the three main roles of the Board are to determine strategy, monitor management and to account to shareholders for the use of company assets and resources (Carver and Oliver, 2002). In achieving those roles, the Board is responsible for ensuring legal requirements are met (including those specifying the form of financial and other reporting to shareholders and, if listed, the requirements of the particular exchange or other body involved in determining rules). The growing support in the courts, specialists and some business groups led to the mandating of independent directors as an integral part of the governance structure in the Sabarnes-Oxley Act (Wallison, 2006, p.1).

By reference to those roles, and in an attempt to clarify the situation as to whether and what independent directors contribute to the company, the following section documents the arguments that have been made for independent directors by reference to two principle roles and qualities often attributed to them – improving shareholder value (an aspect not only of accountability but also of strategy) and monitoring of management (also inclusive of strategic guidance).

However, board independence is not such a favourable factor when we examine the empirical evidence which shows that the presence of independent directors on the board can harm the innovation and creativity of the organisation (Baysinger and Hoskisson, 1990). In the non-profit sector, where directors are volunteers and without compensation, the recruitment of independent directors is thought to come with certain disadvantages. Independent directors may not only lack specific knowledge to support innovation, but they are also hard to retain (Brody, 1996). The most significant issue is how to recruit and retain outsiders (Pati, 2007). As mentioned above, the motivation of directors is a good gauge of their effectiveness on a board (Taylor, Chait and Holland, 1991). This applies to independent directors and in general it is advisable to recruit directors who have a connection to the organisation. These directors are more likely to be available for recruitment, and will be more motivated (Taylor, Chait and Holland, 1991). Unfortunately many independent directors do not have such connections and those directors who are insiders are more easily recruited, easier to retain and have stronger motivation (De Andres-Alonso, Azofa-Palenzuela and Romero-Merino, 2009).

The ‘Ideal’ Independent Company Director in New Zealand

As discussed previously, independent directors on board are still more rare than the norm and are only mandated for publicly listed firms. With 98%+ firms in New Zealand being unlisted, such regulatory mandates do not extend to the vast majority of business, and a reasonable inquisition is that if independent directors deliver value, firms where their inclusions is optional and not required, might decide on the inclusion of outsiders on the board.

As independent directors interact more with the other board members than with shareholders, directors might be in a better position to determine whether independent directors add value to boards in New Zealand. One facet of our longitudinal research into New Zealand company board composition therefore asks which criteria shareholders, senior managers and existing directors would prefer in newly appointed independent directors.

This research was designed to capture a broad cross-section of responses throughout New Zealand and for a period of several years. In order to reach New Zealand business of all sizes and industry classifications, the survey instrument was distributed to the client lists of several supporting organizations. Further supporting the argument that the discussion of ‘Governance’ is highly relevant in New Zealand, more than a dozen national organizations participated in the survey distribution, creating one of the largest data sets on governance in the country.

Using distributors from different industries and in many locations throughout New Zealand was intended to reduce bias in the sample group.

Distributing organizations were:

BNZ, ANZ, National Bank, Simpson Grierson, Business New Zealand, Employer and Manufacturers Association (Northern), Otago Southland Employers, PriceWaterhouseCoopers, 3 Media Group, Cameron Partners Investment Bankers, Swann Recruiting, The New Zealand Shareholders Association, Venture Taranaki, NZ Institute of Management, Unitec, Waikato Chamber of Commerce, Business Mentors of New Zealand, Employers and Manufacturers Association Central, Canterbury Employers Chamber of Commerce, New Zealand Venture Capital Association, Ministry of Womens Affairs, Te Puni Kokori, Chartered Secretaries of New Zealand, Human Rights Commission, Crown Company Monitoring Advisory Unit, Waikato Management School.

There is no doubt among directors, shareholders and senior managers that independent directors contribute positively to the board, although there is a difference between shareholders and directors, to what degree these independent directors contribute. Shareholders report a contribution by independent directors to a slightly lesser extent than directors do, likely because they do not have first-hand experience of the contribution of individual directors during board meetings. This raises an issue of transparency when directors report back to shareholders, to make sure shareholders understand the substance of board deliberations, the benefits of vigorous debates and the strong unified leadership when the board instructs senior management. When shareholders do not understand how directors contribute to the creation and

maintenance of an effective and resilient governance system in the firm, they likely will be less appreciative and understanding of the decisions directors make.

The overall appreciation for the contribution of independent directors should be good news for those shareholders, owner/operators or senior managers of SMEs in New Zealand, who have not yet found a compelling reason to add independent directors into the governance structure of their firms.

Diversity as Part of the New Independent Director Search

Diversity is an often-discussed issue in relation to governance, most often in the context of age and gender, presumably with concern that women and younger people are underrepresented in governance roles. Without doubt, an 8% participation of women in governance roles in publicly listed firms is appalling in New Zealand that prides itself of having been the first in the world to grant women the right to vote, and where only a few years back all key roles government were held by women (Prime Minister Helen Clark [prior Prime Minister Jenny Shipley], Speaker of the House Margaret Wilson, Governor General Sylvia Cartright, Chief Justice Sian Elias).

With a keen interest to identify whether shareholders, directors and senior managers had preferences as to gender, age and other factors, this research offered them to select which attributes of an incoming director would be most valuable to contribute to diversity in the boardroom.

With a range of factors available to select from, a clear picture of preference emerged, and not necessarily a pleasing one for those who had hoped that there is an outcry for age and gender diversity among New Zealand boards. We can dispose of the matter of age and gender quite easily: Neither of these two factors (gender more convincingly than age) was ranked as being a contribution to diversity among boards. There is an indication that the average age of 52 among New Zealand directors might be high for some, but no strong preference was expressed for any specific age band. During the interview sessions with younger (<40) shareholders, senior managers and owner/operators it became quickly evident that these individuals not infrequently preferred director candidates who were at least 15 years older than themselves, to balance a board of much younger people. There generally was no expression for directors to be younger than the ones we currently see in boardrooms in New Zealand. On one hand, this deals a blow to those who believe company directors in New Zealand are an ageing group of predominantly males, but more importantly, this research confirms that there is no preference for any specific age group, thus allowing access to the board roles to people irrespective of age or gender. Decision-makers in the area of governance do appear to recruit directors with specific emphasis on gender or age.

What then do Shareholders, Executives and Directors look for in new Independent Directors?

Immediately apparent is what is not considered a desirable attribute for new independent directors: (a) Holding multiple directorships, (b) being an employee of the firm, and (c) holding a directorship-training certificate.

Multiple Directorships

Being a director can be a part-time or full-time profession for individuals, who then seek multiple directorship mandates and thus practice governance simultaneously for several firms. On the positive side, holding multiple directorships might indicate that the person has developed better-than-average skills in the area of governance and is appreciated for the contribution to boards by several other firms. This might lessen the risk for a firm to recruit an under-qualified director. A 'professional director' might also gain current knowledge about governance issues in some firms that might be applied to the governance at other firms, thus possibly contributing to an effective transfer of knowledge. And, lastly, a professional director might have directorship mandates in firms in similar/related fields and thus might be able to contribute specific knowledge of value, subject to conflict situations.

All of this foregoing does not seem to constitute valid arguments for shareholders, senior managers and directors in their search for new independent directors. Only 2.5% believe it is important that new independent director holds multiple directorship, while 67% believe it is not important.

Following from the individual discussions with directors and owner/operators it seems clear that professional directors are not perceived to have current practical management/leadership experience and thus are suspected not to be able to contribute in those areas. There also appears to be some sense of mistrust as to the commitment a director has to each board if he/she sits on many boards at the same time.

A Director as an Employee of the Firm

Much to the relief of those pushing for more independent directors on boards, 74.1% of shareholders, senior managers and directors do not wish a new director to be an employee of the firm (which would make that director non-independent). Whether there is the awareness that the status of being an independent director precludes employment at the firm, or whether there are other motivations at work, clearly employees are not seen as adding value to the board.

In the discussion with directors and owner/operators they clearly expressed an appreciation of the 'independent' status of directors and that employees would not meet this requirement. This allows the cautious conclusion that there is a value attribution to being independent which appears to contradict the historic notion that outsiders could not contribute as directors due to lack of specific firm knowledge.

The Value of Having a Director Training Certificate

Slightly more than half of the respondents (52.3%) believed holding a Qualified Director certificate was important (offered in New Zealand by Directions – Understanding Governance Ltd, a private provider with a roster of corporate leaders as presenters), while only 48.4% thought the same for a certificate from the Institute of Directors. For neither institution this a sign of endorsement by the market, and it appears that no superior value is placed on the completion of a directorship-training course.

This situation should sound alarms among educators, regulators and corporate leaders. If the current training regimes are not appreciated as being important, then either there is a lack of knowledge of the director skills gaps (not knowing what one doesn't know...), or there is a lack of appreciation for the learnings a participant can take away from these training events. In either case, a campaign to raise awareness might be required to drive more directors to upgrade/update skills through some vehicle of formal governance education. There is a need in New Zealand for more directorship training events that deliver value, and this research shows that it is not only novice directors who would likely benefit from training, but that there is a serious skills gap among sitting and presumably more experienced directors.

When turning to the attributes most desired in a new independent director, shareholders, senior managers and directors are strongly unified. They are keen on independent directors who have (a) a good reputation, (b) can form and defend their own opinions, (c) have a track record of success in business, and (d) have company-specific market knowledge and experience. To a clearly lesser degree, directors are desirable when they (d) have global business experience and (e) can communicate effectively with shareholders.

The Reputation of Directors

Nearly 70% of respondents consider the reputation of directors to be very important, and more than 27% consider it somewhat important, making this the single most important attribute for independent directors. It is not clear what exactly 'reputation' means, but the in-depth discussions with directors identified several areas included in this definition: (a) Absence of public failures such as bankruptcies, criminal/civil prosecutions and other scandals; (b) 'being known' in the industry specific to each firm, and (c) being held in high regards by the current directors.

Although 'having a good reputation' appears to be easily defined, it is important that future research better identify the characteristics associated with 'good' and 'bad' reputation. For instance, would a director who regularly does not go along with a majority of other directors suffer a reputational damage for being troublesome? Events such as being a director of an insolvent firm or being convicted of criminal acts would justifiably affect the reputation of a director, but what about the director of a firm that voluntarily liquidates because it has come to the end of its useful corporate life? 'Reputation' as a term invites the application of a value system that will be subjective rather than objective, and thus care must be taken to not adversely affect the eligibility of directors who can effectively contribute but might be tainted by irrelevant activities.

A Director with A Strong Opinion

67.7% of respondents find it 'Very Important' (and a further 28.2% find it 'Somewhat Important') that a director can form opinions and then defend them vigorously during a debate among directors. This outcome seems to indicate the true value independent directors have, and suggests a belief by the respondents that such a vigorous debate does not currently exist on boards.

In general, this sentiment by respondents seems to indicate a fear of directors banding together for the wrong reasons and thus manifests a level of distrust against directors

that is disturbing. If it needs a director with the stamina to maintain a vigorous defense for his/her argument to succeed, does that mean that less strong directors will not be heard? Is there a fear that directors' valid opinions might not be debated if the fervor and fighting spirit are missing? It appears from the discussion with shareholders and senior managers that a lack of understanding exists over the operation of board meetings. There seems to be a prevailing belief that directors decide based on established alliances in the boardroom, and that newcomers would have no chance to present alternative viewpoints unless they are able to fight for them. This seems to be a naïve interpretation of board routines and likely more wrong than correct. A remedy for this widespread misconception might be to invite shareholders and senior managers to attend board meetings, at least those sessions that discuss matters not commercially sensitive or otherwise not suitable for immediate public consumption, so that they get a first-hand impression of the dynamics of a board meeting. Re-iterating points made above, in this context it seems appropriate to refresh the suggestion that board minutes appropriately reflect any debate and intense discussion of issues, so that there can be no doubt that directors have a forum in which to debate matters fully and effectively.

The Practical Knowledge of Directors

95.4% of respondents desire directors with industry-specific knowledge presumably so that they can overcome the lack of insider knowledge at the firm with transferable relevant skills and knowledge from the outside. This would intuitively be the fastest approach to get independent directors up to speed in understanding the business, but does this provide for the largest possible pool of director candidates to choose from?

If many of the skills required by directors are transferable skills, such as understanding the legal obligations of directors, being able to interpret financial statements and performing audit function, creating long-range visionary strategic plans, communicating strategies to the CEO and management, and communicating with shareholders and other stakeholders, why does a new director have to understand the minute details of how the operation works? Would this not be a skill that can be learned quickly, and be complemented by insiders such as senior managers, who can provide specific operational details?

It is noticeable that there is little interest in adding directors to the board who hold professional qualifications such as "solicitor" or "accountant" but do not work in an executive role in business. While solicitors and accountants have historically been asked to come onto the boards of SMEs, likely as arbitrators of the various owner factions and to provide 'free' professional advice, shareholders, senior managers and directors now are far less likely to be asked to serve. The majority of respondents believed that professional degree holders had too narrow a scope of expertise to be able to contribute to general management issues. Although accountants and solicitors might very well have amassed a lot of knowledge while dealing with clients in a wide range of industries and situations, it appears that this 'knowledge by proxy' is deemed insufficient for the current challenges of independent directors. This means conversely that it is no advantage for an aspiring independent director to hold such qualifications.

This research identifies the necessity to better inform shareholders, senior managers and directors about the purpose and benefits of independent directors. If the approach by firms is to seek directors with knowledge as close as possible to that of the current

inside directors, then this will likely reduce the pool of available candidate to those being the mirror image of the existing directors and thus be less-than-useful as truly independent contributors of governance resource.

The Global Experience of Directors

85.4% of respondents consider it somewhat or very important for a new independent director to have global business experience. With New Zealand being dependent on foreign direct investment and exports, to create a trade balance surplus, the connection to a business world beyond New Zealand is important for competitiveness, growth and sustainability. In the in-depth interviews, many business operators and shareholders of SMEs expressed concern over their lack of knowledge to take their business onto the global scene. There are concerns over the cost and risk of an expansion, uncertainty over the appropriate methods of market entry overseas, fears to not understand the cultural needs of those markets and the beliefs that expansion beyond New Zealand is “too hard”. However, when offered the option to have a director on the board that understands how to operate beyond New Zealand, considerable interest was voiced in such a person and the associated business knowledge.

Conclusions

We conclude that shareholders, senior managers and directors consider an independent director as an advisor of a special kind with contributions in multiple areas and based on solid work experience, preferable also in the global arena. While there is no significant expression of preference for age and gender, competence ranks highly in the minds of the key stakeholders, more so that professional qualifications.

This opens the door to many current executives who wish to step up into a board/governance role but as reported previously (Mueller et al, 2006), there is considerable concern over the available recruitment vehicles available to satisfy this growing demand for independent directors.

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Quality management in hotels in the Basque Country

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Key words: Quality Management System, Quality Standards, Quality in tourism sector.

Introduction

The tourism sector is considered very important for the Spanish economy. In 2010 Spain received 52.6 million visitors, which generated nearly 10% of the GDP. However, starting in the early 90s, the companies in this sector became aware of the fact that there were new destinations with exotic appeal and competitive prices. Tourists demanded more value for their money and better service.

In response to this situation, the Spanish tourism sector decided not to compete on price (which involves the risk of substitutability) but to have companies in the sector stand out by implementing strategies addressing quality. Quality can be the key to improving performance and service in a competitive environment (Ingram and Daskalakin, 1999; Costa, 2004). In fact, Spain is the first country in the world to define specific quality standards for each subsector and create a certification system handled by an independent third party.

Companies in the tourism sector in Spain reacted to the threat of new exotic and more competitive destinations by focusing on improving the quality of service and management. In fact, Spain has been a pioneer in the implementation of voluntary quality certification systems for hotels. The Quality Club of Rural Homes in the region of Valencia (*Club de Calidad de las Casas Rurales de la Comunidad Valenciana*), created in 1999, and the Plan of Excellence in Hotels in Puerto de la Cruz (*Plan de Excelencia Hotelera de Puerto de la Cruz*), developed in 1993, are two illustrative cases.

The quality approach spread to Spanish tourist companies more generally in 1996 when the Spanish Tourist Quality System (*Sistema de Calidad Turística Española, SCTE*) project was started. This project was run by the State Tourist Administration, and it provided technical support for the development of quality systems suitable to the different subsectors: hotels, travel agencies, restaurants, etc. The SCTE aimed to provide Spanish hotels (and other tourist companies) with a methodological tool that helped them to manage their businesses with a focus on quality, and it made it possible for them to be more competitive and to offer high quality services and products. The institutional backing was provided in the form of Spanish Tourist Quality Trademark known as **Q for Quality**.

In the first years of the project, the SCTE developed specific quality systems for the tourist subsectors, all of them with certification for business and implementation of continuous quality improvement in organizations. In the year 2000, the tourism sector,

with the support of the State Department of Trade and Tourism, created the Spanish Institute for Tourist Quality (*Instituto para la Calidad Turística Española*, ICTE). The ICTE is a private, independent non-profit organization created specifically for the tourist sector with the mission of standardizing and implementing tourist quality standards, certification of quality systems (specifically Q, the Spanish Tourism Quality Trademark), and promotion of quality systems in this sector.

The Q standards take into account the requirements of ISO 9001:2000 and ISO 14000:2004, but they are not identical; rather, they have a certain complementarity (Casadesus, 2010).

Framework and objectives of the study

The first aim of this study was to find out the approach that hotels take regarding quality management: what managers understand by quality management, and what motivations drive them towards quality. Many organizations are motivated to adopt quality systems by external factors such as pressure from clients, pressure from competitors, and the desire to enhance the image of the company. Other companies are motivated by internal factors such as improving efficiency, reducing costs associated with poor quality, and product improvement (Casadesus and Heras, 2005; Shannon et al. 2001).

The second aim was to discover what quality standards companies use and the scope that these standards cover in hotels in the Basque Country. Several methodologies for quality management have been developed, including the ISO 9000 series, Six Sigma programs, the EFQM business excellence model and within Spain, the trademark Q for tourist companies. Some authors note that providing quality tourism experiences remains problematic. The characteristics of tourism as a service—intangibility, heterogeneity, perishability and simultaneity—as well as the diverse nature of the tourism experience represent significant challenges to the successful implementation of quality management procedures (Sharpley, 2003). In particular, in Spain there was a poor penetration rate of the ISO 9000 family in the tourism sector in spite of the fact that Spain is the fifth country in the world in terms of the number of companies with ISO 9000 certifications (Casadesus, 2010). However, Spain was the first country in the world to define specific quality standards for companies in the tourism sector and a certification system run by an independent third party.

One of the aspects that we wanted to study was employee commitment to quality service. Some authors point out (Witt and Mühlemann, 1994; Sharpley et al, 2003) that the factor that links all models of quality management is the people involved in the delivery of service. The success of quality initiatives depends on the willingness and ability of staff to respond to the demands for increased quality in the delivery of services. As a consequence, positive employee attitudes are vital to customer satisfaction. In other words, helpful behaviour from the service provider is one of the fundamental aspects of management quality in tourism.

Methodology

Our empirical study was carried out in the Basque Country. This Spanish region has a long tradition of tourism due to the geographical and cultural characteristics that make it a destination of the quality tourist.

A survey of hotels located in the Basque Country was conducted from September to November 2010. The hotels were selected from the “Guía Empresarial del País Vasco, 2010.” We selected 223 hotels, and after explaining the aim of the study over the telephone and asking them to participate in the survey, we sent them an e-mail with a link to a web page where they could respond to the questionnaire. Over the course of a month, we sent them an e-mail every week in which we reminded them about the survey. The response rate was 16%.

The questions about the concept of quality and motivations are in the following table:

What do you understand by quality? (Do not mark more than 3)
Possible answers: <ul style="list-style-type: none"> ▪ It is a philosophy that tries to satisfy the customer needs. ▪ It is to fulfil/implement the ISO standard. ▪ It is to manage quality as a competitive advantage. ▪ It is a method to get everybody in the company involved with the company's objectives. ▪ It is a method to improve the company's processes. ▪ It is a method to prevent mistakes. ▪ It is a method for achieving the continuous improvement.
What are your main reasons for applying quality management? Do not mark more than 3)
Possible answers: <ul style="list-style-type: none"> ▪ To improve our relationship with the environment. ▪ To fulfil compulsory norms. ▪ To increase profit. ▪ To get more customers. ▪ It was a requirement of the group the company belonged to. ▪ To manage quality as a competitive advantage. ▪ To bring about a cultural change within the company. ▪ It is “in fashion” or it enhances the company's image. ▪ Out of conviction.

Table I

In order to discover what quality systems are used and the scope of quality management, we asked hotels which certifications or quality systems they use and the processes that they use, as seen in table 2.

Do you have quality certifications, homologations, etc?
Possible answers: <ul style="list-style-type: none"> ▪ No ▪ Q touristic ▪ ISO 9001 ▪ Awards ▪ Others
Which processes have you documented in your hotel?
Possible answers: <ul style="list-style-type: none"> ▪ Reception ▪ Check in ▪ Check out ▪ Cleaning ▪ Bar ▪ Maintenance

<ul style="list-style-type: none">▪ Accommodation▪ Purchasing▪ Others
Are the documented processes evaluated?
Possible answers: <ul style="list-style-type: none">▪ No▪ Yes How? - Internal audit<ul style="list-style-type: none">- Person in charge- System- Other
Are there critical points in the documented processes?
Possible answers: <ul style="list-style-type: none">▪ No▪ Yes For instance: _____
Does your organization have a system of continuous improvement?
Possible answers: <ul style="list-style-type: none">▪ No▪ Yes

Table II

With respect to employees and other stakeholders in the companies, such as suppliers and managers, the questions were:

Does a teamwork structure exist in your organization?
Possible answers: <ul style="list-style-type: none">▪ Yes, it exists and it is well developed.▪ Yes, it exists but it requires further development.▪ It practically does not exist.▪ It doesn't exist but we are thinking of developing one.▪ It doesn't exist and we are not thinking of developing one.
In terms of the quality management that you carry out, do you think that employee commitment has:
Possible answers: <ol style="list-style-type: none">1. decreased drastically?2. decreased?3. stayed the same?4. increased?5. increased drastically?
In terms of the quality management that you carry out, do you think that manager satisfaction has:
Possible answers: <ol style="list-style-type: none">1. decreased drastically?2. decreased?3. stayed the same?4. increased?5. increased drastically?
In terms of the quality management that you carry out, do you think that supplier satisfaction has:
Possible answers: <ol style="list-style-type: none">1. decreased drastically?2. decreased?3. stayed the same?4. increased?5. increased drastically?

Table III

Results and discussion.

Motivations and approach to quality

Most of the hotel managers (83%) identify quality with a philosophy that tries to satisfy customer needs. 63% of them identify quality with a method for implementing continuous improvement. And 43% of them think that quality is mainly a method to get everybody in the company involved in the company's objectives.

As for the motivations that drive hotels towards quality management, most of the hotels (80%) pointed out that managing quality was a competitive advantage. 40% of them said that they applied quality management out of conviction. The third (37%) the fourth (20%) most cited motivations were to get more customers and to increase profit.

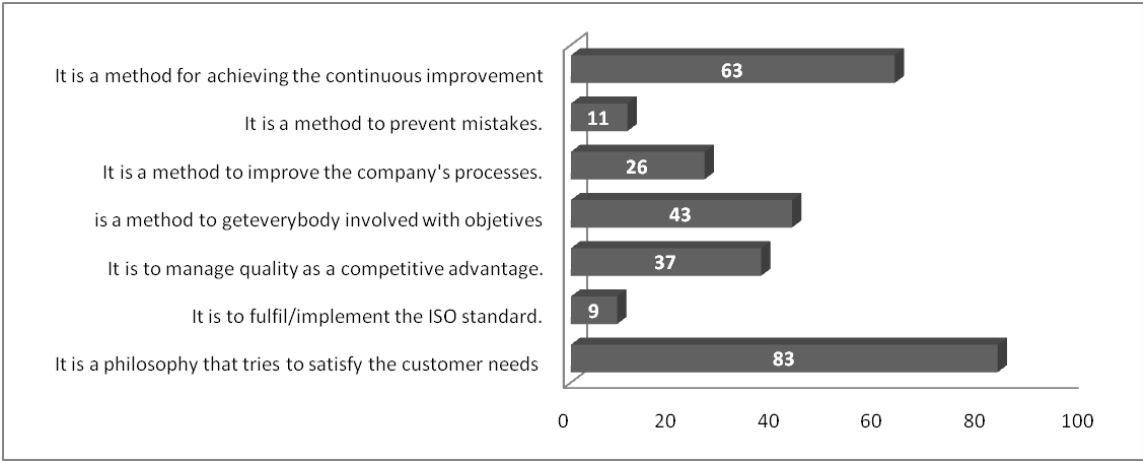


Figure 1: What hotels understand by quality (percents)
 Motivation is primarily related to results. The purpose of having a competitive advantage is to get more customers or profit. Those managers who applied quality management out of conviction are usually seeking greater efficiency, which leads to an increase in profit as a consequence.

Certifications

43% of the hotels have the Q certification (the Spanish tourist quality certification), 29% have other certifications and 28% of them do not have any certification. Among those that do not have any certification, most of them said that they have a tailored system. They have a quality management system although they don't have any certification.

11% of the hotels have ISO 9000 certification, and all of those have the Q certification as well. As we mentioned above, the Q and ISO 9000 certifications are complementary standards. The same thing is the case with ISO 14000.

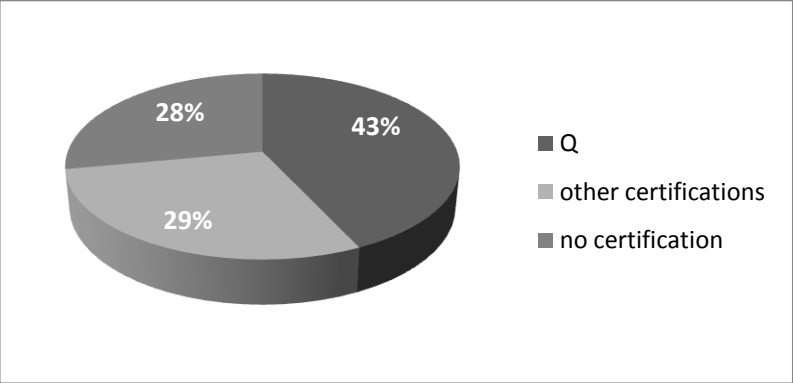


Figure 2: Certifications

74% of the hotels have a continuous improvement system, which means that some of the hotels that are not certified have this kind of system. But it is clear that the hotels that don't have a continuous improvement system are not certified. 96% of those hotels have a formalized suggestion box system, 73% have a method for solving problems and 50% use the 5S methodology.

Most of the hotels surveyed documented their processes with written procedures. 63% of them have documented procedures for the following processes: reception, check-in, check-out, accommodation, cleaning, and maintenance. 34% have one or more of their processes documented, and only 3% have none of their processes documented.

Processes are evaluated periodically. 51% of hotels evaluate their processes through an internal audit, and in 29% of the cases the person in charge carries out the evaluation of processes. 11% evaluate their processes using other methods and, finally 9% of them do not evaluate their processes at all.

Almost half of the hotels declared that they have critical point in their processes. When they were asked to give more details, the recurring idea was that the most critical point is where there is direct connection with customers. How customers feel they have been treated greatly influences their level of satisfaction. This fact is closely linked to the next section.

Employee involvement

60% of the hotels believe that they have a teamwork structure and that it is well developed; 29% report that they have a teamwork structure in place but that it needs further development; 6% think that it practically doesn't exist, 3% said that they don't have a structure but they are thinking about developing one and, finally, 3% respond that they don't have any structure and that they are not thinking about developing one. Most of the cases where there is a teamwork structure that needs further development are hotels that do not have any kind of quality certification.

With regard to employee commitment as a consequence of implementing a quality management system: 48% believe that it has increased, plus another 7% that think that it has greatly increased, and 38% answer that the level of commitment has stayed the same. Only 7% report that employee commitment has decreased.

Manager satisfaction is also affected: 48% of respondents think that levels have increased, and another 3% that think that levels have greatly increased; 45% believe that the manager satisfaction has stayed the same, and only 3% consider that it has decreased.

As for suppliers, none of the hotels believe that supplier satisfaction has decreased. 34% report that it has increased, plus another 7% that think that it has greatly increased. 59% think that the supplier satisfaction levels have stayed the same.

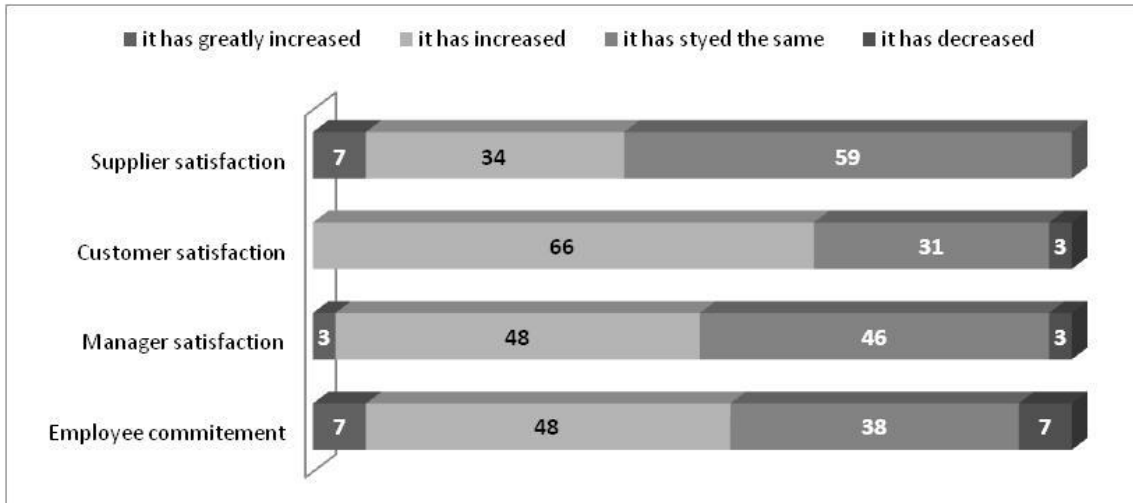


Figure 3: Results regarding the implementation of quality management.

Results

With respect to the results regarding the implementation of quality management in these organizations, the overall impression is that it has been very positive for the company. Regarding customers, 37% of the hotels report that the number of customers has increased, while 55% think that the number has stayed the same and only 6% think that the number of customers has decreased.

When asked about profit, 41% say that profit has increased, another 41% report the same level of profit, and only 17% report a decrease in profit.

The results for customer satisfaction are the most relevant: 66% of respondents think that customer satisfaction has increased, 31% report that it has stayed the same, and only 3% believe that it has decreased.

Overall, 79% of the hotels believe that the quality system has been implemented successfully, as opposed to the 21% who they do not consider it to be successful.

Conclusions

As a general conclusion, we see that the philosophy of quality is extensive in hotels in the Basque Country. Almost 80% (79%) of the hotels surveyed reported that the quality system has been successfully implemented.

The concept of quality that they have is related to customer satisfaction and continuous improvement, whereas the motivation to adopt a quality system is connected to results, which was the most frequently cited motivation for managing quality as a competitive advantage.

The hotels in the Basque Country have a culture of quality management: most of them have a quality system, of which 72% have quality certification. The most popular is Q touristic, the Spanish Trademark for the tourism sector.

The use of a quality management system led to an increase in employee involvement in 55% of the cases. This fact is very important because it is closely related to customer satisfaction. Additionally, 60% of the hotels surveyed have a well developed teamwork structure in place. Increases in manager satisfaction and supplier satisfaction are reported in 51% and 41% of the cases, respectively.

The results of the survey clearly show that hotels consider that having a quality management system in place has led to increases in customers, profit and customer satisfaction. These results are even more significant when we consider that the survey was conducted during a period of economic crisis.

As for research limitations, the first is that the hotels that completed the survey could be those that are committed to quality management. That fact could introduce a bias which makes the situation seem better than it really is. The second limitation is the small size of the sample.

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Optimizing the development process by an optimal method-selection using individual characteristics – an approach

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Key words: requirements from methods to method user, individual characteristics, method-selecting in the development process

Category: Conceptual Paper, Research Paper

Introduction and necessity of method selection

In today's global competitive environment, it is essential that companies not only direct their activities towards customer needs but also cope with cost pressure and demands for higher flexibility and individual products and services. By considering the demand of individual products, which comprise more integrated functions in the product, the product, its development process and its production become more and more complex.

For the production of high quality products numerous aspects have to be considered. So, on the one hand requirements of several stakeholders have to be considered and on the other hand, during the whole time period of planning, developing and production, numerous problems have to be solved and the productions has to be proved. Only at coverage of requirements a product can be developed which is accepted by the customers. With regard to the development process these requirements have to be conductively converted to products, that means components and assemblies, which are produced in the following.

For those different processes and sub-processes, which do consequently base on each other, several varied methods can be applied. For instance, within the planning of a new product, different methods for capturing of requirements can be used. In this case, the Conjoint Analysis as well as structured interviews can be named as example.

During the development numerous aspects have to be worked out and numerous problems can be healed. In doing so, practicable solutions for the requirements must be found, which are transferred in the product afterwards. For such a search for solutions, methods of brainstorming or also methods concentrating on conflict solutions like the Theory of Inventive Problem Solving (TRIZ) are capable.

At the following planning and realisation of the products, again various methods can be used which result in a reduction of rejects and costs. For example, the surveillance of

production can be held via SPC. The following figure once again shows those examples with potential applicable methods for each appearing application.

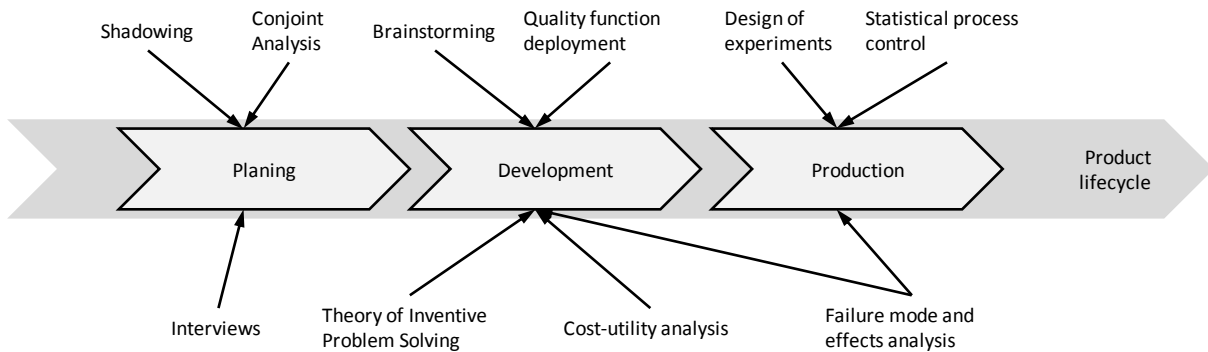


Figure 20: Examples of applicable Methods for planning, development and production process

Figure 1 already shows that for several processes and phases of the product life cycle methods of different sectors can be used. Resulting from this, for each application it has to be determined which method fits best in this situation. For this, numerous criteria can be considered. The chosen method having the aim of requirement collecting, for example, depends on the number of questioned participants. By choosing such a method also the result is inevitably influenced, so that when choosing a non-suitable method either useable results cannot be worked out or additional expenditure is involved in those. Consequently, the choosing of method is a key position when thinking of a reduction of productions time and its involved costs.

In this paper a way of proceeding is presented, which supports the user of methods when choosing methods with reference to several criteria. In doing so, the general approach and the adaption of this procedure to the development process is presented as a possible process. For this, firstly, the main factors involved of the development process are presented, which are considered by several criteria at the actual chose of methods. Finally, the proceeding for comparing the methods is introduced. This process consequently presents the compendium which can or has to be adapted to each considered process, to the problems that have to be dealt and to the involved application of method. Only by identifying the based main factors involved and the criteria deduced from that, a purposeful choose of method can happen.

The developing process and its main factors involved

The VDI-Guideline 2221 (Verein Deutscher Ingenieure 1993) describes the development process by an iterative model considering four main phases and seven steps. There are several additional models which describe the development process (i.e. development process following Pahl and Beitz (Pahl et al. 2006), development process following Ehrlenspiel (Ehrlenspiel 2003) or the Munich process model (Ponn 2007)), but most of them are very similar to the VDI-Guideline 2221. To each of this phases different methods can be assigned, from which many are useable alternatively. Figure 21 shows the Phases and Stages of the VDI-Guideline 2221.

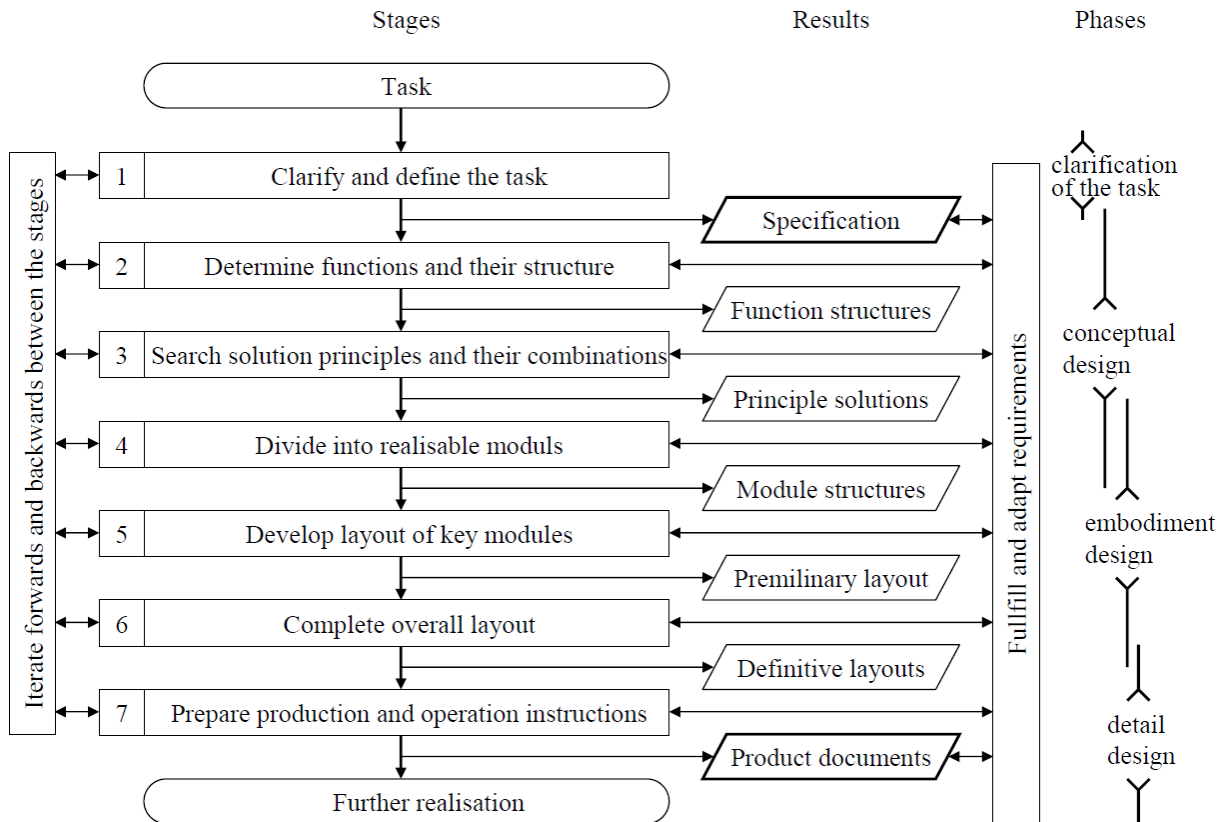


Figure 21: Development process following VDI-Guideline 2221 (Verein Deutscher Ingenieure 1993)

In a first step the scope of task has to be clarified, in which a list of requirements arises. Afterwards, solution neutral functions for the requirements are defined, for which principle solutions are declared in step 3. From this, modular structures are deduced on which base a rough concept is developed. Finally, the definitive layout and the production documentation are worked out.

Following (Günther 1998), there are four main reciprocal influence factors on the development process:

- Framework conditions (planned time for development)
- Product (for example, a car)
- Problem (new solution principles needed, old ones cannot be taken)
- Problem solver (great team of developers, all with different knowledge bases)

As an example, a new car has to be developed. Then the car is the product which influences the development process by, for example, its complexity. There are several problems occurring during the development process, for example, a new solution principle for the motor has to be chosen. Because of the global competitiveness the development process has to be shortened. Thus, time is a framework condition that influences the development process strongly. Therefore several developers are needed, of which everybody has another degree of experience, everyone knows different methods.

For an optimal method-selection the characteristics of the problem as well as information about the developer and the framework conditions have to be considered. There are some models supporting the developer choosing a method, but most of them choose a method considering only characteristics of the occurring development problem as well as information about certain framework conditions. By the lack of considering characteristics of the method-user, i.e. his experience, knowledge and creativity, the results of the used methods are not optimal. Thus there are unnecessary iterations in the development process associated with a waste of time and money. For solving this problem and improving the result of the method selection, a new model has been developed which is described in this paper. By using this model the best fitting methods for creating solutions, combining partial solutions and for evaluating can be chosen and one of them selected. For this, information about the framework conditions and characteristics of the development problem and of the developer will be considered. Furthermore it presents the basic implementation of the developed model for selecting methods in a tool.

Existing models for structuring and selecting a method

If developers want to solve a problem, they can choose from a large number of methods, of which he probably knows only some. There are some existing models for structuring and selecting a method. These models establish a two step approach for selecting a method. The objective of the first step consists of exclusion of completely unsuitable methods. Therefore, commonalities of the methods are identified, thus, clusters of methods can be defined. In some approaches cluster are only defined by the objectives of methods, another approaches analyse methods in detail for clustering them. In the second step, an evaluation of the methods concerning different criteria is done. For example, it is analysed whether a use of a method is better or lesser suited during a phase of the development process. So far, a lot of different rough models for structuring methods have been developed, of which some are presented below.

The VDI-Guideline 2221 implies a rough guide for selecting a method in the previously described two step approach. In the first step of the VDI-Guideline 2221 methods are analysed and structured concerning their object which is shown in Figure 22.

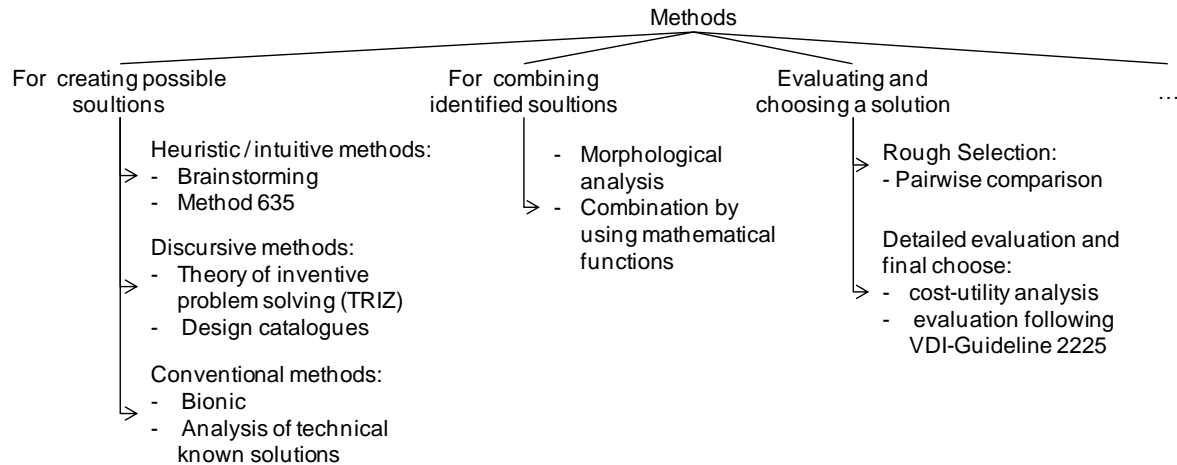


Figure 22: Rough structure of development methods following VDI 2221

For example, it will be differentiated between methods for creating possible solution ideas and methods for evaluating these solutions and choosing one of them. Because there are numerous methods for creating possible solution ideas, there is another differentiation by the Guideline which distinguishes between heuristic methods, also known as intuitive methods, discursive methods and conventional methods. Heuristic methods mainly base on creativity and on a sudden idea for solving the problem. Examples for this approach are the classical Brainstorming and Method 635. Discursive methods are characterized by a deliberate step by step process, which can be communicated and followed easily. Therefore, the problem is analyzed and divided into several smaller parts. Examples for this approach are TRIZ and the use of design catalogues. Conventional methods try to identify new solutions by analysing and adapting existing solutions. Hereby, existing technical as well as natural examples are studied. Examples therefore are Bionics and analyse of known technical solutions (Verein Deutscher Ingenieure 1993, Pahl 2006).

The second group consists of methods which are used to combine identified partial solutions to one overall concept. One example for this group is the systematic combination of the partial solutions like it is done at the morphological analysis. Another example is the combination using mathematical functions (Verein Deutscher Ingenieure 1993, Pahl 2006).

In the last group there are methods, which are used either for a rough selection of solutions or for a detailed evaluation followed by the selection of the methods. It is the objective of the rough selection to exclude unsuitable solutions and therefore to reduce the number of solutions which have to be evaluated. Hereby, the pairwise comparison is one possible method. The remaining solutions have to be evaluated, thus a final solution can be selected. This may be done by the cost-utility analysis or by the evaluation method following VDI-Guideline 2225 (Verein Deutscher Ingenieure 1993, Pahl 2006).

In the second step, the methods are analysed in respect of their suitability during each of the seven phases. These methods are differentiated in suitable, limited suitable and not suitable ones. (Verein Deutscher Ingenieure 1993).

Strasser as well as Ponn analysed existing models including the previously described one and came to the conclusion, that the selection process of a method is not optimally

supported. Based on the previously described approach better suited models have been created (Strasser 2004, Ponn 2007): Firstly, Strasser analysed the methods more detailed and created a profile of each method, which includes its most important characteristics (i.e. Ability of a method raising the degree of innovation, Ability of a method expanding or diverging the solution space), thus suited clusters of methods can be defined. Furthermore, he developed a detailed checklist for analysing the development problem, which helps to preselect a cluster of possible methods. Thus a method is selected based on the comparison of problem and the profiles of the methods (Strasser 2004).

Based on the previously described two step approach Ponn developed a modularised process of selection of a method. Therefore he identified several process components as well as their input and output based on the Munich procedure model. Subsequently, the methods are described by profiles developed by him. Additionally, these methods are assigned to the different phases of the development process as well as to the process components. In this model a method is selected based on the characteristics of the problem which are used for determining the process components and detailed method characteristics (Ponn 2007).

Although the developer affects the development process and hence also the developed product, none of the previously described models consider the developer characteristics. Thus, another model for selecting the methods, which additionally considers the developer and its personal characteristics, has to be developed. Thereby, the structure of the VDI-Guideline 2221 will be used in the new developed model. Hereby, the most unsuitable methods can be excluded at an early stage and will not be compared in detail.

Created Model for selecting development methods

Developing is a process in which several problems considering a great number of requirements have to be solved (Pahl et al. 2007). Before a problem can be solved, based on the identification and definition of the problem suitable methods can be selected.

The developed model bases on the following three theses:

- By considering the degree of novelty development problems can be distinguished into original designs, adaptive designs and variant designs. Original designs are designs, where new problems are solved by using new solution principles or new combinations of known solutions principles. The solution principle remains unchanged at adaptive designs, only the embodiment is adapted to new requirements. Variant designs describe a development process in which only the sizes and arrangements of parts and assemblies are varied (Pahl et al. 2007).
- The developer often has to change used methods. Main criterias for selecting a method are the situation of the development process and its individual characteristics.
- Because of the lack of information about weightings of different individual characteristics at the beginning, the weighting factors of all used characteristics of individual and of the situation were set equally.

Although adaptive and variant designs are the most common ones, there are specific parts in each design which have to be developed newly (VDI 2222), for example, the interfaces of a variant design has to be changed or an alternative solution principle has to be selected.

Considering the interactions on the development process, already shown, as well as the theses, described previously, individual characteristics, criteria of framework conditions and the situation of development are considered in the developed model and illustrated in Figure 23.

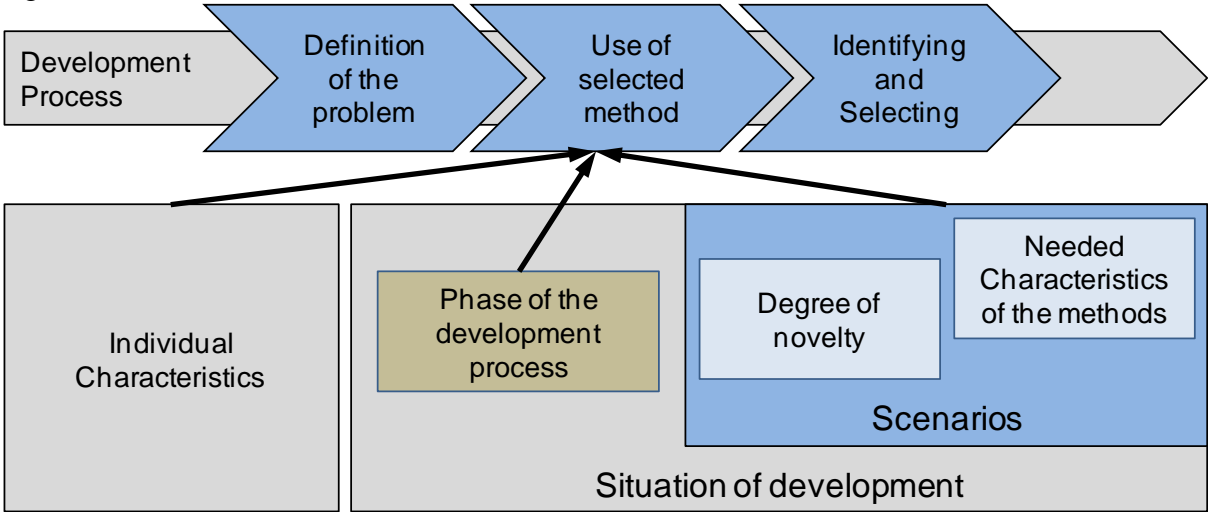


Figure 23: Considered Influence on the process of selection

The situation of development is an objective description of the occurring problem, for which a method is needed. It includes among other things the moment of the development process allocated following VDI-Guideline 2221 to one phase of the development process as well as the type of design considering their degree of novelty. Thus, based on the situation of the development situation needed characteristics of the methods can be identified, i.e. methods which are needed for creating possible solution ideas. Additionally, these ones should be useable with low effort and without a team.

In this new approach the needed characteristics of the methods and the type of design are combined as scenarios. These scenarios describe typical situations of the development process, which can occur more than once at various points of time. Furthermore, the individual characteristics of the developer as method user have to be taken into account. Hereby, for example, his ability to work in a team and his creativity are respected in the selection process of the new developed approach.

The new developed model of this paper bases on the general two step approach like the ones previously described. Thereby, in the first step methods are pre-structured for excluding the unsuitable ones and thus limiting the number of methods, which has to be analyzed and compared in detail. After that in the second step the actually evaluating is done by considering characteristics of the problem as well as of the developer.

The identified scenarios are presented at chapter 0; chapter 0 presents examples of individual characteristics and given models of ergonomics for structuring them. The process of analysing the methods in detail followed by the selection process is described in chapter 0.

Scenarios and needed characteristics of methods

Considering the individual characteristics as a criterion for selecting a method is important, but without considering the situation the results are not optimal. Therefore, a developer would have to analyse the development situation and derive needed method characteristics from it. Strasser developed a model for analysing the situation by using an extensive checklist. Although, this is a very powerful tool, its use is combined with high effort, thus it is not possible using it practically each time a method is selected during the development process. For reducing this effort and developing models which can be used every time a method is selected, scenarios are defined which describe typical, often recurring situations of the development process.

By analysing the properties of these scenarios and their framework conditions, several criteria can be identified for the detection of suitable methods. Afterwards, the needed degree of fulfilment concerning each criterion can be defined. By analysing the methods with regard to each of the criteria one dimension for selecting a method is available. Table VIII shows three examples of such scenarios of which the first one is described subsequently.

One possible scenario describes the case of an occurring emergency, for example, the recall of a product at which a change of the solution principle is needed. Thereby a functional solution principle for the problem has to be found very fast. This means for switching the solution principle methods are needed which can be used, for example, with low effort for preparation and execution. Additionally, the chance of getting a suitable alternatively usable solution principle should be high.

Scenarios	Needed characteristics of the methods and their needed degree of fulfilment		
	Effort for execution	Effort for preparation	Chance of getting suitable results
Emergency	low	average	high
Driver of Innovations	average	average	low
Rationalisation	high	high	average

Table VIII: Link of method characteristics and defined scenarios

Individual characteristics and given structure of ergonomics

There are some research projects in which several individual characteristics that are needed for successful developing have been identified. Two of them are presented subsequently.

For example, Dylla investigated the individual development process of ten participants by a given development problem. The development process of 6 participants has been analysed in detail. Hereby, Dylla identified among other things the methodological skills, the knowledge of the developer and the competence of drawing of the participants (Dylla 1990).

Jänsch analysed the occurring problems of the introduction of new methods and identified appearing weak points. Based on this, she developed a new model for developing and introducing methods. Therefore, Jänsch summarized the results of given research projects that identified several important factors as the abilities and knowledge of developers (Jänsch 2007).

These identified abilities and knowledge can be structured based on findings of ergonomics, illustrated in Figure 24. The working performance depends on his work capacity as well as on his readiness to work. Thereby, the work capacity describes the theoretical possible performance someone can provide, thus it is a measure for the theoretical maximum performance. The readiness to work describes the readiness to bring this performance (BAuA 2007, Günther & Tempelmeier 2004).

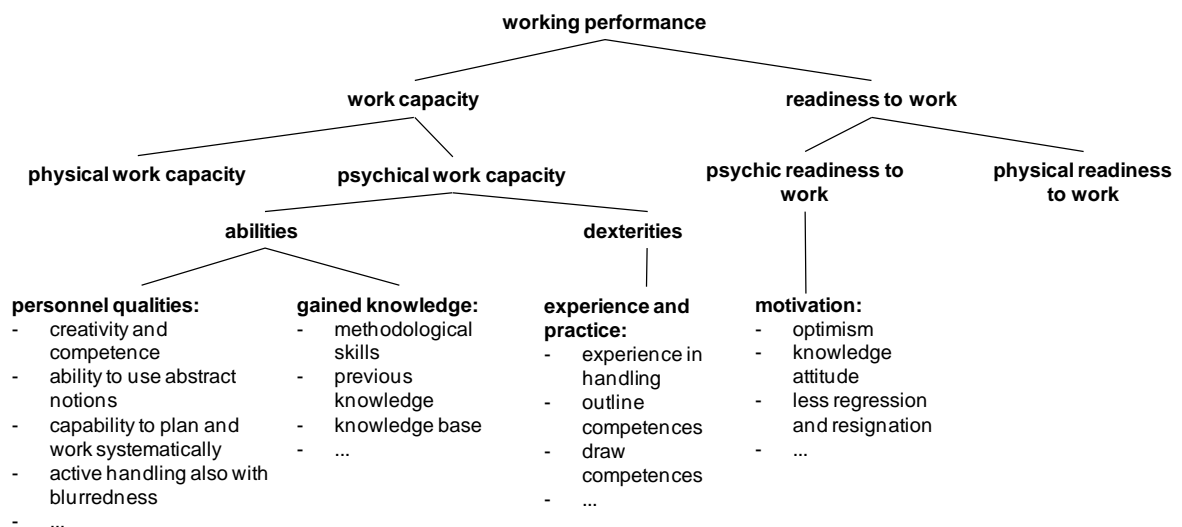


Figure 24: Structure of personal characteristics following (BAuA 2007, Günther & Tempelmeier 2004)

The work capacity can be distinguished between physical and psychical components. Examples for the physical work capacity are mobility or endurance. The psychical component implies the individual characteristics and basic skills as well as the knowledge he gained. Because of the mainly intellectual character of the development process as well as of used methods, only the psychological capacity for work is considered (BAuA 2007, Günther & Tempelmeier, 2004).

This can be further subdivided into the abilities and the dexterities. On the one hand the abilities contain personal qualities like creativity or ability to use abstract notations and on the other hand the gained knowledge, i.e. methodological skills. The dexterities describe the degree of practise and experience. Experience in handling and the competence of drawing

are examples for dexterities needed by developers (BAuA 2007, Günther & Tempelmeier, 2004).

The readiness to work can be distinguished into a physical and a psychical component, too. Thereby, the term physical readiness to work is understood to describe, for example, the daily rhythm as well as sign of fatigue. Because of the individuality of these criteria and the need of collecting this information every day, it is not possible to gather this information practically. In consequence, the physical readiness to work is not considered in the developed model.

The psychological readiness to work is a direct measure for the motivation of the user which is directly affected by his mental and physical wellness. Although the motivation affects the working performance, because of its great dependence on the situation and the problem, it is not an individual characteristic which has to be solved. For example, a developer can be highly motivated to solve a single problem, but no other one. Additionally, his motivation can be influenced by tangibles stimuli, i.e. his wage, and intangibles stimuli like a promotion or he is praised by his superior member (BAuA 2007, Günther & Tempelmeier, 2004). Because of the problem of measuring the motivation and each influence, it is not possible to consider the motivation practically in the developed model.

Most of the individual characteristics consisting of the abilities and the dexterities can be measured by known methods and techniques of psychology. The ability to work in a team, creativity, sense of responsibility, power of judgment and flexibility are already recorded and evaluated during assessment centres using standardized questionnaire and tests (GGP 2007, Florysak 2006).

Detailed analysis of methods realizing the selection process

For analysing the methods the pairwise comparison of the methods concerning each criterion is used. Thereby, the pairwise comparison has the advantage, that it can be used to derive a ranking of methods for each criterion without having knowledge about the maximum or minimum of a criterion. Additionally, another advantage of the pairwise comparison is its ability to work without quantitative information. Some characteristics of the individuals and of the situation can be measured using quantitative scales but most of them can be measured only using qualitative scales, hence, their evaluation implies several uncertainty [Ponn 2007].

In the following Table IX the pairwise comparison is presented. Thereby, for each criterion an individual pairwise comparison has to be compiled. Because of its importance for further selection process, this work has to be done by experts concerning the analysed methods.

This form of pairwise comparison only allows a statement if a method is estimated to be higher or lower than another method concerning a single criterion. Thereby, a 2 in the matrix defines, that the method on the row is better than the method on the column, a 0 implies the method of the row is lower than the method of the column. If a 1 is selected, the methods are evaluated equally.

Pairwise Comparison of Methods concerning an individual or a method characteristic		Methods				Sum of line	Normalized sum of line
		A	B	C	D		
Methods	A	x	0	0	2	2	0,33
	B	2	x	1	2	5	0,83
	C	2	1	x	1	4	0,67
	D	0	0	1	x	1	0,17

Table IX: Pairwise comparison of the methods

Subsequently, the sum of each line is calculated and normalised by the possible maximum sum of a line, hence, a ranking of the methods can be specified. Although, it seems to be possible to achieve an exact ranking, the results of the pairwise comparison contain some errors, because of occurring errors during measuring as well as errors of the pairwise comparison itself. Thus, clusters of methods based on their ranking concerning each single criterion are defined. At first, three clusters are defined by dividing the scale of the normalised sum of line into three. Subsequently, these limits were rounded, hence, the “high”-cluster includes all methods those normalized sum line is greater than 0.7. The “low”-cluster includes methods those values are lesser than 0.3.

For example, if the pairwise comparison of Table IX would present the comparison concerning the needed creativity, method B belongs to the group of methods that needs a high amount of creativity (highlighted in red). Methods A and C belong to the same group of methods needing an average amount, although method C needs less than A (highlighted in yellow). Method D needs only a minimum of it (highlighted in green). The result of the pairwise comparison and the ranking is summarized in Figure 25.

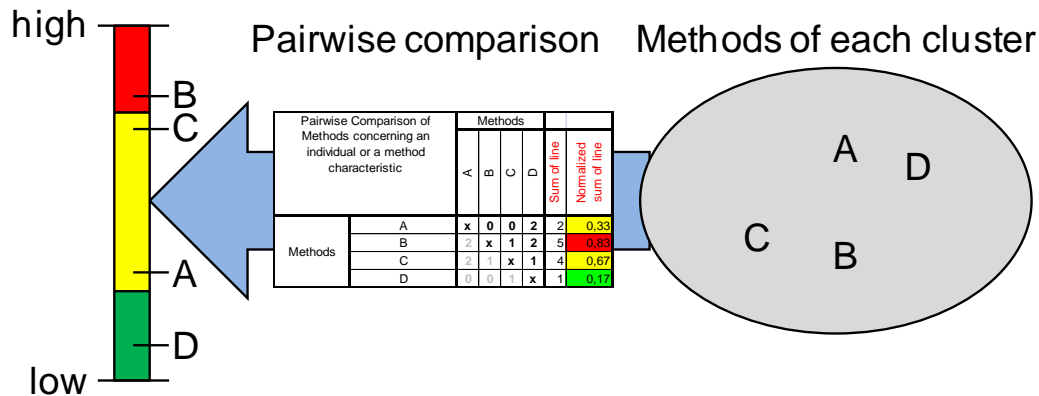


Figure 25: Clustering of methods concerning their results of the pairwise comparison

By using these exact limits for clustering, methods with a normalized sum line in proximity to one of these limits could be easily grouped to the wrong cluster. Using the example of Table IX, if method A would be evaluated being equal to method C, instead of being a member of the “average”-cluster A would be a member of the “low”-cluster (normalized sum line would be 0.17), thus, a change of only one pair of elements of the

pairwise comparison could switch a method from one cluster to another one. For solving this problem transient areas (limit ± 0.05) are defined. A method with a value insight the defined transition area is assigned to the main cluster considering its exact normalized sum line as well as to the other cluster with reservation is highlighted in squared brackets. Using the example of Table IX the methods A and C each are assigned to two clusters, presented in Table X.

		Methods
Criterion	high	B, [C]
	average	A, C
	low	[A], D

Table X: Clusters of methods

Concerning some characteristics of the individuals or situations, it is not meaningful to define three clusters, because of its binary type of decision. For example, a method can be used meaningfully during one or more phases of the development process. It only has to be decided if the method meaningfully is useable during each phase or not. This decision has to be made for each phase of the development process.

Selection process by using the defined clusters

Finally, the process of selection itself will be presented. Therefore, on the one hand the clusters of the methods as well as the identified characteristics of the methods and individuals are used. Experts have to identify these suitable characteristics as well as they have to evaluate the pairwise comparisons. Additionally, on the other hand information about the developer, his grade of each individual characteristic as well as his description of the development situation have to be collected and ranked using the same tripartite scale.

During the process of evaluating and selecting a method, the results of this survey of the developer as well as the results of the clusters are compared. Figure 26 presents this process that is subsequently described in detail.

For example, the developer states that the current development process is in the phase of the conceptual design. Furthermore, he states his own degree of an individual characteristic (i.e. his own creativity) to be low and another individual characteristic (i.e. his ability to work in a team) to be high. These results of the survey are highlighted in black at Figure 26.

After finishing the survey about the individual characteristics and the development situation, at first, it will be checked, whether a method can be used in the stated phase, e.g. the phase of “conceptual design”. Next, the results of the methods are compared with the statements of the developer concerning each individual characteristic. For example, a method A (highlighted in green) only needs a low degree of individual characteristic A and a high degree of individual characteristic B. Instead of this, method B demand a high degree, the individual characteristic A and an average degree of individual characteristic B.

Thus, the degree of conformity can be calculated for both methods. The calculated degree of conformity of Method A is 100%, the one of method B only 33%. Therefore, method A is a better choice for being used by the developer in the development situation. By calculating this degree of conformity, best suited methods can be selected and furthermore, it can be estimated, how well suited they are.

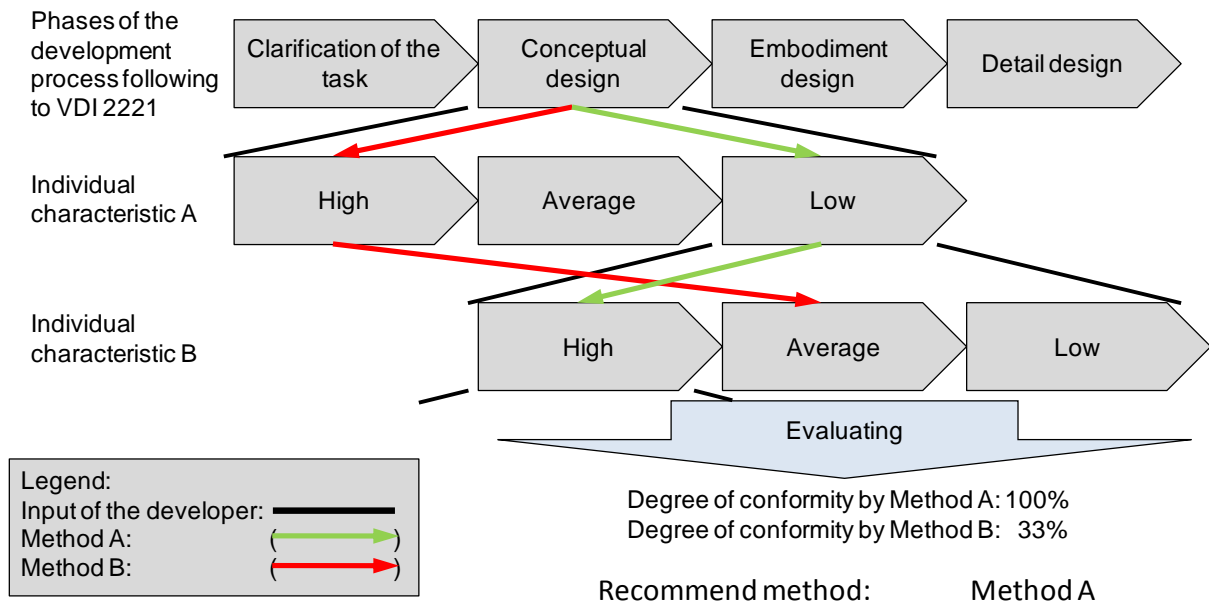


Figure 26: Process of Selection in the developed model

First evaluation of the model with a selection of methods

There are 21 criteria which are used for the first evaluation of the new developed approach to select suitable methods. Thereby, eight of them represent necessary characteristics of methods, e.g. suitability of the method to use it without a team or effort needed executing the method. Additionally, there are 13 individual characteristics (e.g. creativity, spatial sense, ability to work in a team).

As a result there are some criteria, which present the same aspect of different perspectives, first from the point of view of the method and its properties, secondly of the personal characteristics needed for the use. As an example, criteria “Team size” and “Ability to work in a team” can be mentioned. Necessity of a team for the successful use of methods is classified by the aspect of the team size. On the other side the ability to work in a team is a degree for the developer’s ability to work with other persons in one group. The criteria “Systematization level” and “Capability to plan and work systematically” are another example. On the basis of the development process situation, it may be necessary to choose methods with a high level of systematization. Otherwise, individual capability to plan and work systematically reflects the aspect of personality characteristics. In this connection a high tendency to plan and work systematically means that degree of systematization of the method should be lower. The developer can otherwise be pressurized to resign his own systematic in favor of the method systematic. Somebody who works and plans chaotically needs a support by systematical approach.

In contrast to the procedure of an assessment centres the characteristics are for this first evaluation collected by a self-assessment of the user in this approach. This means, the user will be asked how he estimates his own creativity, for example. Hereby, the developer estimates each individual characteristic by the same tripartite scale that is used for ranking and clustering the methods, thus a direct comparison as shown in chapter 0 is possible.

The developed Excel-Tool for evaluating this model is useful to implement the pair-wise comparison, which can automatically derive the ranking of methods and helps to detect properties of each characteristic. In contrast to the procedure of an assessment centres the characteristics are collected for this first evaluation by a self-assessment of the user in this approach. This means, the user will be asked, how he estimates his own creativity, for example. Hereby, the developer estimates each individual characteristic by the same tripartite scale that is used for ranking and clustering the methods, thus a direct comparison as shown in chapter 0 is possible.

On the one hand, the following Tables Table XI, Table XII as well as Figure 27 present the results of pair-wise comparisons of the methods for creating possible solution ideas and also the ranking of the methods which is derived from the comparisons. Additionally an excerpt of the developed Excel-Tool for the detection of personal characteristics and development situation is presented.

Table XI illustrates the pair-wise comparison matrix for the individual characteristic “Creativity”. Methods for creating possible solution ideas are compared with each other concerning their creativity, which is needed for the successful use of methods. As a result, the heuristic / intuitive methods might need more creativity than discursive or conventional ones.

Analysed criteria: Creativity				Methods															
				creating possible solution ideas															
				heuristic / intuitive						discursive				conventional					
				Brainstorming	Gallery method	635 Method	Delphi method	Six thinking hats	Disney creativity strategy	systematical analysis of physical correlations	classification schemes	Design catalogues	Theory of Inventive Problem Solving (TRIZ)	Literature research	Bionic	Analysis of known technical systems	Pilot schemes	Sum of line	Normalized som of line
Methods	creating possible solution ideas	heuristic / intuitive	Brainstorming	x	1	1	2	2	2	2	2	2	2	2	2	22	0.85		
			Gallery method	1	x	1	2	2	2	2	2	2	1	1	2	2	22	0.85	
			635 Method	1	1	x	2	2	2	2	2	2	1	1	2	2	22	0.85	
			Delphi method	0	0	0	x	0	0	0	0	1	0	1	0	2	17	0.08	
			Six thinking hats	0	0	0	2	x	1	2	2	2	1	1	2	2	17	0.65	
			Disney creativity strategy	0	0	0	2	1	x	2	2	2	2	1	1	2	17	0.65	
		discursive	systematical analysis of physical correlations	0	0	0	2	0	0	x	1	2	2	0	0	1	1	9	0.35
			classification schemes	0	0	0	2	0	0	1	x	2	2	0	0	1	1	9	0.35
			Design catalogues	0	0	0	2	0	0	0	0	x	1	1	0	2	2	8	0.31
			Theory of Inventive Problem Solving (TRIZ)	0	0	0	2	0	0	0	0	1	x	1	0	2	2	8	0.31
		conventional	Literature research	1	1	1	1	1	1	2	2	1	1	x	0	2	2	16	0.62
			Bionic	1	1	1	2	1	1	2	2	2	2	2	x	2	2	21	0.81
			Analysis of known technical systems	0	0	0	1	0	0	1	1	0	0	0	0	x	2	5	0.19
			Pilot schemes	0	0	0	2	0	0	1	1	0	0	0	0	0	x	4	0.15

Table XI: Extract of the pairwise comparison of methods for creating possible solution ideas concerning their need of creativity

Table XII illustrates the ranking which results of the pairwise comparison. Methods intuitively considered need a higher degree of creativity while discursive methods require rather a low degree of creativity.

		Methods		
		Creating possible solution ideas		
		heuristic / intuitive methods	discursive	conventinell
Creativity	high	Brainstorming, Gallery method, 635 Method, Synectics, Combination of two ore more methods		Bionic
	average	[Combination of two ore more methods], Six thinking hats, Disney creativity strategy	systematical analysis of physical correlations, classification schemes, [Design catalogues], [Theory of Inventive Problem Solving (TRIZ)]	Literature research
	low	Delphi method	[systematical analysis of physical correlations], [classification schemes], Design catalogues, Theory of Inventive Problem Solving (TRIZ)	Analysis of known technical systems, Pilot schemes

Table XII: Extract of the Methods-Ranking

Figure 27 illustrates an excerpt of the developed Excel-Tool with an example for methods creating possible solution ideas, which can be used for the collection of individual characteristics as well as of characteristic of the development situation. In the upper section the scenario can be chosen. Subsequently, two examples of the necessary method properties which are derived from the scenarios are shown. In the middle part it is necessary that the user carry out the evaluation of the own person concerning every individual characteristics. At the bottom evaluation takes place according to the chapter 4. The most suitable methods, additional restrictions as well as level of conformity of methods with the description are indicated.

Questionnaire for selecting a method by using scenarios and characteristics of the methods			
	Yes	No	
Do you want to use scenarios? (The needed method characteristics are affected by this)	x		
	Clarification of the task	conceptual design	embodiment design
In which phase of the development phase shall the method be used ? (Please mark only one field with a "x")		x	
Questionnaire for selecting a method by using method characteristics			
	high	average	low
Please describe the needed degree of systematization. (Please mark only one field with a "x")		x	
Is it possible using a method which has a high effort of preparation? (Please mark only one field with a "x")			x
	Method can be used by a single person	Method can only be used by a team	
Some methods need a team for being executed successfully. Do you want to select a method which can be done by a single person or by a team? Is it possible for you to put a team together?		x	
Questionnaire for selecting a method by using individual characteristics			
	high	average	low
Are you personally characterized by a systematically planning and working? (Please mark only one field with a "x")	x		
Please evaluate your own spatial imagination (Please mark only one field with a "x").		x	
Are you personally characterized by creativity? (Please mark only one field with a "x")	x		
Are you experienced in using methods? (Please mark only one field with a "x")	x		
			Number of accordances between your statements and the analysis of methods (max. 20 possible)
Auswertung Here are the best suited methods presented	Synectic, Triz, Bionic		13
Here are additional restriction of the methods presented. Some of these restrictions are very special, others are very general.	- For using bionic as a method, natural system which can be used for it, must exist and have to be known		

Figure 27: Extract of the Questionnaire for selecting a method for creating possible solutions

Summary

Following the development process, among others, developers have to solve a lot of problems. Many of these problems cannot be solved immediately; hence, one or more methods have to be used for solving them. For many types of problems, there are several

useable methods, thus, the developer has to select one of them. Therefore, the developer has to be supported by a guide, for example. Many models, which have been developed, support the developer by selecting a method by the consideration of the development problem. For this a more or less detailed guide and a questionnaire were developed. By neglecting individual characteristics for the process of selecting a method, the optimal method cannot be chosen, thus, the influence of the problem solver to the problem will not be considered. Hereby, the result either of the method selection are not optimal or there is a waste of time reaching them. Therefore, this paper improves these models by proposing the use of individual characteristics as another dimension for selecting a method. Hereby, a better support for selecting a method is being ensured.

A first verification of the developed model had been performed. Therefore, the selection process has been tested by using 22 methods for creating possible solution ideas, combining identified solutions and for evaluating and choosing a solution. For the consideration of individual characteristics, 13 of them were identified and are considered. Additionally, eight method characteristics are identified and used for characterizing the problem. The identified characteristics of the problem and the developer are surveyed by a questionnaire as a part of a developed tool.

Even though in this paper only the way of proceeding was presented and adapted to the development process. This proceeding can also be used in other sectors after it has been adapted. For that the main factors involved as well as the appropriate criteria have to be worked out. Afterwards, this proceeding can be used for all divisions of a company leading methods with various aims. In this way, a further reduction of costs for extra work or rather iterations and its costs involved can be achieved.

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Improving the Health Care Service Quality by using the Health Examination Data to Predict the Risk of Colon Cancer

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Category: Research paper

Introduction

The periodic health examination (PHE) plays an important role in the preventive health care service. The research provided by Lin et al. (2011) indicates the significant effectiveness and value of periodic health examinations which can promote early treatment of the major and manageable diseases such as hypertension, diabetes and hyperlipidemia. Lin et al. (2010) showed that the health examination data of the middle-aged Taiwanese employees can be efficiently applied to predict the metabolic syndrome development. Chang et al. (2010) indicated that the PHE is an important health promotion strategy. Earlier diagnosis and treatment of manageable diseases are the main purposes of PHE and the stepping stone to achieving good disease control. It can be seen from literature that, by means of the PHE, the preventive health service can provide main functions, such as risk assessment by disease screening and prediction, laboratory testing, and health counseling. Therefore, the periodic health examination can act as a link between the patient and the health care system.

According to the research of O'Connor et al. (1988) and Rashid and Jusoff (2009), the service quality in health care can be categorized into three aspects: service elusiveness, employee diversity, and interrelatedness. In health sector, it is not easy for consumers to understand the essence of health service products in their mind. It is because of intangibility nature of the service or service elusiveness. The provider can help consumers to understand the quality of a specific service by manipulating the tangible aspects. For the phase of employee diversity, discretion is widespread in health care because of the highly customized and judgmental nature of the service. For the phase of interrelatedness, educating patients about the use of particular service helps them understand the service, making them alert in the consumption, and improving their perceptions of a service. According to the evidence report of investigating the value of the periodic health evaluation

which is conducted by the Johns Hopkins University (2006), the periodic health evaluation could have an effect on more proximal outcomes, thus potentially leading to improvements in patients' quality of life. The report also indicated that the patient-physician relationship is important in affecting patient satisfaction, adherence to clinical recommendations, and receipt of appropriate clinical counseling and care. Based on the above concepts and evidences, the service quality of PHE can be improved if PHE provides good services such as accurate predication in identifying diseases or conditions at an early stage and thus helps postpone the development of subsequent adverse outcomes.

As Bureau of National Health Insurance (NHI) of Taiwan initiated a free preventive care service program (usually called health examination) in 1996 for adults with age over 40, the adult PHE started receiving attention by the public of Taiwan in recent years. However, Chang et al. (2010) presented that the utilization rate of PHE by the elderly in Taiwan was less than 50%. They concluded that further promotion of preventive health services in Taiwan is necessary. As shown in the literature (Borders et al. 2003), service quality can affect people's willingness in receiving health examination. Borders et al. (2003) demonstrated that the strategies of improving the quality in medical care service would lead to the increases in the chances of women receiving a clinical breast examination.

One of the purposes of this research is to provide a model for predicting diseases with high accuracy so that the PHE provider can improve the service quality of the patient-physician relationship by offering better health counseling and risk assessment. Once the quality in the preventive health service is improved, it would be possible to increase the utilization rate of the PHE.

Colon cancer is one of the most common malignancies which is accounting for over a million new cases and about 500,000 deaths per year worldwide. It is the third leading cause of cancer mortality in both genders in Taiwan. Accumulating evidence has indicated that the early detection and removal of colorectal adenomas greatly reduces the mortality and incidence of colorectal cancer. Reliable detection and resection of colorectal neoplasia before they become malignant is the underlying principle for colorectal cancer screening. By way of modern techniques such as chromoendoscopy, magnifying endoscopy and narrow band imaging, improvement of diagnostic accuracy of colonoscopy examination can be achieved. However, the utilization rate of colon cancer screening through the colonoscopy examination in Taiwan is less than 20% (Tseng, Lee and Wu 2009). This is due to the colonoscopy examination is an invasive procedure which will affect people's willingness in receiving this examination. Most of the colon cancer literature has focused on the study of the screening, diagnosis and treatment of this cancer. Not much research can be found in the prediction of the incidence of the colon cancer. Therefore, another purpose of this research is to provide a good predicted outcome for the incidence of the colon cancer which would be helpful in promoting people to receive the colonoscopy examination as they have received the preventive health examination.

Data mining is the collection of methods which offers methodological and technical solutions to find hidden patterns, trends and relationships in data. Over the last several years, data mining tools have been widely applied in dealing with the analysis of medical data and the development of prediction models to assist in disease diagnosis and in the

choice of treatment. Bellazzi and Zupan (2008) presented a review paper to discuss the scope and role of the research area of predictive data mining and to propose a framework and guideline for constructing, assessing and exploiting data mining models in clinical medicine. Chou et al. (2004) presented a hybrid breast cancer diagnostic model by integrating artificial neural networks and multivariate adaptive regression splines. Some other examples of the breast cancer prediction are provided by Ryu, Chandrasekaran and Jacob (2007) and Jonsdottir et al. (2008). Kurt et al. (2008) applied logistic regression, classification and regression tree, and neural networks methods in prediction coronary artery disease and presented the comparison of the performances of each prediction method. Chang, Wang and Jiang (2011) proposed a two-stage analysis procedure with six data mining techniques to simultaneously predict hypertension and hyperlipidemia by the common risk factors.

Hence, in this paper, based on the data of the preventive health examination and data mining methodology, we present a systematic approach for (1) finding the risk factors which are highly associated to the presence of the colon cancer; and then (2) predicting the risk of contracting the colon cancer using the obtained risk factors.

Methodology

In this paper, we proposed a systematic approach which applies the data mining methodology to predict the risk of contracting the colon cancer. This systematic approach has two-stages data analysis procedure: (1) finding the risk factors; (2) developing the predictive outcome model.

Data sources

A retrospective cohort analysis was performed with 342 adult subjects (with age from 25 to 81) who had received both preventive health examination and the colonoscopy examination at a medical center of central Taiwan in 2008. The components of the physical health examination (with 60 examined items, including assessment of blood pressure, height, weight, pulse, and examination of breasts, cardiovascular system, pulmonary system, abdominal region, neurological system, gynecological or urological systems, and etc.) are the independent variables (i.e., the predictor variables). The result of the colonoscopy examination is the dependent variable, which is classified as abnormal (with the suspected malignant neoplastic lesions) and normal (without any neoplastic lesions).

The First Stage: Finding the risk factors

According to the literature of data mining in medical applications (Jonsdottir et al. 2008), when the choice of attributes (or the input features) is too large, a great effort is usually devoted to reducing the number of attributes. Since the physical examination for each subject consists of 60 attributes (which are the independent variables), it would be appropriate to apply data mining and/or statistical methodologies to reduce the number of the attributes to find the important attributes as the risk factors for predicting the incidence of the colon cancer. In the first stage, we use the logistic regression analysis and the discriminant analysis methods to obtain the risk factors.

The Logistic Regression Analysis method

Logistic regression analysis (LRA) extends the statistical methods of multiple regression analysis to the situations where the outcome variable is categorical. When constructing the logistic regression function, the maximum-likelihood ratio was used to determine the statistical significance of the variables (Hosmer and Lemeshow 2000). The model for logistic regression analysis assumes that the outcome variable, Y , is categorical, but LRA does not model this outcome variable directly. Rather, LRA is based on probabilities associated with the values of Y where $Y=1$ represents the subject constructing the colon cancer and $Y=0$ otherwise. The conditional probability of having the colon cancer is given by $P(Y=1|\mathbf{X}) = \pi(\mathbf{X})$ where $\mathbf{X} = (x_1, x_2, \dots, x_p)$ represents the vector of p independent variables (which stand for the risk factors in this study) selected by the logistic regression approach. The LRA model for p risk factors can be expressed as

$$\ln\left(\frac{\pi(\mathbf{X})}{1-\pi(\mathbf{X})}\right) = \beta_0 + \beta_1 x_1 + \dots + \beta_p x_p$$

where $\beta_0, \beta_1, \dots, \beta_p$, are the regression coefficients.

The forward stepwise method is used to increase the significance (with p value < 0.05) of the risk factors and to calculate the correct classification rate. Then, a logistic regression model with the best correct predictive rate can be obtained, and the indicators obtained in this model are the risk factors of the colon cancer. In this research, SPSS statistical software is used to perform the LRA. Among the 60 examined items, 18 items are significant to the outcome (dependent) variable Y and are denoted as the risk factors. Table I lists the selected risk factors with the p -value shown in the parentheses.

Table I. The Risk Factors selected from the Logistic Regression Analysis Method

1. Age (0.0438)	2. Weight (0.0047)	3. Diastolic blood pressure (DBP) (0.0019)	4. Fat rate (0.0321)
5. Platelet count (0.0068)	6. Neutrophil (0.0068)	7. lymphocyte (0.0071)	8. monocyte (0.0074)
9. Eosinophil(Eos) (0.0061)	10. Erythrocyte sedimentation rate (ESR) (0.0453)		
11. beta-oxybutyric acid test urine specific (0.0351)	12. gravity (0.0253)	13. Urine occult blood (0.0140)	
14. Homocysteine (0.0310)	15. Fasting plasma glucose (0.0251)	16) Alkaline Phosphatase (Alk-p) (0.0020)	
17. Blood Urea Nitrogen (BUN) (0.0170)	18. hemorrhoids (0.0001)		

The Discriminant Analysis method

In this study, the discriminant analysis (DA) is also applied to find the risk factors. The model is built based on a set of observations where the classes (or categories) of the outcome are known. Noted that the outcome in this study is the dependent variable Y defined in the LRA method. The initial set of observations is referred as the training set.

Based on the training set, the DA method builds a set of linear functions (called the discriminant functions) for the predictors shown as following

$$Y = \beta_0 + \beta_1 X_1 + \dots + \beta_p X_p$$

These discriminant functions can then be used to predict the classes of outcome for a new observation with an unknown class. In this study, there are two classes of outcome (normal and abnormal) from the colonoscopy examination. Each new observation is evaluated by these discriminant functions and is assigned to the class with the highest value of the discriminant function. Finally, the decisive function is obtained with the X_i having significant weight β_i , where $i = 1, 2, \dots, k$ and $k < p$, as the risk factors for the colon cancer. The established model is implemented by SPSS statistical software. There are 37 examined items are significant to the outcome variable Y . Table II lists the selected risk factors with the p -value shown in the parentheses. Obviously, the number of the risk factors selected by using the DA method is much more than by using the LRA method.

Table II. The Risk Factors selected from the Discriminant Analysis Method

1. Age ($<10^{-5}$)	2. Height (<0.0001)	3. Weight ($<10^{-5}$)	4. Waistline ($<10^{-6}$)
5. systolic blood pressure (SBP) ($<10^{-6}$)	6. Diastolic blood pressure (DBP) ($<10^{-6}$)	7. Fat rate (0.0208)	
8. Body mass index (BMI) (0.0035)	9. erythrocytes ($<10^{-6}$)	10. Hemoglobin ($<10^{-6}$)	
11. Hematocrit ($<10^{-6}$)	12. Mean cell volume (MCV) (0.0416)	13. Mean cell hemoglobin (MCH) (0.02460)	
14. Mean cell hemoglobin concentration (MCHC) (0.0449)	15. Platelet count (0.0110)		
16. Erythrocyte sedimentation rate (ESR) (0.0022)	17. Urine occult blood (0.0345)		
18. Urobilinogen (UBG) (0.0216)	19. Alpha fetoprotein (AFP) (0.0064)		
20. Carcinoembryonic antigen (CEA) (0.0014)	21. Homocysteine (0.0001)		
22. Fasting plasma glucose (0.0047)	23. Albumin (0.0421)	24. Albumin Globulin (A/G) Ratio (0.0031)	
25. Direct bilirubin (BC) (0.0077)	26. Total bilirubin (0.0269)		
27. Glutamic Oxaloacetic Transaminase (GOT) (0.0049)	28. Glutamic Pyruvic Transaminase (GPT) (0.0106)		
29. r-Glutamyl Transpeptidase (r-GT) (0.0066)	30. Alkaline Phosphatase (Alk-p) (<0.0001)		
31. High-density lipoprotein cholesterol (HDL-C) (0.0001)			
32. Low-density lipoprotein cholesterol (LDL-C) (0.0144)			
33. Total cholesterol /HDL cholesterol (TC/HDL) ratio (<0.0001)	34. Triglyceride (TG) (0.0001)		
35. Uric acid (<0.00001)	36. Ferritin (<0.0001)	37. hemorrhoids ($<10^{-6}$)	

The Second Stage: Developing the predictive outcome model

In the second stage, the methods of artificial neural networks (ANNs) is applied to develop a predictive outcome model for the colon cancer based on the risk factors selected by the LRA and the DA method, respectively, in the first stage.

The Artificial Neural Networks method

Artificial neural networks are analytic techniques which mimic the processes of learning in the cognitive system and the neurological functions of the brain. The ANNs can predict new observations (on specific variables) from other observations (on the same or other variables) after executing a learning process from existing data. An ANN architecture called multi-layer perceptron (MLP) with back-propagation (a supervised learning algorithm) is known to be a powerful approximating function for prediction and classification problems. It is perhaps the most commonly used and well-studied ANN architecture (Haykin 1999).

The error correction learning works of ANN is described as follow. From the response at neuron j at iteration t , $r_j(t)$, and the desired response $y_j(t)$ for a given input pattern, the instantaneous error $e_j(t)$ is defined by $e_j(t) = y_j(t) - r_j(t)$. Using the gradient descent search algorithm, the weight connecting the output of neuron k to the input neuron j at iteration $t+1$, $w_{jk}(t+1)$, can be adjusted by the following equation

$$w_{jk}(t+1) = w_{jk}(t) + \eta \delta_j(t) x_k(t),$$

where η is the learning rate parameter which will affect the searching speed of the gradient descent search algorithm; $x_k(t)$ is the value of neuron k at iteration t ; $\delta_j(t)$ is the local error which can be directly computed from $e_j(t)$ at the output neuron or can be computed as a weighted sum of errors at the internal neurons.

In this paper, the feed-forward MLP based prediction model was implemented with three layers (one input layer, one hidden layer and one output layer). Integrating the two stages, we constructed two predictive outcome models, the LRA-ANN model and the DA-ANN model. For the LRA-ANN model, the learning rate is set by trial and error and is set as 0.9 for both models. For validation of the models, k -fold cross-validation method is applied. After testing different k -fold, it is revealed that the 10-fold with 9 training sets and 1 testing set is better than the others and is used in this study.

The Artificial Neural Networks method

The confusion matrix shown in Table III and three evaluation indices which include sensitivity, specificity and accuracy are used to appraise the performance the two proposed predictive outcome models. The higher values of the sensitivity, specificity and accuracy imply that the model has better performance in predicting the outcome. The definitions of these evaluation indices are presented as below.

Table III. The Confusion Matrix for the Colon Cancer

Outcome predicted	Real Outcome	
	Having colon cancer	Not having colon cancer
Having colon cancer	TP	FP
Not having colon cancer	FN	TN

- Sensitivity (SEN) – the probability of correctly predicting a subject having the colon cancer.

$$SEN = TP/(TP + FN)$$

- Specificity (SPE) – the probability of correctly predicting a subject not having the colon cancer.

$$SPE = TN/(FP + TN)$$

- Accuracy (ACC) – the accuracy rate of classifying each subject into the correct category.

$$ACC = (TP + TN)/((TP + FP + TN + FN))$$

Results and Discussion

In order to compare the performance of the two predictive outcome models, we constructed 10 experiments by using the 10-fold cross-validation method where the combination of the training sets and the testing set are different in each experiment. The comparison of the sensitivity (SEN), specificity (SPE) and accuracy (ACC) for the two predictive outcome models with 10 set of data groups are presented in Table IV.

Table IV. The Performance of the proposed LRA-ANN and DA-ANN models

Experiment	SEN		SPE		ACC	
	LRA-ANN	DA-ANN	LRA-ANN	DA-ANN	LRA-ANN	DA-ANN
1	66.67%	77.78%	96.00%	100.00%	88.24%	94.12%
2	50.00%	50.00%	84.62%	92.31%	76.47%	82.35%
3	85.71%	71.43%	88.89%	100.00%	88.24%	94.12%
4	33.33%	66.67%	96.43%	92.86%	85.29%	88.24%
5	45.45%	81.82%	86.96%	91.30%	73.53%	88.24%
6	60.00%	70.00%	95.83%	91.67%	85.29%	85.29%
7	53.85%	53.85%	95.45%	95.45%	80%	80%
8	61.54%	76.92%	100.00%	100.00%	85.71%	91.43%
9	45.45%	63.64%	95.65%	100.00%	79.41%	88.24%
10	50.00%	50.00%	96.67%	93.33%	91.18%	88.24%
Average	55.20%	66.21%	93.65%	95.69%	83.33%	88.02%

It can be seen From Table IV that the DA-ANN model has better performance in all three evaluation indices. The probability of correctly predict a subject not having the colon cancer (SPE) is much higher than the probability of correctly predict a subject having the colon cancer (SEN) in both models. This may be caused by the differences of the selected risk factors in the first stage. However, the overall accuracy of prediction is over 80% in each model. This implies that both models have good predicting effect in the colon cancer.

Conclusion

In this study, based on the data of the preventive health examination and data mining methodology, we present a two-stage approach for finding the risk factors which are highly associated to the presence of the colon cancer and for predicting the risk of contracting the

colon cancer with high accuracy. Therefore, the PHE provider can utilize the predicting models to improve the service quality of the patient-physician relationship by offering better health counseling and risk assessment. Moreover, this research provided a good predicted outcome for the incidence of the colon cancer which would be helpful in promoting people to receive the colonoscopy examination once they have received the preventive health examination.

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The relationship between working satisfaction and service quality of the elderly care attendants and moderating effect of ethical climate

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Introduction

Ageing now was an important universal issue the rate of elderly people increased continuously, and the population ageing phenomenon not only had impacts on economic, medical treatment, family, and all walks of society, but also was an influential factor for the future society. Twenty years ago, there were 1.3 million elders, which was 6.53% of the population; nowadays it was nearly one times than in the past, till February of 2011, there were about 2.4 million elders, which held 10.75% of the population (MIO, 2011). The more the elders were, the more people with chronic diseases and impaired functions were. So far, there were about 1,459 elderly care institutions (MIO, 2011). The institutions of elderly care had taken the place of family, and shown interchangeability. As a result, the quality of elder institutions should be comprehensive, and it is not only an index and evaluations. Service quality was an important performance indicator of service industry (Parasuraman, Zeithaml & Berry, 1985). It could also be considered as the level to content customers' need and expectation, and represented customers' opinions to the level of general superior service. It was a kind of cognitive quality, and it depended on if an enterprise could fulfill its customers' requirement (Juran, 1974). An enterprise had to solve inner customers' requirement before conveyed good service quality to outer customers (Hallowell, Schlesinger & Zornitsky, 1996). Hence, Job Satisfaction of workers was a major factor for affecting service quality at the same time (Hartline & Ferrell, 1996 ; Snipesa et al., 2005). That was because when there were satisfied workers, there were pleased costumers.

The human resources in long-term care institutions were care main attendants, their job satisfaction and service quality were imperceptibly the principal links of management in elder care institutions. According to this research, service quality had positive influence on both customer satisfaction and profit-making ability of an enterprise (Parasuraman, Berry & Zeithaml, 1988). Among studies on the correlation between job satisfaction and service quality, most of them investigated the relationship between management and satisfaction of the staff or the service quality (He. P , Murrmann & Perdue, 2010 ; Travis,

2006 ; Hallowell, Schlesinger & Zornitsky, 1996); However, a few of them examined directly the correlation between job satisfaction of the employee and the service quality. Therefore, it was one motive for this research to probe into it.

Although there were a lot of researches on service quality, most of them were about service quality of enterprises (Elmadag, Ellinger & Franke, 2008 ; Prince & Simon, 2009 ; Ahmad et al., 2010 ; Siddiqui & Sharma, 2010 ; Akbar et al., 2010). It seemed that there were a few researches done on the service quality of elderly care institutions. However, more and more employees engaged in the elderly care industry, and it was a major industry promoted by the government. The care attendants in elderly care institutions were chief research subjects. Hence this research took attendants as the research subjects, and stretched to the topic that whether different subjects would affect the correlation between job satisfaction and service quality. This was the second motive for doing this study.

The job nature of “elderly care” was a kind of “service”. The purpose was to offer supportive actions for elders with declining physical and mental states. These actions could improve elders’ physical condition and ameliorate their living quality. With the lift of customers’ rights and interests, elders and their families anticipated higher service quality. Yet care attendants might have a prejudice against, or a negative attitude towards, elders (Reyna, Goodwin & Ferrari, 2007), because they spent lengthy time taking care of bedridden, chronic or alienated elders, and even did not have enough knowledge or ability (Schaefer & Moos, 1993). Therefore, their prejudice formed negative attitude and behavior (Reyna, Goodwin & Ferrari, 2007). Elders’ physical functions might degenerate, mind might attenuate, and they might often express themselves unclearly, so how to ensure they would receive high service quality? According to related literatures (Victor & Cullen, 1988; Charles & Schwepker, 2001), it found ethical climate was worth discussing, too. Ethical climate referred to the ethical atmosphere in organizations; the staff could feel the direction of ethics, require permitted behaviors keenly, and know the forbidden behavior. Most former studies about ethical climate all put emphasis on the staff in enterprises and schools (Parboteeah & Kapp, 2008 ; Stone & Henry, 2003 ; Keiser & Schulte, 2009 ; Lau & Wong, 2009), but a few of them aimed at the ethical climate of elderly care institutions, so this research studied the influence on service quality in the interaction between job satisfaction and ethical climate. This was the third motive.

The two purposes of this research, one we understand the influence of job satisfaction on service quality. Another we know if the correlation between job satisfaction and ethical climate would have moderate effect on service quality. The research result was for suggesting the future promotion of service quality for organizational management.

Literature Review and Hypotheses

Job Satisfaction

The first scholar who proposed job satisfaction was Hoppock, and it referred to the subjective response of employees to working situations. Job satisfaction was from the

consciousness of employees that whether their own ability could satisfy customers' need (Heskett et al., 1994). Job satisfaction was an attitude towards work, and it was a positive or pleasant emotional state of workers from assessing their own job or working experience. Generally speaking, it would make employees work hard, and then increased achievements for organizations (Petty, McGee & Cavender, 1984). With higher job satisfaction, the employment turnover rate would greatly decline, or the increase in turnover rate would reduce productivity and lower customers' satisfaction.

While organizations rewarded employees with fair salary and fulfilled their inner expectation, it would strengthen their job satisfaction and willingness to engage in organizations. Cron and Slocum (1986) proposed that salaries, promotion, colleagues, job nature, and supervisors were all the factors which affected job satisfaction. According to Minnesota Satisfaction Questionnaire (MSQ) studied by Weiss et al. (1967), job satisfaction had both intrinsic and extrinsic satisfaction. The former closely related with job itself such as accomplishment, self esteem, salary, promotion and so on; the latter related indirectly with job itself- practical policies of a company, treatment to employees, job stability and so on. The general job satisfaction referred to an overall satisfaction of individuals.

Service Quality

Gronroos (1984) had an idea that service quality was the cognitive level of everyone's experience and feelings while participated in the process. Because "service" comprised features of intangibility, inseparability, variability and perishability (Fisk et al., 1993), it was different to concrete products. Thus, service quality was often uneasy to assess objectively with quantified measurement. Parasuraman, Berry and Zeithaml (1988) thought customers would judge the service quality according to the gap between early service expectation and latter service cognition. When effective service exceeded customers' expectation, it was a good service. After proposed SERVQUAL, a famous service quality scale.

Good or bad management mostly depended on the interaction between frontline employees and customers (Hartline, Maxham & McKee, 2000); Furthermore, it would influence feelings of customers about service quality. Service quality of attendants would directly affect customers' satisfaction (Crosby, Evans & Cowles, 1990). Because customers always used attendants' behavior to judge service quality received, attendants' behavior during service process was extraordinarily important (Parasuraman, Zeithaml & Berry, 1985). Likewise, service behavior of care attendants was the first condition when conveying service quality. Care attendants were in the boundary-spanning position between the operation of organization and direct contact with customers. As a result, how to give employees mental or substantial assistance to enhance their emotional attachment and bring sense of obligation to help organizations achieve goals was considered more and more important during these years (Eisenberger, Fasolo & Davis, 1990).

The Influence of Job Satisfaction on Service Quality

Fishbein and Ajzen (1975) proposed Theory of Reasoned Action (TRA) whose purpose was to understand and predict personal behavior. It advocated that attitude towards behavior and subjective norms would have influence on behavior intention. According to this theory, whether a person conducted certain behavior depended mainly on individual attitude towards behavior and subjective norms; especially, the attitude towards behavior (Khazanachi, 1995).

Hom, Prussia & Griffeth (1992) believed that job satisfaction was a kind of emotional state, and its nature a type of attitude. When employees had higher job satisfaction, they would be more enthusiastic workers. For instance, while employees were satisfied with their job, the manner to repay grew suddenly. It also facilitated them to dedicate themselves, repay the organization (Organ, 1990; Williams & Anderson, 1991), and promote the service quality. Korman's research (1977) indicated that job satisfaction of employees would inspire working willingness, motive, and sway work efficiency and effects. To sum up, job satisfaction and service quality had positive correlation. Propose following hypotheses:

H1 : Job satisfaction had positive correlation with service quality

H2a: Intrinsic job satisfaction had positive correlation with service quality

H2b: Extrinsic job satisfaction had positive correlation with service quality

Ethical Climates

From Victor and Cullen's (1988) points of view, ethical climate referred to organizational practice with ethical connotation and a procedural universal consciousness. Schwepker (2001) also indicated ethical climate was an individual general consciousness about related codes, policies, and supervisors' action in organizations. Malloy and Agarwal (2002) deemed that forming ethical climate was to form the members' structure of psychological consciousness which fit in with the organization, and it made the staff understand what the common values and goals were in the organization. Consequently organizational ethical climate would also affect many policy decisions; besides, supervisors played an important role in its continually existence and formation (Schein, 1985).

Reflections and applications of ethical climate on elderly care was to proceed an action, among the elders, caretakers, and care institutions, which fit human nature, establish good relationship, and accomplish both sides' criteria. This research based on Schwepker's view (2001) and gave ethical climate a definition-when offering elderly service, the related ethical behavior codes and policies set up and carried out by the supervisor; or a consciousness about ethical subject formed with norms among colleagues. Therefore, stretch the viewpoints of Schein (1985) and Schwepker (2001) supervisors of care institutions and norms among care attendants both played crucial roles in continuous existence and formation of ethical climate.

The moderating Effect of Ethical Climate

Based on Social Cognitive Theory presented by Bandura (1989), cognition and other individual factors, behavior, and external environment would affect each other. In this theory, individual dimension included personality, cognition; external environment

included social norms, codes, and peer encouragement; behavior dimension included individual concrete behavior. Wood and Bandura explained human behavior from the point of triadic reciprocal causation, and said behavior was formed by both individual factors and external environment. High consciousness of ethical climate would make care attendants follow supervisors' requirement about work ethic by mastery modeling. Such an effective modeling would raise the intention of ethical behavior. Moreover, due to the high positive ethical climate, care attendants would perceive supervisors' insistence and regulations, and peer encouragement or norms. These regulations or behavior would also have instructive feedback to care attendants, make them bring self-regulatory and self-reflective (Wood & Bandura, 1989), and then promote the service quality. In other words, forming positive ethical climate should promote the service quality of organizations. Consequently, this study reasoned a following hypothesis:

H3: Employees will enhance service quality moderating effect between high job satisfaction and positive ethical climate.

Research Methods

The methods of this research were designed to explain the relation among research hypotheses- aimed at care attendants of eight elderly care institutions in Taiwan about the job satisfaction, service quality and ethical climate.

Sample and process

This research adopted care attendants of eight elder care institutions in Taiwan as sample- three public and five private ones. The questionnaires were mailed, instructions were given above the questions, and subjects were told to fill out the questionnaires anonymously. After the questionnaires were filled out, they were mailed back. The total questionnaires were 310, and the valid ones were 285- those with incomplete and consistent answers were subtracted. The valid return rate of this survey was 92%.

Measures

The validity and reliability of this research's measuring means of important elements, job satisfaction, service quality and ethical climate, were all examined. The descriptions are as follows:

Job Satisfaction

Owing to different industry, this study adopted measure of job satisfaction based on short form Minnesota Satisfaction Questionnaire, by Weiss et al., (1967). More, it used a self scale which focused on interviews with seven outstanding senior care attendants recommended by managers. According to the expert's advice the form was consisted of 5-point Liker scale statements, and it had 10 items. The intrinsic satisfaction comprised 6 items-receiving respects in work place, being able to offer service, playing ability fully, having opportunities to develop, always having things to do, and managing ability of supervisors; the alpha was 0.81. On the other hand, extrinsic satisfaction comprised 4

items- policies of institutions, treatment from supervisors, working situation and environment and praise received; the alpha was 0.86. Responses range of this form was from 1(very dissatisfied) to 5 (very satisfied), and sum of item responses represented the global job satisfaction. The alpha was 0.89.

Service quality

Lin and Tsaun (2004) found that there was positive correlation between service behavior of frontline employees and customers' cognition about service quality. Most elders in care institutions were with functional degeneration or Alzheimer's disease, they could not express themselves clearly, so it was hard to make elders express how the service quality they received was. As a result, this research studied the service behavior of care attendants as the dimension of service quality. In this study measured by Prosaically Service Behaviors was of Lance & Stephen (1997). The form consisted of 15 items- helped customers with problems beyond expected or required, performed all tasks that are required, and helped other employees with heavy workloads. The scale used in present study was measured on 7- point Liker scale from 1 (strongly disagree) to 7 (strongly agree). The alpha was 0.92.

Ethical climate (EC)

The measure of ethical climate (EC) in this study, based on work by Charles and Schwepker (2001), consisted 7 items and five-point Liker-type statements 1(strongly disagree) to 5 (strongly agree). Items were as follows, institution enforces ethical codes strictly, and good management of a company to let employees know unethical behaviors would not be tolerated. The Scale had satisfactory reliability with coefficient alpha 0.90.

Data analysis

The returned data from questionnaires were analyzed by SPSS 15.0. The variables were examined by descriptive statistics- Frequency, Percentage, Standard Deviation, job satisfaction, service quality and ethical climate were assessed by Pearson correlation coefficient, difference between intrinsic and extrinsic satisfaction was tested by t-test, and related factors of job satisfaction were examined by the linear regression analysis.

Results

There were 60 male care attendants, 21%, and the average age was 45.5; female objects were 225, 78.9%, the average age was 42.7(the oldest was 68; while the youngest was 20). Their education levels were: elementary schools, 9.1%; junior high schools, 37.5%; senior high schools, 42.8%; vocational schools, 8.8%, universities or colleges, 1.4%. 32.6% of current elderly care institutions was public, 40.0% was private, and 27.4% was juridical persons. In the institutions, 72.6% was formal attendants, 1.4% was temporary attendants, 9.1% was contracted attendants, and 16.8% was from human resources companies. The seniority of care attendants were not limited with the current institutions, and the average was 5.6 years (the longest was 30 years; the shortest was 3 months). Care attendants who had certifications were 96.8%.

Table I presented all the descriptive statistics, correlation coefficient and reliability of all variables. The result showed that Intrinsic Satisfactory ($Mean = 3.80, SD = .53$) was slightly higher than Extrinsic Satisfactory ($Mean = 3.62, SD=.66$). Job satisfaction had a notable positive correlation with service quality ($r = .48, p<.000$); while it had a high positive correlation with ethical climate ($r = .43, p<.000$); the service quality showed a high positive correlation with ethical climate ($r = .35, p<.000$).

Table I Average, standard deviation and correlation coefficient in research (N=285)

Variables	Average	SD	1	2	3	4	5
Job satisfaction	3.71	.52	(.89)				
Intrinsic Satisfaction	3.80	.53	.92***	(.81)			
Extrinsic Satisfaction	3.62	.66	.88***	.61***	(.86)		
Service Quality	5.31	.74	.48***	.50***	.33***	(.92)	
Ethical climate	3.86	.52	.43***	.33***	.45***	.35***	(.90)

Note: *** $p<.0001$, ** $p<.01$, * $p<.05$, diagonal is reliability

In table II this research based on hierarchical regression analysis to assess the first hypothesis, to study the major effect of job satisfaction and service quality. There was a positive correlation between job satisfaction and service quality ($\beta = .48, p<.000$). That was, the higher job satisfaction of care attendants was, the better service quality of elders was. Therefore, first hypothesis (H1) was supported. Secondly, intrinsic and extrinsic satisfactions were also notable, the results were .50 and .33 distinctively, so hypotheses 2a and 2b were proved. The score of intrinsic satisfaction was higher than the extrinsic satisfaction's, so they were assessed by t test and had remarkable difference.

On the aspect of ethical interaction, the original chief effect of job satisfaction was notable ($\beta = .48, p<.000$); while adding interference, the standardized regression coefficient of interaction between independent variable and dependent variable ($\beta = .17, p > .05$) was decreased which was not notable. There was a notable correlation between job satisfaction and ethical climate ($\beta = .36, p<.000$). Furthermore, this research carried a multicollinearity diagnostics in all regression models. The VIF, Variance Inflation Factor, used to prediction variables was between 1.0 and 3.0 and displayed that multicollinearity problem did not have much influence on this research result. To learn more about the interactive state between job satisfaction of care attendants and ethical climate, the high and low score groups were decided by the 25% of the highest and lowest ethical climate scores of valid questionnaires. Put the values of high and low ethical climate into regression, and then made an interaction figure (figure I).

In figure I, we could get the idea that the interaction between high ethical climate and job satisfaction could enhance the positive correlation of service quality; the interaction between low ethical climate and job satisfaction did not have notable effect on the

correlation of service quality. This result agreed with third research hypothesis, so H3 was supported.

Table II The hierarchical regression analysis of influence of job satisfaction and service quality on service quality

Predicted variables	Service quality		
	β	R ²	ΔR^2
Step1 : main effect			
Job satisfaction	.48***	.22	.23
Intrinsic Satisfaction	.50***	.25	.25
Extrinsic Satisfaction	.33***	.11	.11
Step2 : moderate effect			
Job satisfaction	.17	.22	.23
Job satisfaction * Ethical climate	.36***	.26	.04

Note: Regression coefficient in table 2 was standardization β coefficient ;

*** $p < .001$, ** $p < .01$, * $p < .05$

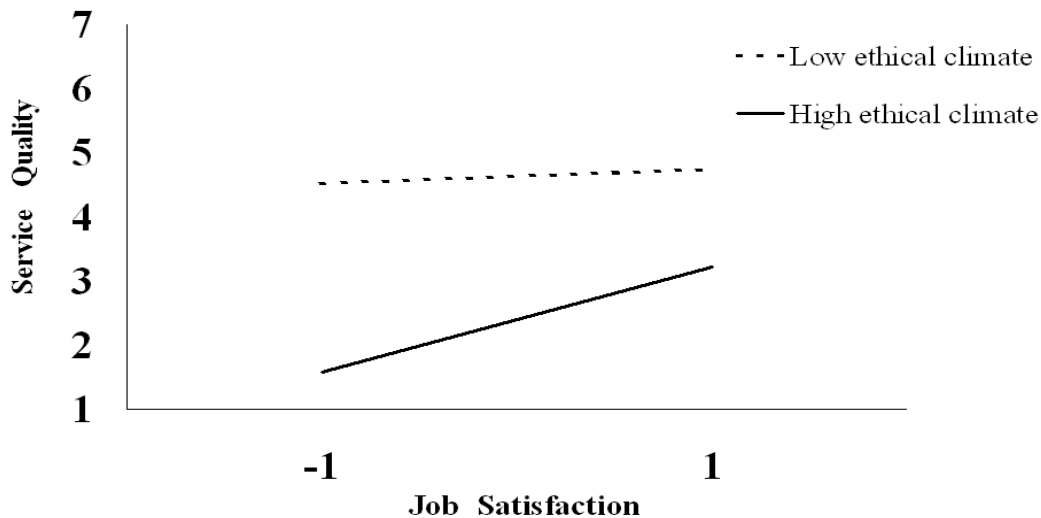


Figure I. the connection of interaction between job satisfaction and ethical climate with service quality

Conclusion and discussion

This research discussed the correlation of job satisfaction and service quality. The research result found that care attendants with high satisfaction could have higher service quality, and it corresponded with theory of reasoned action (Fishbein & Ajzen, 1975). In other words, care attendants with high satisfaction, such as, receiving respect in a group, playing their abilities fully, having good working environment, would initiatively upgrade their

service quality, such as, doing regular service extraordinarily, fulfilling extra requirements, helping elders voluntarily and desperately. Tzeng and Ketefian (2002) found that there were correlations among the working environment of health care attendants, caring process, job satisfaction and fillings of patients. Karatepe, Avci and Arasli (2004) studied the sample of frontline employees, and it indicated that not only job standardization would have influence on job satisfaction and service quality, but job satisfaction would affect service quality. Although this research used care attendants as the sample, the research result was the same as others' - the correlation between job satisfaction and service quality would not be changed by different subjects.

In addition, this research found there was a notable statistical difference that intrinsic satisfaction was slightly higher than extrinsic satisfaction. According to abroad and domestic researches, care attendants occupied 70% of health human resources, but they had to offer direct service to 90% of the elderly (Castle, 2007; Zweig & Lawhorne, 2001). The primary factors which affected extrinsic satisfaction of care attendants were considerable workload, limited promotion, long working hours, poor treatment (Helmer, Olson & Heim, 1993 ; Castle, 2007). On the other hand, factors of intrinsic satisfaction was the obviously different background of care attendants, such as, education background, seniority, working experience, and which made them face working challenges and distinct self-requirement. Many researches already pointed out the importance of vocational education (Aberdeen, 2004) which could both enhance professional knowledge of care attendants and increase satisfaction of care attendants(Lin et al., 2003; Yeh et al., 2004).

On the aspect of interaction between job satisfaction of care attendants and ethical climate, this research brought that in the interaction of job satisfaction and ethical climate the service quality would be improved. It represented that if care attendants could follow the norms of ethical climate in the situation of interacting with elders, it would help the elders accept the responsibility and reliability of care attendants and strengthen the relationship. Moreover, supervisors' value had quite effect on cultivating ethical climate in work place (Cohen, 1993). By changing the ethical climate in an organization, they could prevent employees from having behaviors against ethics, for instance, mistreatment, fake positive attitude. Anti-ethic behavior would cause serious mischief to both elders and organizations (Wimbush & Shepard, 1994), so a feasible way to make employees have positive power was to change the ethical climate of an organization (Sinclair, 1993). Creating ethical climate could provide organizations benefits like higher job satisfaction, stronger organizational commitment, and lower intention to change a job (Schwepker, 2001).

Ethical climate might not be so important in manufacture industry, but it was in elderly industry. No matter what the relation of job nature was, engaging in elderly care industry needed sympathy and patience. Therefore, the care attendants were required not only basic skills but also moderate personal affection to show their concern. Tsai and Huang (2008) studied the relationship among types of ethical climate, job satisfaction and commitment of organization. The research supported that the commitment of hospitals would affect by ethical climate.

Limitations and future research

The best way to understand the service quality was to interview with elders, but most of them were unable to express or could not convey meanings clearly. Consequently, this research could only replace it with assessment of care attendants' behavior. To suggest future research, it might be feasible to arrange observers on the spot and apply longitudinal research. That is because the research design of this study was crossing scale, the job satisfaction and service quality were also measured at the same time, and the research result could not carry out cause and effect inference.

About the research limitations, the problem was common method variance. There might be problem of common variables and overestimate the correlation among variables (Podsakoff & Organ, 1986) because the independent variable, dependent variable, and moderate variable were all collected from the same subject.

Implication for practice

On the basis of conclusion above, this research raised two connotations of management. First, job satisfaction had positive effect on service quality. Wright and Beasley (2004) said that motivation could make job satisfaction better and reach the goal of organizational perpetual management. From related researches on raising job satisfaction, it showed that if employees were satisfied with their job, the sense of safety would be inspired, and they would enjoy working more. Wright and Beasley (2004) pointed that the intrinsic and extrinsic encouragement were the primary elements. Intrinsic encouragement included factors of job itself, and most of them were about job satisfaction: achievement, job itself (liberty, promotion), praise, learning development, workload, and so on. Extrinsic encouragement referred to factors of working environment, and most of them were about job dissatisfaction: interpersonal relationship, leadership, salary, working environment and safety, and so forth. It was important to raise job satisfaction by adopting encouraging methods which were correspond with requirement and agreement of employee to enhance the employee's centripetal force and loyalty to the organization (Deloach & Monroe, 2004). Farther, supervisors could alter job satisfaction of care attendants by socialization. Investiture tactics were associated with not only reduced role conflict, greater job satisfaction but also lower behavioral intentions to quit (King et al., 2005).

Under the interaction between high job satisfaction and high positive ethical climate, employees would increase their service quality. Creating and Maintaining Ethical Work Climates Strategies: Reducing organizational anomie, inconsistency and unreliability of institutional leadership are key factors through changing and developing aspects of organizational culture. Scholars agreed that top management values and practices were critical in setting the ethical climate of an organization (Winbush & Shapard, 1994). Institutional policy has a strong impact on the level of ethical and law-abiding conduct must be implemented (Andrews, 1989). Incentive system was particularly critical in most ethical climates. Managers could take concrete steps to modify a goal-driven reward system and strictly punish violations of expected ethical conduct, even if such actions result in achieving desirable economic objectives (Cohen, 1993).

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The key factors and relationship between TQM and service quality of accountants in Taiwan high school

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Key words: TQM, Accountants, Service, quality, High School, Taiwan

Introduction

People frequently criticize the service of the accountants in Taiwan high school owing to the fact that the official accounting department has been an independence administration system with no exception in Taiwan high schools. Besides, accounting department is an independent institution different from the others. However, based on the laws of accounting, accounting department controls the budgets which are the expenditure of other departments. So, the accountants encountered conflicts with the staff of other institutions that was due to different positions and perspectives on laws such as accountants control audits standard, mechanism and so on. Therefore, how to upgrade service quality of accountants has become an important issue to the government (Holzer et al., 2009). For instance, the government of Mauritius perceived that the government had efforts to promote service quality for the public department in order to increase its productivity and efficiency in 2006 (Prabha et al., 2010). Thus, measuring the quality of service in higher education has been increasingly important (Abdullah, 2006), especially in accounting department. Moreover, the implementation of promoting service quality of accountants is a diverse strategy, the total quality management (TQM).

As Kiernan (1993) proposed, TQM is a strategy implementation, that is to say a way of quality management. Chase (1998) commented that TQM is a management practice in general. Dale et al. (2010) tried to build a TQM theory, but only developed the variables of TQM finally. Further, some other researchers also claimed that TQM is a strategy model and a general practice serving as an effective method in public serving quality (Holzer et al., 2009; Kim, 2009). However, In Taiwan, TQM is only implemented in other public sectors for administration evolution since 1980s. Accordingly, this study applied TQM to service quality of accountants in Taiwan high schools. There are three main purposes in this study. The first purpose is to provide better understanding on the importance of the serving quality in accountants and TQM. Secondly, the research investigated the essential factors on service quality of accountants in Taiwan high school. The last and above all purpose is

to offer a substantial amount of data and suggestions regarding how to upgrade service quality of accountants in Taiwan high school.

For above the purposes, due to few studies deeply aiming at relationship between TQM and service quality, the paper deeply explore relationship between TQM and service quality of accountants. Besides, the idea of serving quality was rarely applied to accountants; this study tried to apply serving quality in accountants, and how to upgrade serving quality of the accountants in high school. Consequently, by conducting this study, hopefully, the findings might contribute to fulfill three gaps. The first contribution in this study is to propose a model to investigate relationship between TQM and service quality of accountants. The second one is to explore the main factors within TQM to the serving quality of the accountants in practice. Finally, which factor is the most important on service quality of the accountants?

Literature Review and Hypotheses

Service Quality

Service quality is a mark how works of the person. From previous studies, service quality as an overall evaluation of service (Taylor & Baker, 1994), whereas others view it as a multidimensional construct formed from an evaluation of several servicing attributes (Parasuraman et al., 1988, 1991, 1994). Service quality is as an overall judgment similar to attitude towards the service and generally accepted as an antecedent of overall satisfaction to serving object (Parasuraman et al., 1988; Zeithaml & Bitner, 1996, 2000). In addition, service quality in all service encounters is thus intrinsically affected by the perspectives of both the service provider and the service receiver. Similarly, Czepiel (1990) concluded that research on service quality must always include the perspectives of both the provider and the receiver. Perceived serving quality results from comparisons by serving objection of expectations with their perceptions of serving delivered by the service providers (Zeithaml et al., 1990, 1988). According to the aforementioned, the provider and the receiver of service quality understand information each other. Therefore, the information process theory is a key theory that it process information between the provider and receiver each other.

In addition, the influencing factors of the serving quality, Zeithaml et al. (1990) suggested four influencing factors: word-of-mouth communications; personal needs; past experience; and external communications. Thus, the serving quality of accountants how to measuring the quality of service in higher education is increasingly important (Abdullah, 2006). Moreover, Parasuraman et al. (1985, 1988, 1994) have made use of qualitative and quantitative research following generally accepted psychometric procedures. This resulted in the development of the original 44-item (expect and reality spilt half) SERVQUAL instrument that represents one of the most widely used practice of serving quality. The SERVQUAL has provided researchers with the possibility of measuring the reality-expectations five gaps (tangibles, reliability, responsiveness, assurance, and empathy) ostensibly composed of five determinants that this study adapts.

According to the above statement, the accountants would like to do the better serving quality that they have to focus on the perspectives of information both the provider and the receiver to consist. By accountants provided accurate information to staff who they received the whole accurate information. That not only can decrease the conflict between provider and receiver each other, but can upgrade the serving quality of accountants (Martin et al., 2010; Miller et al., 1997). However, serving quality provided on this process of which has an operating mechanization, and so-call strategy's implement. Besides, how accountants improve their serving quality that is an important lesson. This idea is often applying service quality of the public. This study focuses on the serving quality of accountants in Taiwan high school. Therefore, the staffs were produced a gap between expectation and reality for service quality of accountants. We inference to as following:

Hypothesis 1. The significant relationship between expectation and reality is for service quality of accountants.

Hypothesis 2. There will be ranking among fifth dimensions for service quality of accountants.

Total Quality Management (TQM)

Armand Feigenbaum firstly presented the TQM in 1961 that this conception is from Deming's 14 points management principles (Feigenbaum, 1961). The literature from late 1980s suggests interest, in the higher education sector, in The TQM model, as alternative methodology or philosophy for governance. Thus, TQM is for long-term relationships have been developed with service objects, so we can say TQM is a strategy for service quality. Kiernan (1993) produced TQM is a means for strategy implementation. Soltani et al. (2008) argued TQM is concerned with the problem of defining quality as well as examining a universal set of precepts to safeguard it as a management philosophy. However, this viewpoint was argued that the lack of a clear definition of TQM is problematic at two levels. First, at the surface level, the existence of a vast topics and approaches in quality management will obstruct theory development associated with TQM (Flynes, 1999). Secondly, at a deeper level, unclear definition makes it difficult to associate the bottom line at the commencement of TQM (Reeves & Bednar, 1994). For this problem, we try to apply TQM on service quality of accountants by the information process theory.

In addition, Wilkinson et al. (1998) analysis of TQM literature identified two important issues: the first stems from 'the difficulty in doing so'; and the second is the existence of a 'wide variety of activities and practices under TQM umbrella'. Oakland (1998) suggested TQM can be improving the effectiveness and flexibility of business as a whole, meeting serving object requirements both external and internal the organization. Dale (2003) pointed out TQM approach that ensures mutual co-operation of everyone in an organization and associated the managing processes between products and services. Soltani (2008) generated TQM practices indicates that the evidence a bounds with the definitions of both hard and soft of quality management. In the words, the practice of TQM is linking managing processes about quality management.

Besides, TQM components, in term of Oakland (1998) show five distinct components including: (1) management commitment, (2) customer-supplier chain, (3) quality systems,

(4) statistical process control tools, and (5) teamwork. Anderson et al. (1994) stated TQM have seven components such as leadership, continuous improvement, internal and external cooperation, customer focus, learning, employee fulfillment, and process management. Grandzol et al. (1998) conducted leadership, continuous improvement; employee fulfillment, learning, process management, internal and external cooperation, and customer focus (indicated the staff focus in this study) (Fuentes, 2010). However, accounting department has been an independence administration system different from the others in Taiwan. Therefore, this study adopts Grandzol et al. opinion in 1998.

Judging from the above, TQM is a strategy of which it might upgrade service quality method. This study applied to the serving quality of accountants in high school that aimed to upgrade it to the better serving quality of accountants. And, in term of Grandzol et al. (1998) measured tool by seven components of service quality. Thus, we propose the followings:

Hypothesis 3. The significant relationship among seven dimensions is a strategy for TQM.

Hypothesis 4. There will be ranking among seven dimensions for TQM.

Effect of TQM and Service Quality

Good serving quality based on input-output of bi-direction information (Galbraith, 1974). Daft & Weick (1984) pointed out the information processing that coping with the information between the deliver and the receiver. Similarly, Surprenant and Solomon (1987) stated that service encounters are human interactions. Therefore, base on this viewpoint of the information process also apply the serving quality in accountants. Previous empirical studied the relationship between TQM and organizational performance as well as service quality have shown a significant results (Flynn et al.,1994; Ahire et al.,1996; Terziovski & Samson,1999). Brah et al. (2000) studied TQM and business performance in Singapore service sector that the result showed TQM implementation relationship service quality. Antony et al. (2002) studied the successful TQM implementation will give benefits in improving quality (Samat et al., 2006). According to the above statement, TQM had the better service quality that it can through the information processing to coping with the information between the deliver and the receiver. Therefore, we propose the followings:

Hypothesis 5. Leadership, continuous improvement, employee fulfillment, learning, process management, cooperation, and customer focus have positive impacts on service quality.

Hypothesis 6. The compares between TQM and the expectation service quality, TQM and the reality service quality have significant respectively.

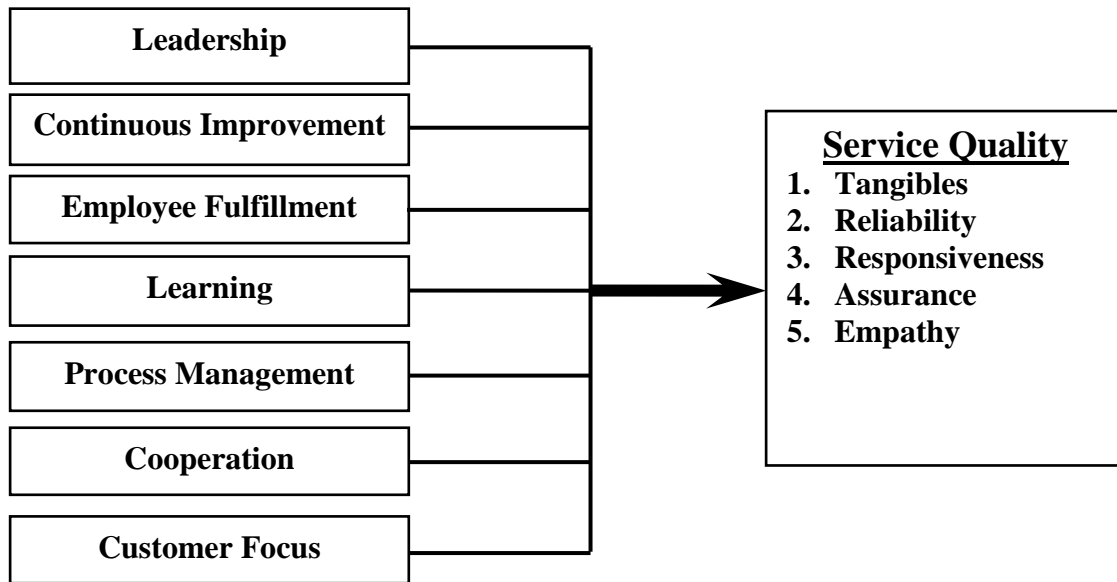
Methodology

Research Framework

This study attempts explore the factors and relationship between TQM and service quality in Taiwan high school. One we tried to find the gaps of service quality between expectation

and reality. The other, we tried to look for the main factors of effect service quality in Taiwan high school. Along with research framework, can be seen in Figure 1.

FIGURE 1
Research Framework



Sample and Procedures

The initial sample consisted of 360 staff from 18 high schools widely spreading in northern, central, and southern Taiwan. Each area comprised 6 schools which were distributed equally among three different sizes of high schools based on the numbers of the school classes. The sizes varied from under 40 classes, 41-50 classes, and over 51 classes. Each school consisted five style staffs including principle, administrating teacher, non-administrating teacher, staff, and accountants that samples were distributed 18, 144, 126, 54, 18. These data were collected from all the public high schools governed by the Ministry of Education in Taiwan. A total of 360 questionnaires were sent to the above samples. The overall response rate on our surveys was 84.72 percent. Of the respondents, 58 percent were women and 42 percent were men; the average age was 43 years (range 29–64 years); the job tenure was five years above (average tenure:16.8); and the most education level was above college. No payment was provided to participants.

Measures and Processes

For this study reliability and validity, the items of two questionnaires were translation Chinese by a university professor and two high school teachers. Then, the translate items checked by two accountants director in the public and they teaching part time a account course in university, two professors about quality management in university, and participants in this study. Unless otherwise indicated, all the variables were measured by the participant responses to questions on a seven-point Likert-type scale. The participants were asked to rate each item using the following scale: 7-“strongly agree”, 6-“very agree”, 5-“agree”, 4-“uncertain”, 3-“disagree”, 2-“very disagree”, 1-“strongly disagree”. We used two scales in this work. One the scale of service quality was measured by forty-four items from PZB

SERVQUAL scale of Parasuraman et al. (1988) and the items categorical from Parasuraman et al. (1991) to fill the bill for this study. Authors of the scale above had agreed with us to translate it into Chinese for the purpose of this study. Other total quality management was measured by 39 items for seven dimensions of TQM scale from Grandzol and Gershon (1998) and they had agreed with us to translate it into Chinese for the purpose of this study.

Measuring process, firstly, we carried out a confirmatory factor analysis (CFA) on these items. CFA for dependent variable tested by SPSS the Amos18. We conducted CFA for further validate our measures. The hypothesized dependent variable and independent variables items measuring model was tested by submitting raw data to Amos 18. Next, we used pair sample t test the gaps between expectation and reality of serving quality, and used a mean method and pair sample t test to expectation and reality dimensions ranking respectively. In addition, we conducted a factor analysis relationship among the seven dimensions of TQM. Then, we compared important ranking among the seven dimensions of TQM. Finally, the main effect of the relationship between TQM and service quality was measured from regression analysis. Besides, one we were tested effect the seven dimensions of TQM to five dimensions of service quality. The other we were tested relationship between TQM and expectation service quality, TQM and reality service quality respectively.

Control Variables

We hoped to be the best significant results and increased reliability and validity in this study. Thus, we reduced the possibility that other factors might effect service quality, so we was control variables two partial for this study. One we included control variables such as age, education, job tenure, and gender, was examined, but they were not included in the final analyses because they did not affect the results (Doucet, 2004). The other respondents' affective states are often assumed to cause common method variance (Burke et al., 1993; Liao, 2007), so themselves-esteem had cause common method variance in this study. Therefore, this study accounted for the possibility that "agree" individuals provided more positive evaluations regardless of the level of service quality and TQM. And we controlled for respondents' affectivity and assessed with a 7-point Likert-type scale (1-strongly disagree, 7-strongly agree) on the respondents specified which the best describes how they typically feel.

Result

Confirmatory Factor Analysis

In generation, we formally tested the hypotheses by a series of structural models in which all of the relationship between TQM and service quality. This study assessed the fit of the data to measurement model prior to assaying essential relationships. The first, testing non-observance estimation, all items standard coefficient were TQM range from 0.110 to 0.482 and service quality range from 0.683 to 0.953, not close 1 or over. Standard errors were TQM range from 0.072 to 0.081 and service quality range from 0.126 to 0.946 that was not much. The variance of testing errors were TQM range from 0.002 to 0.886 and service

quality range from 0.314 to 2.707, they belonged to the positive completely. Therefore, this model was not violating question to estimate. Secondly, measure of parsimonious fit PNFI (TQM: 0.696, SQ: 0.589) and PGFI (TQM: 0.658, SQ: 0.603) were greater than 0.5. Thus, the extra-quality was a good model. Thirdly, all items standard regression coefficient range TQM 0.110 to 0.482 and service quality from 0.683 to 0.953, t-values were greater than 1.96 and showed significant. Next, the sub-dimension construct validity were TQM from 1.242 to 1.287 and service quality from 0.635 to 1.214 to be greater than 0.5. Therefore, they were in compliance with the requirements of convergent validity, and it was excellent model for internal quality. The finally, the minimum of average variance extracted TQM: 0.6368 and SQ: 1.173 were greater than TQM: $(0.482)^2$ and SQ: $(0.953)^2$ that was the square of the maximum correlation coefficient in sub-dimensions. Therefore, the theoretical was in compliance with the requirement of discriminated validity, and proved a good model of the inherent quality again.

Service Quality

Table I presented the results of pair sample t testing hypotheses. We main tested Hypothesis 1: the significant relationship between expectation and reality was for service quality of accountants. The results absolute value t from 3.494 to 9.096, p-value from 0.000 to 0.001 reached significant in whole. Therefore, Hypothesis 1 was supported. In addition, there was the average absolute of difference between the expectation and reality of service quality, assurances (0.601) the maximum, and to empathy (0.203) the minimum. This result implied the important opinion that the assurance was a major factor to upgrade service quality of accountants. Moreover, Table II presented the result for Hypothesis 2 that was ranking among fifth dimensions for expectation and reality service quality respectively. The expectation services ranked important according to priority assurances, reliability, responsiveness, tangibles and empathy. Equally, the reality services ranked in turn priority reliability, assurances, responsiveness, tangibles and empathy. Therefore, the most staff believed the expectation or reality of service quality that the key factors are on reliability, assurances and responsiveness.

TABLE I

Difference between Expectation (E) and Reality (R) of Accountants Service Quality

brief description of the item	R-E	mean	t	p
Tangibles were from item 1 to item 4 that the contents belonged to appearance of accountants and hardware facilities.	Tangibles R-E	- .32049	-9.096	.000***
Reliabilities were from item 5 to item 9 that the contents finished work for service credibility and accuracy of accountants.	Reliability R-E	- .34230	-7.283	.000***
Responsiveness were from item 10 to	Responsiveness	-	-5.848	.000***

item 13 that belonged to negative question about activity and efficiency of accountants in the service.	R-E	.37967		
Assurances were from item 14 to item 17 about trust, safe, politeness and support to accountants in the service.	Assurances R-E	-.60109	-3.494	.001***
Empathy were from item 18 to item 22 belonged to negative question as first taking all staffs.	Empathy R-E	-.20393	-3.636	.000***

n=305; *** p < .001

TABLE II
Ranking for Expectation and Reality Service Quality

Expectation			Reality		
Variable	Mean	Ranking	Variable	Mean	Ranking
Tangibles	5.6598	4	Tangibles	5.3393	4
Reliability	6.2689	2	Reliability	5.9266	1
Responsiveness	6.0275	3	Responsiveness	5.6479	3
Assurances	6.4481	1	Assurances	5.8470	2
Empathy	5.2210	5	Empathy	5.0170	5

n=305

Total Quality Management

Hypothesis 3 and 4 showed table III that presented the descriptive statistics and correlation matrix for the analysis data set. The result showed correlation among dimensions for TQM, and them ranking. We used mean method and pair sample t test for ranking of TQM, and understood important factors within TQM to improve service quality of accountants. In order to the means in dimension of TQM was range from 4.753 to 5.255. By this statistics, the ranking were in order priority cooperation, customer focus, continuous improvement, process management, learning, employee fulfillment and leadership, that the method ranked the same as pair sample t test. This hypothesis 3 was supported. Furthermore, the dimensions of TQM correlations were significant all, and correlations coefficient was range from 0.445 to 0.799. Similarly, hypothesis 4 was supported.

TABLE III
Variable ranking (R), Means (M), Standard Deviations (S.D), and Correlations

N	Variable	R	M	S.D	1	2	3	4	5	6	7
1	Leadership	7	4.753	1.038	1						
2	Continuous	3	5.123	1.094	.663**	1					

3	Improvement Employee Fulfillment	6	4.971	0.878	.590**	.680**	1			
4	Learning	5	5.108	0.927	.445**	.716**	.675**	1		
5	Process Management	4	5.115	0.809	.590**	.745**	.725**	.708**	1	
6	Cooperation	1	5.255	0.920	.516**	.776**	.668**	.724**	.799**	1
7	Customer Focus	2	5.210	1.112	.475**	.685**	.625**	.618**	.742**	.722** 1

Ranking, Mean and p-value of Pair t test in Independent Variable

N	Variable	R	M	1	2	3	4	5	6	7
1	Leadership	7	-	.301						
2	Continuous Improvement	3	.069	.000***						
3	Employee Fulfillment	6	-	.000***	.001**					
4	Learning	5	.054	.000***	.741	.001**				
5	Process Management	4	.061	.000***	.852	.000***	.856			
6	Cooperation	1	.201	.000***	.001**	.000***	.000***	.000***		
7	Customer Focus	2	.163	.000***	.084	.000***	.051	.027*	.313	

n=305; *p < .05 ** p < .01 ***p < .001

Effect of SQ and TQM

The finally, hypothesis 5 showed Table IV. Hypothesis 6 presented Table V. At first, we used both the line regression analysis and stepwise regression analysis to predict effect TQM to service quality of accountants. Both analyses presented the coefficient of determination (R^2) to 0.633 and 0.631, the statistics showed. Accordingly, one this result had a high explanatory power and a good regression effect by TQM to predict service quality of accountants. The other was Beta contribution (β) that it showed influential for the seven dimensions of TQM to service quality. In line regression analysis, the most influential dimensions within TQM were continuous improvement, cooperation, following by leadership, and the least impact is customer focus. Another the stepwise analysis, model 1 only contained continuous improvement; model 2 contained the two dimensions of continuous improvement and employee fulfillment; model 3 contained the three dimensions of continuous improvement, employee fulfillment, and cooperation; model 4 contained the fourth dimensions of continuous improvement, employee fulfillment, cooperation, and leadership; model 5 contained the fifth dimensions of continuous improvement, employee fulfillment, cooperation, leadership, and learning. Table 4 showed the most influential as the continuous improvement, and the process management and customer focus less

influential. Second and last, Table 5 showed correlation between TQM dimensions and expectation of service quality, TQM dimensions and reality of service quality respectively. The correlation was low between TQM dimensions and expectation of service quality, and high between TQM and reality of service quality. According to the aforementioned, hypothesis 5 and 6 were supports.

TABLE IV
Regression Analyses for Reality Service Quality

N	Line Regression		Stepwise Regression								
	Variable	R ²	β	R ²	β						
					1	2	3	4	5	6	7
	TQM	.633		.631							
1	Leadership		.145								
2	Continuous Improvement		.271								
3	Employee Fulfillment		.059								
4	Learning		.098								
5	Process Management		.107								
6	Cooperation		.205								
7	Customer Focus		.039								
	Model 1					.743					
	Model 2					.499	.328				
	Model 3					.407	.216			.226	
	Model 4				.144	.325	.173			.249	
	Model 5				.156	.283	.140	.115		.219	

n=305

TABLE V
Correlation TQM and Expectation SQ, TQM and Reality SQ

N	Variable	Pearson Correlation Coefficient	
		Expectation	Reality
	TQM	.338	.778
1	Leadership	.249	.591
2	Continuous Improvement	.209	.743
3	Employee Fulfillment	.325	.634
4	Learning	.249	.645
5	Process Management	.382	.700
6	Cooperation	.328	.714
7	Customer Focus	.281	.619

n=305; $r < .2$, very low; $.2 < r < .4$, low; $.4 < r < .6$, generate; $.6 < r < .8$, high; $r > .8$, very high

Discussion and conclusion

In this study, we examined firstly the gap between expectation and reality value of service quality in accountants, ranking for expectation and reality value of service quality in high school. In addition, we tested correlations among seven dimensions within TQM, and ranked them. Last but not least, we measured effect TQM to service quality of accountants. Moreover, we measured correlation between TQM and expectation value of service quality, and TQM and reality value of service quality respectively. The results have supported our hypotheses in whole. We found that the effect of the assurances is the largest and that of empathy is the minimum in service quality of accountants. There is a small between ranking of expectation and that of reality of service quality, but their top three is consistence with reliability, responsiveness, and assurances. Besides, the correlations among seven dimensions within TQM showed significant, and cooperation is the top in the ranking. Furthermore, this good constructive model has high explanatory power. Finally, the relationship between TQM and service quality of accountants reached significant.

Implications and Contributions

In this study, the findings match with the hypotheses totally. To begin, the top three in the ranking in the expectation and reality of service quality are elements of reliability, responsiveness, and assurances. These three dimensions obviously imply the criteria of service quality in accountants. The leader of accountants should take three primary directions to improve service quality. Further, reliability and assurances would be applicable not only to the products but also to the services. In addition, the difference has been significant between expectation and reality of service quality. This shows a true that service quality of accountants is lower. Besides, if accountants tend to fill out the gap that the accountants must disclosure about accounting laws and affairs information to the staffs, so that the staffs can understand accounting laws and affairs. Therefore, it is that appropriate this article applied the information process theory on service quality.

Next, ranking the seven dimensions within TQM were three top orders of cooperation, customer focus, and continuous improvement. For this reason, maybe the accountants should take into consideration to cooperation with the staffs; also they can create high service quality. The work of accountants focused on process management of service quality in Taiwan high school, but it ranked at forth in this study. That mean the process management is still important, but it is not so important. Therefore, if accountants tend to do their works well, they must change their managerial style into the walk-around management and they must coordinate cooperation with the staff in public institution to finish their work together. Therefore, the coordinate cooperation is main criterion to enhance service quality of accountants. In addition, the leadership is ranking the last in this paper which implies the importance of leadership is easily neglected. It maybe because accountants other department belong to the same an independence administration system in Taiwan public. There is no flexible space to change that the public servants must implement their work on the basis of the laws. The leaders of the public are too. Therefore, the leader of the accountants in the public sector isn't the same as a sector in private units who has the power to control the finance and the strict audit. The leader of the public department in Taiwan has not possession of the power above.

In the end, the result shows enough explanatory power effect TQM to service quality of accountants. So, the leader of accounting department can adopt TQM to make improvement strategy of service quality. In addition, the continuous improvement and cooperation are the most influential of all factors. Accountants might strengthen both continuous improvement and cooperation to improve service quality. Besides, the result shows both the expectation and reality of service quality are related to TQM. The expectation of service quality is low, and the reality of service quality is high. The staffs have completely understood the conception of quality management in high school; therefore, they expect not so high to service quality of accountants. However, the fact is that, the staffs desire as well to promote high service quality in accountants. In a word, this is the reason why the expectation is lower and the reality is higher.

Finally, this article offered several contributions to the theory and practice view. To start with, we firstly applied the information process theory to TQM and service quality of accountants to explain the relationship between phenomenon and model. Second, accountants are through the information process to make staffs understand accounting laws and affairs, and staffs are through the information process to understand accounting affairs and endorsed accounting opinion. Therefore, both accountants and staffs will promote their work as well. Third, the result shows cooperation, customer focus, and continuous improvements are important for service quality of accountants. So the leader has to enhance collaboration work among departments. Fourth and last, we understand the important result of this study that TQM is an effective strategy in service quality.

Limitations and Future

This study had two limits as follows: To start with limitation can able to produced common method variance from survey at the same. We adopt the following three ways to deal with this question. At first, the sample consisted of the different area from northern, central, and southern high school in Taiwan. The next, sampling six schools every area and the sizes varied from under 40 classes, 41-50 classes, and over 51 classes that every range sampling two schools. At last, sampling twenty staff every high school, exception one accountants also included principle, administrating teacher, non-administrating teacher, and staff. The second and last limitation was sampling. Owing to the questionnaire was by the school accountant to the responders. The accountants gave the questionnaire of survey to the good interact or know well staff possibilities that it was inevitable. Therefore, this study also surveyed with five categories staff as the above. We were by larger number of the responders as far as possible to decreases this impact. In addition, questionnaire by anonymous and requested the accountants to send back the stamped envelopes, and responders kept neutral attitude and judgment to answer the items content in order to minimize the error.

We proposed several directions for future research in this study. At first, this study used also the information process theory in explanation of the issue of service quality of accountants and the result supported. In future researches, if the researchers consider using other theory to service quality in accountants to explain this affect our results. The next, this study object was the accountants in Taiwan high school, because we observed common

low quality service of accountants in public. Future research might measure the object by other industry or department such as personal department, telecommunication industry, or bank industry. The third, the atmosphere between TQM scale and service quality is seemed close. We put in the both together in the study, and they produced well the result. In the future, maybe some people consider the reverse thought to explain this affect. So any study the future researcher could design about the total difference atmosphere between independent and dependent variable are accepted. The forth, our study deeply explored the relationship between independent and dependent variables without moderate or mediator measures to do test. However, the researcher could be according to themselves study require to add moderate or mediator variable to further examine the effects. The fifth and last, the questionnaire of this study answered by five categories staff, including principle one of them. The future study are could do cross-lever study on those responder.

Conclusion

This study explored the strategies of TQM and serving quality of accountants in Taiwan high schools. The result shows a significant relationship between TQM and the serving quality of accountants. Besides, this study makes an important contribution to studying theory and practice TQM and service quality. In the theory contribution, the information process implicated TQM and service quality of accountants. The hypothesis results of this study were significant. The findings in the present study also proved that information processing theory applying to service quality of accountants and TQM is reasonable. Moreover, the accountants can help the staffs understand the affairs of accounting department and laws by using the information process theory. In the practice contribution, the leader of accountants might adopt the cooperation approach to promote the collaboration between the accountants and the staff in other departments. If the leader is good at the information process theory on the practice work, and be great at a strategy of TQM on service quality of accountants, such as promote interaction, respect staff, continuous improvement, and process management, the leader might enhance service quality in accountants. In conclusion, we can know that TQM is an effective strategy in service quality from the results.

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FACT: A Comprehensive Business Excellence Model

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Introduction

In order to respond the highly competitive external environment and the customers' expectations, enterprises have to look for effective approaches to enhance their management capabilities, such as Total Quality Management (TQM), Business Process Reengineering (BPR), Enterprise Resource Planning (ERP), Organizational Change Management (OCM) and Business Excellence (BE), etc. Among them, BE is one of the most popular approaches being used in the past two decades. The definition by Wikipedia (2011) stated that BE is the systematic use of quality management principles and tools in business management, with the goal of improving performance based on the principles of customer focus, stakeholder value, and process management. Key practices in business excellence applied across functional areas in an enterprise include continuous and breakthrough improvement, preventative management and management by facts. Some of the tools used are the balanced scorecard, Lean, the Six Sigma statistical tools, process management, and project management. Based on the definition, we acknowledge that BE is able to trace its root to TQM, however comparing to the principle concepts of TQM, BE is more holistic in nature than TQM. As described by the European Foundation for Quality Management (EFQM), BE refers to outstanding practices in managing the organization and achieving results in terms of a set of eight fundamental concepts. These concepts are 'results orientation, customer focus, leadership and constancy of purpose, management by processes and facts, people development and involvement, continuous learning, innovation & improvement; partnership development, and public responsibility.'

Besides, business excellence models (BEMs) have been generally developed by national bodies as a basis for award programs. For most of these bodies, the awards themselves are secondary in importance to the widespread adoption of the concepts of business excellence, which ultimately leads to improved national economic performance. By far the majority of organizations that use these models do so for self-assessment, through which they may identify improvement opportunities, areas of strength, and ideas for future organizational development. Users of the EQA Excellence Model, for instance, do so for the following purposes: self-assessment, strategy formulation, visioning, project management, supplier management, and mergers. The most popular and influential model in the western world is the Malcolm Baldrige National Quality Award Model (also known as MBNQA model, the MBNQA Criteria, or the Criteria for Performance Excellence), launched by the US

government. More than 60 national and state/regional awards base their frameworks upon the Baldrige criteria.

Due to BEMs have been widely implemented in the industries over two decades, a ton of experiences and evidences are accumulated. Researches were conducted to investigate their effectiveness which includes the benefits and the deficiencies. Some researches indicated that organizations obtained significant benefits. The benefits include the financial profit (Hendricks & Singhal, 2000; Pannirselvam & Ferguson, 2001) and the non-financial outcomes (Hendricks & Singhal, 1996; Ford & Evans, 2000; Wilson & Collier, 2000; Pannirselvam & Ferguson, 2001; Douglas & Judge, 2001). However, it has been noted that not all the messages are positive. On the one hand, some research findings pointed out that an excellence approach is not a guarantee of success (Powell, 1995; Terziovski & Samson, 1999; Fisher *et al.*, 2001). Also, although there is compelling evidence that business excellence delivers benefit to the organization, it is clear that it does not work for everyone (Jennigs & Beaver, 1997; Stephens *et al.*, 2005). On the other hand, practitioners usually complain that they encounter difficulties in implementing BEM which include sophisticated assessment criteria, lack of infrastructure, quality bureaucracy, excessive paperwork, cumbersome procedures, time consuming, and lack of focus (Miller, 1993; Goh & Ridgway, 1994; McTeer & Dale, 1994; Wilkes & Dale, 1998; Lee *et al.*, 2006).

Why the research findings are inconsistent? Why the practitioners meet difficulties? To answer these questions is not an easy task. It's a complicated issue in nature, which involves many contingency factors in the implementation of BEMs, such as size, industrial sector, organizational structure & system infrastructure, culture, and the degree of quality maturity, etc. The present authors argue that the most crucial thing is how BEMs are perceived by the adopters, because the perception of BEMs will guide their behaviors of using the management tool. In the way of dichotomy, BEMs can be perceived either prescriptive or descriptive. The prescriptive aspect indicates that the adopters treat BEM as a 'must' to achieve business excellence. Generally speaking, two groups of people adopt this aspect. One of the two groups is either the quality award examiners or self-assessment assessors. They are requested to follow the criteria provided by the award organization to conduct their examination. And the other group of adopters chooses BEM as the major management approach in the outset and keeps sticking on it. They often feel disappointed in the period of implementation due to the perception of 'must' aspect will keep them away from looking for another effective management approach except BEMs. On the other hand, the descriptive aspect indicates that the adopters treat BEM as a 'reference' to examine how the business excellence of the enterprise is. This group of adopters usually aims at winning the award. The use of BEM is mainly for the purposes of confirming if they have already fulfilled the requirement of the quality award.

The present authors hold that the BEM should be prescriptive-based for the purpose of providing a 'total solution' to every aspect of organizational management. However, the past literature indicated that it is still under debating for whether the existing BEMs (such as MBNQA, EQA, etc) are prescriptive or not. Based on the reasons stated above, to develop a rather comprehensive BEM which is able to help an organization in pursuit of business excellence becomes necessary. More specifically, in this paper, the present authors intend to achieve the following research objectives: (1) to give an introduction to the

existing BEMs and self-assessment, (2) to summarize the deficiencies of the existing models, (3) to raise the fundamental premises for a comprehensive business excellence model, and finally (4) to propose a comprehensive model to meet the fundamental premises.

Literature Review

A review of the past research related to BEMs is described in this section. It includes the introductions to BEMs & self-assessment, the extension models for the implementation of BEMs, and the deficiencies of the existing models. Each of these is presented in the following.

BEMs and Self-assessment

BEMs

The research done by Miguel (2004) indicated that over 80 nations have currently administered a national-level BEM which includes about 50 MBNQA-based and about 25 EQA-based. The remaining few are tailored to suit the particular the specific cultural context of the nations. The two major quality awards are thus introduced in this paper, Malcolm Baldrige National Quality Award (MBNQA) in USA and European Quality Award (EQA) in Europe. The features and attributes of the two major quality awards are briefly described. They are presented in terms of the following aspects: core values & concepts, criteria & scoring system, evaluation dimensions, and award application procedures (see Table I).

Malcolm Baldrige National Quality Award

In an effort to improve quality management practices and the competitiveness of U.S. firms, President Ronald Reagan signed the Malcolm Baldrige National Quality Improvement Act in 1987. The MBNQA was named in remembrance of Malcolm Baldrige, Secretary of Commerce, for his great contribution to US quality excellence movement. This award was created to promote quality awareness, identify the requirements for quality excellence and share information about successful quality strategies and benefits. The National Institute of Standards and Technology (NIST) currently administrate this award with assistance by American Society for Quality (ASQ) for the application review process, preparation of award documents and other administrative duties.

Table I. Summary of MBNQA & EQA features and attributes

Name (year)	MBNQA (1987)	EQA (1991)
Country	USA	European
Responsible organization	NIST	EFQM

Core values and concepts	1. Visionary leadership	1. Results orientation
	2. Customer-driven excellence	2. Customer focus
	3. Organizational & personal learning	3. Leadership & constancy of purpose
	4. Valuing workforce members and partners	4. Management by process & fact
	5. Agility	5. People development & involvement
	6. Focus on the future	6. Continuous learning, innovation & improvement
	7. Managing for innovation	7. Partnership development
	8. Management by fact	8. Corporate social responsibility
	9. Societal responsibility	
	10. Focus on results & creating value	
	11. Systems perspective	
Criteria and scoring system	1. Leadership (120)	1. Leadership (100)
	2. Strategic planning (85)	2. Strategic (80)
	3. Customer focus (85)	3. People (90)
	4. Measurement analysis & knowledge management (90)	4. Partnership & resources (90)
	5. Workforce focus (85)	5. Process & product/ service (140)
	6. Process management (85)	6. People results (200)
	7. Results (450)	7. Customer results (90)
Evaluation dimensions	Process: Approach, Deployment, Learning, Integration (ADLI)	Result, Approach, Deployment, Assessment, Review (RADAR)
	Result: Level, Trends, Comparisons, Integration (LeTCI)	
Award procedures	1. Applicants submit the 75-page application materials	1. Applicants submit the 75-page application materials
	2. Independent review conducted by at least five examiners	2. Individual assessments are conducted by at least six assessors
	3. Consensus review conducted on outstanding applicants	3. Team of assessors meets and determiners consensus score for applicants. Next, those short-listed receive site visits
	4. Site visits are conducted on short-listed finalists	4. The assessment teams prepare the site visit reports
	5. Judge reviews the on-site evaluation report and recommends the award winners to director of NIST	5. The panel of judges reviews the site visit reports, determines the winners and the role model

The process to legislate this award led to the development of a bill stated that it would help to improve quality and productivity by ‘establishing guidelines and criteria that could be used by business, industrial, governmental and other enterprises in evaluating their own quality improvement efforts’ (DeCarlo & Strett, 1990). The MBNQA criteria, used to assess an organizational performance, are divided into seven categories and provide the strategic direction for the entire organization. The seven categories are leadership, strategic planning, customer focus, measurement analysis & knowledge management, workforce focus, process management and results. These categories are built on a set of 11 interrelated core values and concepts (see Table I). The MBNQA model includes a leadership triad (leadership, strategic planning, and customer focus categories), a results triad (workforce focus, process management and results categories), and measurement analysis & knowledge management serves as the information provider to support the two triads. The way in which organizations evaluate each criterion stated above in terms of a two-dimensional system which included ‘process’ and ‘results’. The process is comprised of four sub-dimensions, ‘ADLI’ which indicates ‘approach’, ‘deployment’, ‘learning’ and ‘integration’. The result is also comprised of four sub-dimensions, ‘LeTCI’ which indicates ‘levels’, ‘trends’, ‘comparisons’ and ‘integration’.

One of the major objectives of MBNQA is to provide the recognition to the organizations that show understanding and improving their quality by continuous improvement in terms of MBNQA approach. The award procedures include: (i) applicants submit the 75-page application materials, (ii) each application is reviewed independently by at least five examiners, (iii) consensus review conducted on the outstanding applicants, (iv) site visits are conducted on short-listed finalists, (v) the full panels of judges review the on-site evaluation reports and recommend the award winners to director of NIST.

European Quality Award

14 major European companies formed the European Foundation for Quality Management (EFQM) in 1988 with the endorsement of the European Commission in response to recognize the importance of quality performance. In 1991, European Quality Award (EQA) was developed by EFQM to honor outstanding European businesses.

EQA is similar to MBNQA but has its own fundamental concepts, criteria and evaluation dimensions (see Table I). The nine criteria are comprised of quality improvement enablers and results. The quality improvement enablers include leadership, strategic, people, partnership & resources, process & product/service. Effective implementation of the enablers influences the results. The result criterion includes people results, customer results, society results and key results (see Table I). The evaluation of each criterion includes a five-dimensional system, ‘RADAR’ which indicates the abbreviation of ‘result’, ‘approach’, ‘deployment’, ‘assessment’ and ‘review’. EQA improves its own quality model by continually analyzing applicant feedback and making necessary adjustments.

The EQA procedures include: (i) applicants submit the 75-page application materials, (ii) individual assessments are conducted by at least six assessors, (iii) team of assessors meets and determiners consensus score for applicants. Next, those short-listed receive sit visits,

(iv) the assessment teams prepare the site visit reports, (v) the panel of judges reviews the site visit reports, determines the winners and the role model.

Self-assessment

BEMs illustrated in the previous section are not only designed to present the criteria and procedures to compete award winner; its purpose is to become an effective self-assessment tool for those who are interested in quality and allocate resources to serve as a guidance for improving their organizations. That is to say, the model is geared not only to the organizations in a position to successfully compete for the award but also to those who wish to take up the challenge of pursuing competitiveness and business excellence. Porter & Tanner (2004, p287-312) proposed an eight-step common processes for an organization to conduct a self-assessment (see Figure 1). It starts from choosing the framework and ends up with eliciting the action plans for those that are necessary to be corrected or improved.

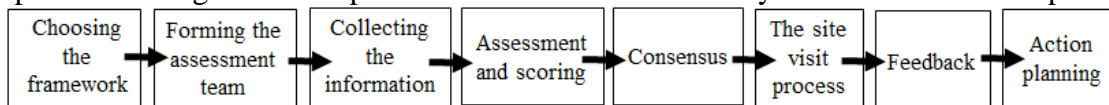


Figure 1 Common processes of a self-assessment

Step 1-Choosing the framework

The purpose of the step is to choose a BEM being used in the self-assessment project. The issues to be addressed include choosing between the various frameworks, for example, MBNQA or EQA. There is no ‘best’ framework, only the appropriate framework. Several factors dictate the choice of the actual framework, including length of experience with assessment and geographical location. At the detailed level within the frameworks, many organizations tailor the framework and terminologies to improve its usability. Except that, the management issues which related to this self-assessment project have to be identified by the in-charge manager in this step. They include the details of each main activity, timescales and resource requirements.

Step 2-Forming the assessment team

Due to the criteria address a wide range of areas, including human resource management/organizational behavior (leadership, people management and results), business analysis (all the results’ criteria), and process management. No single person is likely to have an in-depth knowledge in all these areas. Thus, the implementation of BEM self-assessment is a team-based activity. It involves forming a team that has the responsibility for preparing the submission. It is essential that the submission team members are drawn from a broad cross section of the organization, have the necessary insights and the authority to access the information required. Also, the process of assessing business or organizational excellence relies on people being able to make an objective assessment of excellence. People’s perception of excellence differs, and the team-based approach makes the whole process robust to those differing views and experiences.

Step 3-Collecting the information

Self-assessment is an organizational health check that is best based on facts and not subjective opinions. However, there are various ways of establishing the facts. This step is governed by two factors, the objectivity required and the resources available. Generally speaking, greater objectivity requires more resources. A range of data collection approaches is available for different stage of quality maturity. The approaches include questionnaire survey, matrix, pro-forma, and award-type processes. Generally speaking, the organization with the less quality maturity chooses the rather basic data collection approaches, such as questionnaire survey. It allows the assessments project to be made without too much resource consumed. On the other hand, the organization with the more quality maturity chooses the more advanced data collection approaches, such as award-type processes.

Step 4-Assessment and scoring

The first task of the assessment team is to carry out an individual assessment and score the submission in this step. Assessors review the entire submission document to identify the strengths, areas for improvement, and clarification issues in the site visit. This information is recorded in a scorebook in terms of a multidimensional evaluation scoring system, such as 'result', 'approach', 'deployment', 'assessment' and 'review' in EQA. The multidimensional evaluation scoring system has many advantages, it is important to separate approach/deployment/assessment/review from results/scope.

Step 5-Consensus

Following the individual assessment and scoring, members of the assessment team come together to share their views on the submission and to reach consensus on the strengths, areas for improvement, scores and clarification issues in the site visit. Consensus is a learning opportunity for each assessor, and provides the opportunity for the team to take an overview of the total information available from each individual assessment, reassess the evidence and reach consensus. The senior assessor plays a key role in the process and is responsible for organizing and running the consensus meeting.

Step 6-The site visit process – clarification and verification

It is almost impossible to capture the true position of an organization in the submission document. During the assessment process, many areas require further clarification. It is also necessary to make the verification to the validity of the submission document. These tasks can be carried out during site visits to the organization. Individual assessment, consensus and site visit are the key sub-processes to a self-assessment project.

Step 7-Feedback

The feedback report is the major output from the self-assessment process. It is the final analysis of the organization and contains the accumulated knowledge acquired by the assessor team. A good report is tactful and constructive and is based on fact not on subjective opinion. It should encourage the organization to take improvement opportunities forward and ensure that the best practice is deployed across the organization.

Step 8-Action planning

Any self-assessment cycle should be concluded with a post completion review to identify what went well with the process, what could be improved, and what benefits have been or are likely to be achieved. The culmination of the whole process is to take the feedback from the assessment and to develop action plans that deliver increased levels of satisfaction for the stakeholders – namely customers, employees, society at large and the shareholders to the other financial stakeholders.

The extension models

Despite BEMs presented above are designed to serve as a total solution of business management, it is still experienced by practitioners the necessity of further guidance in the implementation. That means organizations usually encounter problems in applying the models because the complex process, such as assessment criteria and scoring system are to generally defined, especially with inexperienced assessors (Siow *et al.*, 2001; Yang *et al.*, 2001; Porter & Tanner, 2004, p287-312). The extension models are then developed to remedy the problems. Some of the models are self-assessment roadmap (Porter & Tanner, 2004, p287-312), self-assessment methodology (Ahmed *et. al.*, 2003), self-assessment decision model (Li & Yang, 2003) and 4P quality strategy model (Dahlgaard & Dahlgaard-Park, 2004), etc.

Among them, it is interesting to find that each model was proposed to respond certain specific deficiencies respectively. For example, ‘self-assessment roadmap’ which was proposed by Porter & Tanner in 2004 is in response of the general defined assessment criteria. This extension model is a contingency-based, which the roadmap is divided into three phases: ‘entry’, ‘user’ and ‘world-class’ in terms of the experience of practicing self-assessment. The three phases were given the names to capture the emphasis of the phase. The entry phase indicates the start to implement self-assessment as a vehicle for improving its performance. The awareness of self-assessment is the essential in this phase. The user phase is entered when the benefits of self-assessment have been recognized and understood. The world-class is reached when continuous improvement becomes embedded into the learning organization. Porter & Tanner suggested that the specific action plan and situation have to be in place for each phase before a self-assessment project being launched. The specific action plan and situation include typical score, time from start, issues to address, leadership, self-assessment approach, organizational elements, support mechanisms, benefits/deliverables, etc.

On the other hand, ‘self-assessment methodology’ and ‘self-assessment decision model’ are proposed to respond the criticism on measurement system. The authors utilized multiple criteria decision making (MCDM) and evidential reasoning (ER) approaches in the self-assessment process. The proposed methodology provide by authors is an eight-level structured framework for self-assessment, which starts from level zero to level seven. Level zero represents the initial decision relating to the appropriateness of applying for the EQA. Level one illustrates the ingredients required for the assessment process. Level two indicates the understanding stage with reference to the EQA criteria. Level three identifies which of the sub-criteria requires a focus on planning, corrective action, measuring, or

improving. Level four concentrates on classifying organizations into seven categories and specifying the characteristics associated with each category. Level five focuses on RADAR logic, and level six provides a comprehensive guideline for assessing each element of the EQA criteria. Level seven is designed to weigh the final scores of the self-assessment process. The authors argued that the intelligent decision system being developed can be used to improve how the self-assessment process is carried out and provide accurate and fast scoring tasks.

'4P quality strategy model' was proposed by Dahlgaard & Dahlgaard-Park in the early 90s. The '4P' definition is based on the argument that the first priority of any quality or excellence strategy should be to build quality into 'people' as the essential foundation and catalyst for improving 'partnerships', 'process' and 'products'. This model starts from conducting a 7-point Likert scale questionnaire of self-assessment. The questionnaire uses a double-scale to measure the degree of importance and agreement in each aspect of excellence. The aim of quantitative self-assessment process is to involve everyone in improving enablers as well as results. The 'vital few' improvement areas are then identified by choosing the biggest differences between the two measures. The organizations finally establish cross-functional improvement team to come up with action plans by using quality map. This model was adopted firstly by the Post Denmark in 1990 and used by several Scandinavian companies after that time. In the opinion of the authors, this model is applicable in almost any organization to ensure a successful start up in TQM, or excellence building process.

The benefits and the deficiencies

A review of the previous researches in this area, it is found that some of the research findings are positive and supportive, while the others are negative and questioning. They are respectively illustrated in the following.

First of all, the positive and supportive research can be summarized into two categories. One of the two categories is to directly investigate the business results for those BEM adopters. The business results include the financial indicators, such as the researches done by Hendricks & Singhal (2000) and Pannirselvam & Ferguson (2001); and the non-financial indicators, such as the researches done by Hendricks & Singhal (1996), Ford & Evans (2000), Wilson & Collier (2000) and Douglas & Judge (2001). The non-financial indicators include the enhanced innovation & idea generation, customer satisfaction, organizational growth, employee satisfaction & involvement and effectiveness & productivity. The other category is to investigate the cause-effect linkages among the enablers and the business results. The researches done by Wilson & Collier (2000), Meyer & Collier (2001), Su *et al.* (2003) and Sauders & Mann (2005) are belonged to this category.

Despite the use of BEMs can produce both financial and non-financial benefits to an organization, it is found that receiving NQA is not a guarantee of long term success and could be failed for those who do not show the continuous improvements in accordance with external environment change (ex., Wisner & Eakins, 1994; Powell, 1995; Melnyk & Denzler, 1996; Terziovski & Samson, 1999; Fisher *et al.*, 2001). For example, the poor

performances of past winners Cadillac, Federal Express, Wallace and Motorola have led pundits to question the value of these awards.

The other researches point out the deficiencies which are related to the operations of self-assessment or award application (Miller, 1993; Goh & Ridgway, 1994; McTeer & Dale, 1994; Wilkes & Dale, 1998; Lee *et al.*, 2006). The operational deficiencies include excessive paperwork, cumbersome procedures, time consuming and quality bureaucracy, etc. To meet the award's requirements it is necessary to collect vast amounts of internal and external information, analysis the data and expend substantial amounts of managerial effort. For example, Corning devoted over 14,000 man hours towards its award submission in 1989. King Division in Westinghouse's Thermo was estimated to have spent almost USD 500,000 on internal labor and as much on outside technical assistance in putting its application together. Florida Power & Light, the first winner of the Deming Prize for Overseas Companies, spent USD 850,000 on fees to Japanese consultants to help it improve its quality systems and the point at which it could meet the Prize's standards. Also, several complaints are come from the adopters that both the Deming Prize and MBNQA represent a creeping bureaucracy of the quality infrastructure (Main, 1991).

Arguments in response to the deficiencies

Now, let's go back to the questions raised in the introduction: Why the research findings are inconsistent? Why the practitioners meet difficulties? Based upon the past literature reviewed in this section, the present authors postulate the following five arguments in response to the deficiencies which were found in the existing models.

The first argument is that the existing models are rarely made adjustments in accordance with the scientific empirical evidences. It would result in the models deviating from the practical arena and the user-friendly perspective. Although two major BEMs follow a different strategy in the model adjustment, they both went through several major and minor changes since they were announced. For instance, the MBNQA made the first major adjustment in 1988 transform the criteria system from a quality framework to a business framework. It was further transformed to a performance framework in 1997. Besides, the number of criteria was made adjustments of more and less, and the form of criteria was also changed as well. Similarly, EQA has undergone several adjustments. One of them was taken place in 1995 for the 'result' criteria being split down into two sub-criteria, leading measures and lagging measures. The other was taken place in 1999 for introducing the RADAR logic and changing the criteria. It is believed that the ideas of the adjustments were mostly derived from the subjective experiences of either the experts in the award-in-charge organization or the external consultant/academician. The present authors argued that lack of scientific empirical evidences will result in the adjustments become too emphasis on the prescriptive perspective which implies the ignorance of users' needs.

The second argument is that the existing models, except self-assessment roadmap and MBNQA, do not include the contingency factors which are particularly important to the organization with different size, industry sectors and experience in practicing self-assessment. For example, small and medium enterprises (SMEs) show their interesting to BEMs, but thus far the models are not widely utilized in this area. Wilkes & Dale (1998)

suggest that the development of a simplified model which is suitable for SMEs is necessary. The simplifications include number and format of the criteria, application processes and guidelines. On the other hand, Svensson & Klefsjö (2006) warned that it probably wastes resources to conduct a self-assessment if the organization has not reached the necessary quality maturity level. Karapetrovic & Willborn (2001) suggested to link the choice of the approaches with the quality maturity level of an organization and the intensity of effort invested in the self-assessment. Less complicated approaches (ex., questionnaire survey) are suggested to the less mature organization, while the more complicated approaches (ex., award simulation) is suitable for the more mature organizations.

The third argument is that the existing models, except 4P quality strategy, are essentially attributed to a sort of assessment tools only instead of serving as a 'total solution' management tool. A total solution indicates that the tool has to be usable in each phase of Deming PDCA management cycle. As we know, both self-assessment and award review processes serve as the function of 'check' in the PDCA cycle. It is necessary to utilize other management tools or techniques to perform the rest of three in the cycle. That means the management tools or techniques except BEMs have to be employed after the areas for improvement being identified. The management tools or techniques are not specified in the existing models in spite of it is always claimed that any management tools and techniques can be integrated into BEMs.

The fourth argument is that the existing models have not had enough persuasiveness to convince 'total employee involvement' which is 'the must' in self-assessment. The researchers in this area indicated that the cooperation and teamwork are necessary ingredients for a self-assessment success (ex., Taylor & Hill, 1992; van der Wiele *et al.*, 1996; Chapman, 2000; Jackson, 2001). Also, Conti (1997) suggested that self-assessment team should be the main mechanism for gaining employee involvement. It is generally that the complexity of most processes places them beyond the control of anyone individual and thus the only efficient way to tackle process improvement is through teamwork. This has to rely on the premise that people are willing to support any effort in which they are asked to take part in (Oakland, 1999). However, the operational deficiencies stated above always keep the employee staying away from involvement in the self-assessment project.

The fifth argument is that the existing models are lack of integration in the operational level in spite of they do have the holistic view in conceptual level. For instance, the double triads of leadership and results are used to conceptualize the principal elements of management in the MBNQA. While, the original philosophy of EQA is that the superior performance is achieved by involving people in improving their processes. Based on the philosophical concepts, they are then further developed the models by decomposing BE into 7-9 criteria and 20-30 sub-criteria. The decomposition breaks down the organizational management into fragmentation that would result in the self-assessment being lack of integration and focus. Although the approaches (such as, the extension models mentioned above), the mechanism (such as, consensus meeting) and the regulations are established to assist the integration, it still does not work well in the practical arena (Munro-Faure & Munro-Faure, 1994, p254; van der Wiele *et al.*, 1996). Lewis (1999) found that most of departments in Southwark Council had experienced the difficulty in embedding the assessment processes into planning and review activity. Also, the researchers suggest that self-assessment and the

subsequent improvement planning should be integrated into the company planning cycle. And strategic planning as the implementation of the identified areas for improvements might need the strategic allocation of resources (Conti, 1997; Henderson *et al.*, 1999; Chin & Pun, 2002).

Fundamental Premises for a comprehensive bem

Having the review of the deficiencies in relation to the existing models, we turn out the way to postulate four fundamental premises (FPs) which are, on the one hand, in response of the arguments raised in the pervious section and, on the other hand, to highlight the required principles for the new model that will be proposed in the next section.

FP 1: It should be a prescriptive-based model but make adjustments in accordance with the empirical evidences which are descriptively derived from the scientific research.

Quality is commonly measured by two dominant factors, ‘functions’ and ‘cost’. It can be mapped to a good quality management tool which is measured by ‘usefulness’ and ‘easy-of-use’. It is apparent that a good quality BEM should be embedded the two dominant factors. ‘Usefulness’ means that adopters choose this management tool in the beginning, and the excellent outcomes are finally achieved through following the guidance of the management tool. ‘Easy-of-use’ means that the management tool is designed by fitting the propensity of humankind, and less mental effort or attention is necessary to pay on it.

Having the illustrations of the two dominant factors, two questions are raised here: What the order of the two factors is? How they are embedded into BEMs? The answers are: ‘Easy-of-use’ is generally the premise of ‘usefulness’. According to the structure of scientific logic, a scientific research often starts from the descriptive approach to empirically look for the possible influential factors in terms of the observed effects. The prescriptive approach is then employed to test the hypotheses which are derived from the previous descriptive research. Both approaches come together to make the progress of science. In other words, science benefits human being by first examining the possible causes from the effects (descriptive approach), and then observing the effects from the experiments of the possible causes (prescriptive approach). The present authors hold that a good quality BEM should follow this structure of scientific logic. That is, on the one hand, the process of following the guideline of the management tool which indicates ‘usefulness’ is the prescriptive approach. And also it can be referred to the terminologies of left-to-right method or cause-to-effect logic which were invented by Conti (2002, 2007). On the other hand, the process of fitting the propensity of humankind which indicates ‘easy-of-use’ is the descriptive approach. It can be referred to the terminologies of right-to-left method or the effect-to-cause logic, the same by Conti (2002, 2007).

FP 2: It should work well not only as a measurement model but also as an organizational improvement model in the self-assessment or the quality award competition.

As we know, BEMs are designed not only to provide the criteria and procedures for the competition of quality award but also the main purpose is to become an effective self-assessment tool for those who are interested in quality management and generate the action plans to improve their organizations. However, the empirical experiences show that both functions often do not exist in the same platform or an organization. Conti (2002, 2007) had proposed these two functions should be separated into two different models as it is used in an organization: 'quality measurement model' and 'organizational improvement model'. He said 'the award and self-assessment with the same model and process. One cannot want to have one's cake and eat it. One cannot manage a model as a recognized standard for measuring (or better, estimating) organizational quality and at the same time promoting it as an organizational improvement model, where flexibility and customization are the name of the game'.

From the philosophical perspective, 'the state of art' indicates certain behavior comes together with rationality and sensibility on the one hand, and the universality is also shown as well on the other hand. 'The state of art' is always the ultimate goal to be pursued. Sometimes, certain management approach or action is called as 'reach the state of art' due to the three attributes, rationality & sensibility & universality, being embedded at the same time. To develop a total solution type of BEM which can work well in both functions (that is, quality measurement and organizational improvement) is challenging. It implies both functions work well not only being used independently but also coming together in one model as well. It deserves the people in this professional society to make effort on it. Thus, the success of this challenging task can be referred as 'reach the state of art'.

FP 3: It should be not only seamlessly merged into the existing system in an organization but also totally accepted by employee.

It is no doubt that the BEM initiatives are utilized for the assistance of an organization in achieving business excellence and organizational sustainability. To accomplish the objective, it is no way without the total acceptance and getting BEM into a habit of daily operation by employee. In practice, integration of the BEM into the existing system can be achieved through a combination of multiple management activities in the organization, including using it as part of the strategic planning process, aligning with other organizational systems, linking with performance management and involving staff in it through teamwork. However, it is found that a number of issues and problems are associated with the implementation, such as excessive paperwork, cumbersome procedures, time consuming and quality bureaucracy, etc., which were mentioned above. These operational deficiencies always keep practitioners away for this management tool. In our opinions, it is resulted from too little focusing on understanding the human factor.

As the suggestion by Oakland (1999), the key is to align the employee with the core processes of the organization. More specifically, if the BEMs can be aligned with activities, which are already taking place within an organization, then it is more likely to become integrated into the organization and thus aid effective implementation. Dale *et al.* (1998) also recommended that the need to integrate the use of the BEMs into other management activities. The example of BE implementation at the University of Bradford Management Center done by Oakland in 2000 showed that it was seen as essential to fully integrate any

BE initiatives into the management systems of Management Center. Nonetheless, Jackson (2001) offers an interesting perspective on integrating BE tools into organizations. She emphasizes the positive effect of the tool facilitating activities that are already in place. As a result people are more comfortable with this situation than they would be in which the existing processes were completely discarded for new ones.

FP 4: It should provide a ready-to-use guidance to incorporate with the other management tools/techniques.

In subsequence of the argumentation in FP2, the existing BEMs are recognized as a good tool in conducting the assessment but it is still deficient in facilitating the organizational improvement. To be a total solution, it is necessary to incorporate the other management approaches into BEMs to remedy this deficiency. The literature told us this truth. Some of the suggested approaches include the balanced scorecard, Lean, the Six Sigma statistical tools, process management, and project management. In addition, many quality specialists (gurus, experts and consultants) have proposed their own approaches. For instance, Ho (1999) proposed a sequence of adoption starting from 5S, BPR, QCC, ISO, TPM and TQM. Krasachol (2000) proposed a five-stage of BE implementation associated with quality techniques starting from no tools in the unaware stage, to Kaizen, 5S and QC tools in the basic stage, ISO 9001, SPC, TPM and TQM tools in the developing stage, BEMs in the mature stage and a complete set of tools for the sustaining stage.

Some of others hold the open aspect, such as Voss (2005) argued that there is no such thing as ‘best’ practice. Practices evolve; they need tailoring to the context and time. He suggests that the right thing to do depends on a complex variety of critical environment and internal contingencies. Hayes *et al.* (2004) also argued that there is no ‘one best way’ and a company must make appropriate decisions to fit the context within which the organization operates. The present authors hold that a systematic and organized approach to be readily incorporated into BEM is encouraged. The models found in literature, such as Ho’s sequence model, are independent of BEMs. It is suggested to be considered a step further to incorporate them into BEMs.

Development of a comprehensive bem fact

In the previous section, four FPs highlight the directions of a new BEM. They manifest the specifications of the new model. How it will be developed in terms of the drawn specifications? In fact, it is a challenging work. Both of ‘the reductionism’ and ‘the holism’ from the existing BEMs are the two philosophical perspectives adopted by the present authors in this work. In light of the experiences in NQA examination and the development of self-assessment system in their own country, the present authors firstly consider the holism perspective to propose the conceptual model in this section. And the reductionism perspective is then considered to implicate the proposed model in the next section.

The proposed model is a three-dimensional design which is called ‘FACT’. ‘FACT’ indicates the abbreviation of ‘Framework of BE’, ‘Add’, ‘organizational Culture/Characteristics’ and ‘management Tools/Techniques’ (see Figure 2). It means that a comprehensive BEM should integrate with not only using BE framework to be guidance

and to make assessment of an organization, but also choosing the appropriate management tools/techniques and cultivating the right organizational culture/characteristics towards BE.

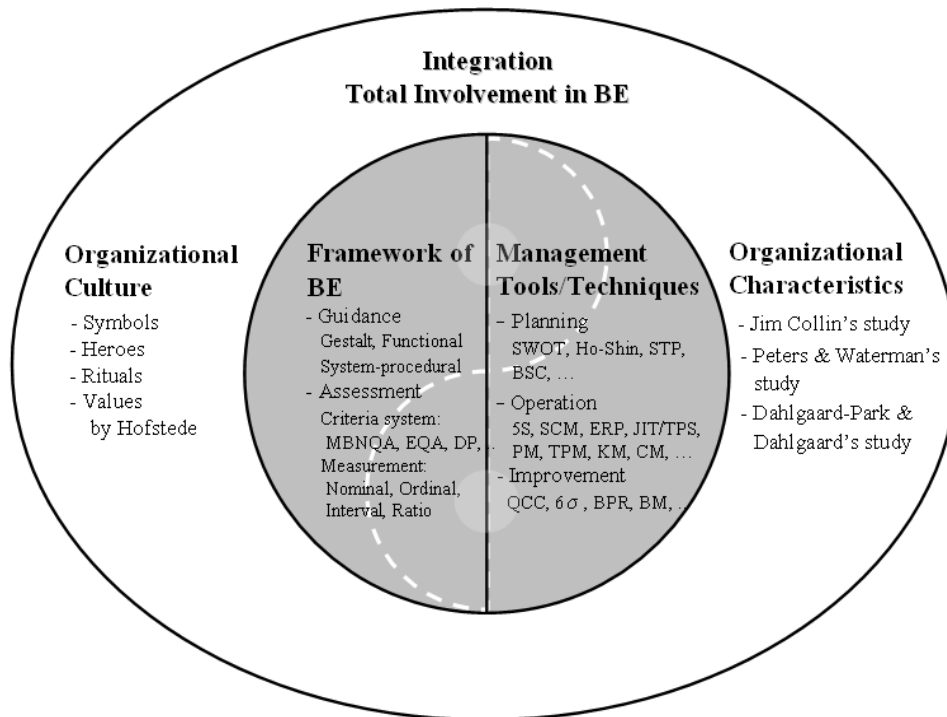


Figure 2 Conceptual model of FACT

Figure 2 presents the conceptual model of FACT. The two dimensions, framework of BE and management tools/techniques, are placed in the left and the right hand sides of the inner circle, respectively. It indicates, on the one hand, they ought to serve as the two independent functions in an organization: ‘BE assessment’ and ‘quality improvement’ which were mentioned by Conti (2002, 2007). And on the other hand, the two functions also ought to come together as one in a circle. The dotline in the circle means that two functions not only coming together as one in a circle but also a step further of fusing each other as a ‘Chinese Tai Chi’. It metaphors that the framework of BE should be further institutionalized into an organization to become an overall guidance to BE and in the meantime, all of the management tools/techniques should be implemented for the purpose of pursuing BE. The third dimension, organizational culture/characteristics, placed in the outer circle indicates that integration and total employee involvement ought to be cultivated in an organization in order to be successful in the journey of BE. It is coined the philosophy of EQA that the superior performance is achieved by involving people in improving their processes, and the 4P quality strategy proposed by Dahlgaard & Dahlgaard-Park (2004) as well. Each of the three dimensions of FACT is illustrated in the following.

Framework of BE

First of all, the use of BE framework is for two purposes: guiding the organization towards BE and conducting assessment of the performance. Guiding towards BE is the primary purpose for the intension of pursuing organizational sustainability. And, conducting

assessment is the secondary purpose which can be either self-assessment to diagnose the strength/weakness of an organization or award examination to select the winners.

For the primary purpose of using BE framework to guide an organization, it is important to set an orientation in the earlier stage of BE journey and to keep sticking on it hereafter. What kind of orientations can be chosen for this purpose? As we know, MBNQA, EQA and Deming Prize are the three most well-known BEMs in the world. Deming Prize is the originator which was launched in 1951. The western countries then followed the Deming Prize in recognizing quality and excellence, as a result MBNQA and EQA were established in 90s. So far as over hundred countries of national and regional BEMs are usually based on either MBNQA or EQA. Despite most of these models are recognized to have a high degree of commonality, the present authors found that they have significant different orientation in the design of each criteria system. For instance, MBNQA consists of seven criteria (see Table I) which represent most of the principle functions of an organizational management. It can be treated as a *functional-oriented* model. While, the nine criteria in EQA (see Table I) adopt the idea for giving the precedence to build people and partnership, then to establish the operation system and to achieve the outcomes hereafter. It can be treated as a *system-procedural-oriented* model. The ten viewpoints in Deming Prize (Porter & Tanner, 2004, p188-204) intend to examine an organization from various aspects as a whole. They include leadership & vision & strategies in top management, TQM framework, TQM concepts & values, scientific methods, quality assurance system, human resources development, effective utilization of information, organization power, management system for business elements and contribution to realization of corporate objectives. Instead of the mutual exclusive criteria design, such as MBNQA and EQA, the ten viewpoints are quite a sense of looking at an organization from different angle. It can be treated as a *Gestalt-oriented* model. Based on the three orientations stated above, adopters are allowed to choose one of them in terms of their preference or the purpose of use in guiding the organization towards BE.

Rather, conducting an assessment is the secondary purpose of using BE framework. For this purpose, the eight-step common processes proposed by Porter & Tanner (2004, p287-312) and the quality award procedures proposed by the award-in-charge organization are some of the good examples for reference. In FACT model, a BE criteria system and its measurement scale have to be chosen in the beginning. As suggested by Porter & Tanner, the choice of a BE criteria system can be one of the following: MBNQA, EQA, Deming Prize, etc. Each of BE criteria system provides a framework of standardized items that an organization can examine its performance. In addition, the choice of appropriate measurement scale suggested by FACT allows the comparisons to be made theoretical correctly among different timelines, organizations and assessors. The measurement scale can be chosen among nominal, ordinal, interval and ratio. In terms of the examinations of written report and on-site visit, the score is ordinal if it is measured by Likert scale in data collection without weighting, while it is interval as the score is derived with weighting. The 1000 point score system is ratio.

Management tools/techniques

The use of management tools/techniques is one of the three major dimensions in FACT. Three types of management tools/characteristics are categorized in this study: planning, operation and improvement. Each category has its specific function. The tools used for the function of planning include SWOT, Ho-Shin strategic management, Balance Score Card (BSC), Segmentation-Targeting-Positioning (STP), etc. The tools used for the function of operation include 5S, Supply Chain Management (SCM), Enterprise Resource Planning (ERP), Just-in-Time (JIT)/Toyota Production System (TPS), Project Management (PM), Total Preventive Maintenance (TPM), Knowledge Management (KM), etc. And the tools used for the function of improvement include Quality Control Circle (QCC), 6 σ , Business Process Reengineering (BPR), Benchmarking Management (BM), Change Management (CM), etc.

In light of BE framework serving as one side of a coin, the use of management tools/techniques is the other side of a coin in FACT. In the opinion of Conti (2002, 2007), a BEM is requested to serve as a recognized standard for measuring organizational quality and at the same time promoting it as an organizational improvement. The functions of both sides in FACT are somewhat broader than the idea proposed by Conti. As mentioned above, the use of BE framework in FACT is for the purpose of not only measuring organization quality but also guiding the organization towards BE. It is the same that the use of management tools/techniques is for the purpose of not only the organization improvement but also for the organization planning and operation. The use of BE framework indicate the functions of 'Check' and part of 'Plan' in a PDCA management cycle. While, the use of management tools/techniques indicates the rest of three functions, part of 'Plan', 'Do' and 'Action' in the cycle. Both sides come up with a coin, which means a complete PDCA management cycle.

Besides, based on the original idea in developing BEM, it is initially used as a tool for the organizational self-diagnosis. The management tools/techniques are then employed for the function of improvement. Afterward, it is extended to be used as for the application of quality award. It indicates that the use of BEM is requested to follow a sequence of self-assessment, improvement and award competition. But the use of BE framework and management tools/techniques in FACT are unnecessary to follow the sequence. In other word, on the one hand, the management tools/techniques can be employed either before or after the assessment. For instance, TPS is able to be employed in any time which is before or after the BE self-assessment being conducted. On the other hand, BE framework can be always used as a guidance to direct the organization towards BE no matter when any specific management tool/technique is employed. Here, 'Chinese Tai Chi' is used to metaphor the process of fusion of the two dimensions in FACT. In terms of Wikipedia (2011) description, the common English translations of 'Tai Chi' are 'Supreme Ultimate', 'Supreme Polarity' or 'Great Absolute'. Chinese philosophers explained the ontological necessity of 'Ta Chi' as any philosophy that asserts two elements, such as yin-yang of Chinese philosophy or positive-negative, will also look for a term to reconcile the two, to ensure that both belong to the same sphere of discourse.

Organizational culture/characteristics

Cultivating the right organizational culture/characteristics for an organization towards BE is the third major dimension in FACT. It is placed in the outer circle to surround the other two dimensions. It implies that it is impossible to have a successful BE without the right organizational culture/characteristics. Two issues are raised here: one is what the right organizational culture/characteristics is, and the other is how it can be cultivated.

In response of the first issue, the present authors postulate that ‘integration’ and ‘total involvement in BE’ are the two most important culture/characteristics in FACT which ought to be cultivated in an organization. There are the similar argumentations raised by the quality specialists. For instance, Dahlgaard & Dahlgaard-Park (2006) argued that to change corporate cultures from a passive and defensive culture to a proactive and open culture among the total employee is the basic principle in order to increase customer satisfaction and continuous improvement. Also, Caudron (1993) and Schein (1993) stated that a supportive organizational culture is essential in promoting a learning organization. Advocating challenging work, open communication, trust, innovation, and cohesion among employees are essential attributes in defining a supportive culture.

Besides, several fabulous empirical studies, which are not often mentioned in the BEM literature, have been done to investigate the characteristic in relation to organizations change themselves from mediocre to excellence. Such as, the study done by Collins & his colleagues (2001) come up with seven organizational characteristics after the conduction of intensive survey to 11 good-to-great enterprises over the period of 15 years (1985 to 2000). The seven organizational characteristics include level 5 leadership, get the right people on the bus, confront the brutal facts, hedgehog concept, rinse the cottage cheese, technology accelerators and flywheel process. The first two indicate the disciplined people. The third and the fourth indicate the disciplined thought. The fifth and the sixth indicate the disciplined action. The last one indicates the combination of the front six characteristics. The other fabulous empirical study done by Peters & Waterman (1982) elicited eight organizational characteristics through the conduction of intensive interviews with more than 14 companies which were leading in the records of long-term profitability and continuing innovation in 1980s. The eight organizational characteristics include a bias for action, close to the customer, autonomy & entrepreneurship, productivity through people, hands-on & value-driven, stick to the knitting, simple form & lean staff and simultaneous loose-tight properties. Each of the eight characteristics can be further attributed to one of the following three aspects: people & structure, customer and action. Except the BE organizational characteristics derived from above empirical studies, Dahlgaard-Park & Dahlgaard (2007) also gave an illustration to the understanding of what is excellence. It is said that ‘Excellence can be attained if you: Care more than others think is voice; Risk more than others think is safe; Dream more than other think is practical; Expect more than others think is possible’.

In response of the second issue, how the organizational culture/characteristics can be cultivated in an organization, the present authors suggested the theory proposed by Hofstede *et al.* (1990). Hofstede *et al.* classified manifestations of culture into four categories which are ‘symbols’, ‘heroes’, ‘rituals’ and ‘values’. The four categories are taken the example of peeling off the successive skins of an onion from shallow (symbols) to deep (values). Symbols are word, gestures, pictures, or objects that carry a particular

meaning within a culture. Heroes are persons who possess characteristics highly prized in the culture and who thus serve as models for behavior. Rituals are collective activities that are technically superfluous but are socially essential within a culture. The three categories are subsumed under the term 'practices', because they are visible to an observer although their cultural meaning lies in the way they are perceived by insiders. The core of culture is formed by values, in the sense of the feelings of good and evil, beautiful and ugly, normal and abnormal, rational and irrational. The feelings that are often unconscious and rarely discussable that cannot be observed as such but are manifested in alternatives of behavior. 'Integration' and 'total involvement in BE', the two most important organizational culture/characteristics in FACT, can be cultivated by using the onion theory and the instrument which are developed for the practitioners.

Implications and Conclusions

Implications of FACT

Having the development of FACT in the previous section, the implications of the model are further illustrated in the following. Instead of using 'Chinese Ta Chi' as the metaphor of the fusion between both dimensions of BE framework and Management tools/techniques in an organizational management, the trinity is used to implicate the three dimensions of FACT as a whole. Figure 3 and Figure 4 present the illustrations of the trinity of the model.

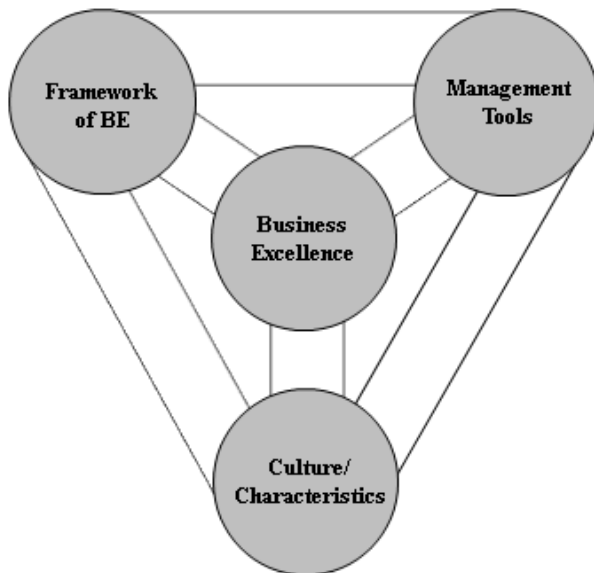


Figure 3 Illustration (I) of the trinity of FACT

The idea of using the trinity as the implications of FACT is derived from the Christian doctrine. This term has been stated in Christian theology since the beginning of the third century. The word of trinity in etymology is derived from Latin 'trinitas' which means 'the number three, a triad'. The corresponding word in Greek, 'τριάς', means 'a set of three'. In this paper, the correspondence with the trinity in etymology of Latin and Greek can be referred to the three dimensions in FACT come together as one goal towards BE. It indicates that not only the fusion of BE framework and management tools/techniques are

the two ‘must’ in the implementation of BEM but also the cultivation of right organizational culture/characteristics is necessary of the third ‘must’ as well (see Figure 3).

Besides, as shown in Figure 4, the trinity in FACT is presented in terms of the three elements of a person. Framework of BE indicates the skeleton. Management tools/techniques indicate the flesh and blood. And organization culture/characteristics indicate the spirit. All of the three elements are not only necessary to sustain one’s life but also should be entirely balanced one another as a whole. It implicates that ‘excellence’ generally represents a talent or quality which is unusually good and so surpasses ordinary standards. The word of ‘excellence’ in Greek is ‘arete’ which means ‘the act of living up to one’s full potential’, ‘something closer to being the best you can be’, or ‘reaching your highest human potential’. It is the most articulated value/virtue in Greek culture. In some sense of this term, it also indicates the happiness which resulted from a life well-lived, being prosperous and fulfilled. Studies have shown that the most important way to achieve excellent performance in fields such as sport, music, profession and academy is to practice, as commonly said, ‘Practice make perfect’.

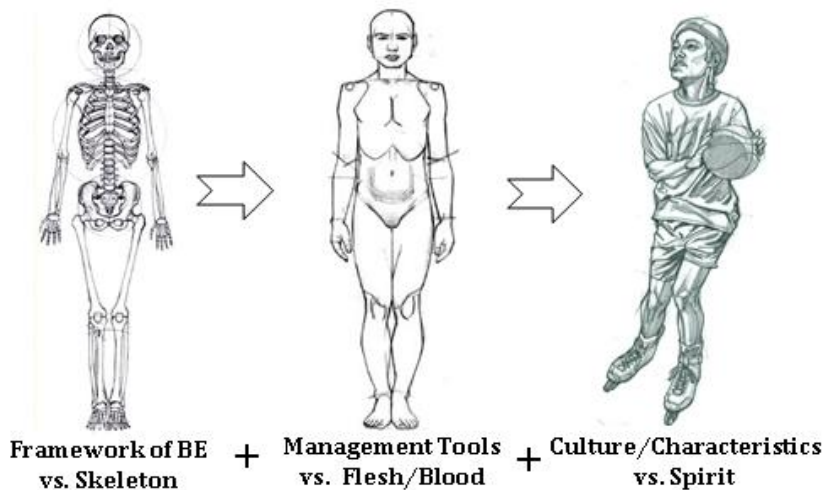


Figure 4 Illustration (II) of the trinity of FACT

Mappings of deficiency arguments, fundamental premises and FACT

Figure 5 presents the mappings of deficiency arguments, fundamental premises and FACT. The purpose of the mappings is to examine if the new model proposed in this paper does respond all deficiencies found in the existing BEMs. The mappings are individually illustrated in the following. The first two arguments are criticized in regard to the lacks of scientific evidences and contingency factors in the existing model designs. The present authors argue that a new model should be prescriptive-based in order to be not only the guidance of users but also the measurement standard in an organization. This is the point to be postulated in FP1 and the dimension of ‘BE framework’ in FACT model. The third argument is criticized in regard to BEM is basically recognized as a measurement tool instead of the provision of a total solution. The present authors hold that a new model should be functioned as not only the measurement but also the planning/operation/improvement in an organization. This is the point to be postulated in FP2 and the necessity of ‘add’ more dimensions in the new model. The fourth and the fifth

arguments are criticized in regard to the lacks of persuasiveness for total involvement and integration in the operational level. The present authors hold that a new model should be easily integrated with not only the systems that have been existed but also the management tools that are appropriate in an organization. These are the points to be postulated in FP3, FP4 and the dimensions of ‘organizational culture/characteristics’ & ‘management tools/techniques’ in FACT model.

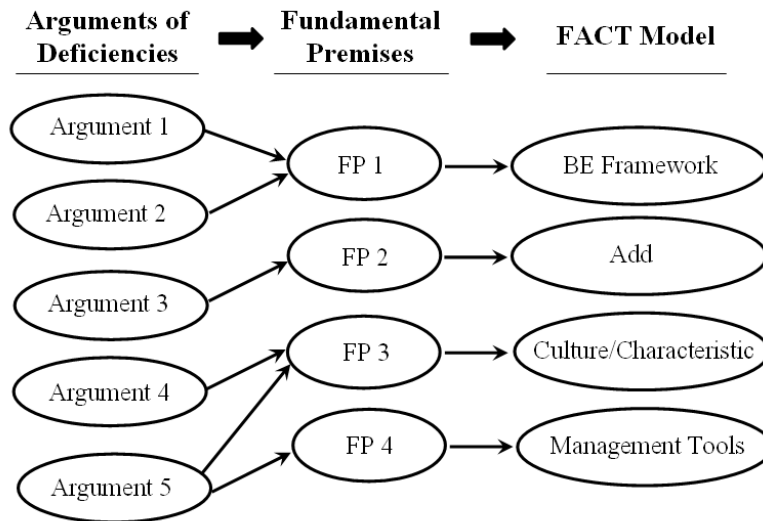


Figure 5 Mappings of deficiency arguments, fundamental premises and FACT

The possible future research

The development of a comprehensive BEM is set for the objective in the beginning of this research. A three-dimensional BEM is finally proposed which is called ‘FACT’. The contribution of this paper is significant, however it is the first study of this proposed model, some issues are planned for the further research. The empirical case studies will be first conducted to investigate, in term of FACT model, what the journey of a BE enterprise had been through. This is for the purpose of developing the roadmap of BE. Here, different forms of organizations can be included as the subjects of the empirical case studies, such as independent enterprise, enterprise group, enterprise supply-chain system or even industrial sector. Upon enough number of the empirical case studies being accumulated, the research objective will be focus on the improvement of national economic performance which is to investigate the benefits of BEMs from the macro viewpoint.

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Combining Technical and Social Aspects to Conduct a Successful BPR Project

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Introduction

The business environment of the present day has become so complex that organizations are necessarily to be alert to respond to the new challenges and opportunities. This involves a continuous process of managing the change. Change compels either innovation or improvement or both. Many organizations tend to focus their attention on identifying innovations rather than improvement. Recently, the concept of Business Process Reengineering (BPR) has emerged as a conspicuous tool for restructuring the organization.

BPR has been defined as the fundamental rethinking and radical redesign of business process to achieve dramatic improvements in critical and contemporary measures of performance, such as cost, quality, services and speed (Hammer, 1990). BPR is an effective tool for organizations striving to operate as effectively and efficiently as possible, because reengineering processes must be made simple in order to meet demands for quality service, flexibility and low cost. But Process Reengineering is not reorganizing, restructuring, downsizing, automation or cost cutting. All of these, may be a result of a well thought out, well planned and well-executed reengineering project. Process Reengineering radically changes the work environment. Individual processes are combined to gain efficiencies and productivity. Workers are allowed to make decisions on the spot to eliminate process roadblocks and increase speed to market. Not only is this beneficial for overall business performance, it can also increase employee satisfaction and loyalty. Employees can expand their skill and knowledge into other areas, and have the ability to make decisions that affect their individual performance.

There are many BPR methodologies and models available, and most of them pursue a similar path and exhibit commonalities in key areas such as planning, monitoring and implementation (Butler, 1994). Today, an increasing number of methodologies, models and tools taken from other disciplines are available in the market, claiming that they are suitable for BPR initiatives. The major drawback of all the existing BPR methodologies studied and researched for this paper is that they have shown that the human and organizational issues were not incorporated successfully. It can be said that they don't combine the technical and the social aspects. The reason why this study is necessary is because it will focus on how to combine the technical and social aspects to conduct a successful BPR project. More

specifically, the authors proposed a framework that determines the most important technical and social factors that should be taken into account when conducting a BPR project. This framework will guide BPR top executives to identify the characteristics that the leader and his employees should possess in order to conduct a successful BPR project, as well as the relationship between them. More specifically, in this study, the present authors intend to achieve the following research objectives: (1) build up an effective framework that combines the social and technical aspects to conduct a successful BPR project, (2) develop a tool that will help an organization to evaluate the degree of success of a BPR project according to the factors proposed in the framework.

Literature Review

A review of the past research related to BPR is described in this section. It includes a general introduction to the history of BPR, as well as its technical and social aspects. For purpose of this study, technical factors will be defined as the steps or the methodology used throughout the project.

The History of BPR

BPR became very popular in the early 1990s with the publication of two articles, one in the Sloan Management Review by Thomas Davenport and the other one in the Harvard Business Review by Michael Hammer, both articles discussed the growing wave of process innovation and radical business process change. However, the methodology and approach was not fully understood nor appreciated by that time. Many times, improvement projects labeled with the title "BPR" were poorly planned and executed. Employees and organizations cringed at the thought of another "BPR" experience. The term itself is being used less, or is being altered so that these types of initiatives are not associated with the "BPR" of the past. Despite this abuse of the practice, the practice of redesigning business processes and the associated technology and organizational structure is more popular today than ever. Companies continue to reexamine and fundamentally change the way they do business. Competitive pressures and a sluggish economy provide the impetus for continued efforts to "deliver more with less." Reengineering remains an effective tool for organizations striving to operate as effectively and efficiently as possible, because reengineering processes must be made simple in order to meet demands for quality service, flexibility and low cost.

On the other hand, in the late 90s, more than half of the reengineering projects failed to be completed or did not achieve dramatic improvement results. Benchmark studies with more than 150 companies identified three success factors that this companies lack of (Prosci's 1998-1999 Reengineering Best Practices Study). The top three success factors in a process reengineering project are: first, it is imperative to have executive management support. Second, it is important to have willing participation of all associates involved in the redesign. The associates involved in the change must see value in the need for change and buy into the project. Last but not least, is the ability of the project team to discern what processes are value-added and customer-focused and which are not. It is easy to get side-tracked on processes that do not serve the customer at the end of the day. In process reengineering, a very important word should always be considered. That word is Gemba,

which means 'actual place' in Japanese. The Gemba is where the value is created. Value is created when people, information, materials, equipment, and processes come together to serve the customer (Gemba Research, 2003). In a process reengineering effort, it is important to figure out what processes support the Gemba and what processes do not. The processes that support the Gemba should be at the forefront of any reengineering project.

Technical Aspects of BPR

Methodologies represent the highest level of abstraction for conceptualizing problem-solving methods. In this study, methodology is defined as a collection of problem-solving methods governed by a set of principles and a common philosophy for solving targeted problems (Checkland 1981). Due to the rapid growth of interest in BPR, a large number of existing methodologies have been individually upgraded or combined in order to fall under the BPR umbrella. Some redesigners resist methodologies and consider them as a constraint especially in the case of fundamental/radical change. Their belief is that change management should be the focus from the beginning to the end of the BPR exercise. Others argue that the use of methodologies allow people to avoid mistakes and the use of their modeling techniques can be used as a medium for raising fundamental questions. Several methodologies have been proposed by different BPR's researchers. Table 1 presents the summary of the existing methodologies.

Table 1 Summary of the existing BPR methodologies

Methodology/ Stages	Davenport And Short	Evans	Peter Keeble	Fitzgerald And Murphy	Motwani et al.	Muthu et al.
1	Develop business vision and process objectives	To Be	Initiate Reengineering Programme	Select process to be reengineered	Understanding	Prepare for BPR
2	Identify the processes to be redesigned	As Is	Scope Programme	Establish process team	Initiating	Map and analyze As- Is processes
3	Understand and measure the exiting processes	The Plan	Redesign Process, systems and organizational structure	Understand current process	Programming	Design To- Be processes
4	Identify IT levers	The Crossing	Implement Culture Change Programme	Develop a vision of improved process	Transforming	Implement reengineered processes
5	Design and built a prototype		Sustain Commitment	Identify actions needed to move to new process	Implementing	Improve continuously

	of the new process					
6			Integrate Process and Organization	Negotiate/execute plan to accomplish actions	Evaluating	
7			Implementation and Monitor			
8						

It can be observed in Table 1 that the existing methodologies show commonalities in key steps such as planning, monitoring and control, but only the last two methodologies include the continuous improvement step which is fundamental in BPR because the organization as a whole will never stop competing in a continuously changing environment which leads to the continuous need for improved organizational processes and functions.

After reviewing each methodology, the authors identify the most important steps and the ones that should be included in every BPR project. These are the followings: First, a *vision* should be created. Based on the clear vision, the management should *select the business processes* that are needed to be redesigned. Then, *define clear and measurable objectives* for redesigning the reinvented processes. The new processes need to be *designed* and after all the employees understand the new processes, these ones are *implemented*. The *control and improvement* of the new processes should be done periodically.

Social Aspects of BPR

As the BPR concept has become mature and organizations have gained experience, the literature has emphasized the social and cultural aspects of the reengineering process, a concept known as *Change Management* (Towers, 1996; Cooper and Markus, 1995; Hammer and Stanton, 1995; Bashein *et al.*, 1994; Carr and Johanson, 1995; Bruss and Roos, 1993; Janson, 1992; Kennedy, 1994; Arendt *et al.*, 1995). Harvey's (1995) study found that change management is the biggest challenge in BPR implementation. Towers (1996) and Hammer and Stanton (1995) argued that managing change and people together is a major contributing factor to the success of BPR-related organizational change. In a discussion of the causes of reengineering failure, Cooper and Markus (1995) referred to the inadequate treatment of the human aspect when implementing BPR-related change. Kennedy (1994) discussed some elements of human change management which he described as 'the more difficult challenge', and explained how BPR represents a danger to people when it introduces new job structures and definitions, and forces employees to change their work style.

Change management involves several social processes such as commitment, leadership, empowerment of employees, communication, and process-based team formation (Arendt *et al.*, 1995). Each social process is described as follows.

Commitment. Commitment is the force that drives the relationship forward, toward a mutually desirable goal that usually points to growth and success. Research shows commitment has a positive effect on productivity, turnover and employees willingness to help co-workers (Bishop, J. and Scott K., 1997). Top management commitment is important to ensure the initiative is maintained and focused. But the commitment should be from the entire organization involved in the BPR project. In order to achieve a successful project, the top management, the project managers and the employees should be committed to the project. Commitment is demonstrated by a combination of two actions. The first action is called **supporting**. Genuine support develops a commitment in the minds and hearts of others. This is accomplished by focusing on what is important and leading by example. Supporting means concentrating on what adds value, spotlighting what's working, and rewarding others who are focusing on what is important and leading by example. The second action underlying commitment is called **improving**. Improving stretches our commitment to an even higher level. Commitment means a willingness to look for a better way and learn from the process. It focuses on eliminating complacency, confronting what is not working, and providing incentives for improvement. The spirit of improving is rooted in challenging current expectation and ultimately taking the risk to make changes. It is the combination of both *supporting and improving behaviors* that makes up the practice of commitment. Separately neither action is capable of sustaining commitment. Commitment to change and sufficient authority over all aspects of the change process are both important in dealing with the cultural and political problems in the form of organizational resistance which often stand in the way of BPR implementation.

Leadership. Throughout history, people have tried to say what makes a good leader. Some of the most often quoted historical authors include Plato, Machiavelli, Hobbes, and Confucius. They all tempted to distinguish between emotional and managerial functions (Turner, J. and Müller, R., 2005). Over the last seventy years, there have been six main schools of leadership theory: *The Trait School*, the idea behind this school is that effective leaders share common traits. It effectively assumes that leaders are born, not made. Attempts to identify the traits of effective leaders have focused on three main areas: abilities, personality and physical appearance; *The Behavioral or Style School*, it assumes, in effect, that effective leaders can be made. Most of the best-known theories characterize managers or leaders against one or two parameters, and place them on a one-dimensional continuum or two-dimensional matrix. The parameters include: People, Production, Authority, Decision-making, and Decision-taking; *The Contingency School*, one contingency theory that has proven popular is path-goal theory. The idea is the leader must help the team find the path to their goals and help them in that process. Path-goal theory identifies four leadership behaviors: Directive leaders, Supportive leaders, Participative leaders, Achievement-oriented leaders; *The Visionary or Charismatic School*, two types of leadership were identified: Transactional (task-oriented) and Transformational (people-oriented). In reality, a combination of the two styles will be appropriate in different circumstances. In project management context, researchers predict that a project manager's leadership style needs to be more transformational than transactional, but found no

significant link. The Emotional Intelligence School, for dimensions of emotional intelligence were identified and, from there, six leadership styles: Visionary, Coaching, Affiliative, Democratic, Pacesetter, and Commanding; and the *Competency School*, The emphasis has been to identify the competencies of effective leaders. Competencies can be learned, so leaders can be made, not just born. Different combinations of competencies can lead to different styles of leadership, appropriate in different circumstances, producing transactional leaders in situation of low complexity and transformational leaders in situations of high complexity (Turner, J. and Müller, R., 2005).

Hammer and Stanton (1995), Cooper and Markus (1995) and Arendt *et al.* (1995) consider leadership to play a vital part in directing BPR efforts toward success. The importance of leadership stems from its role in providing a clear vision of the future, communicating this vision, being able to involve widely other people in the BPR efforts, and being prepared to provide sufficient commitment to the BPR efforts (Hammer and Stanton, 1995).

Employee Empowerment. Employee empowerment is an effective factor leading to the success of BPR implementation, since it promotes self-management and collaborative teamwork principles (CSC Index, 1994; Mumford, 1995; Rohm, 1992/93). Empowerment allows the key operations of the upper levels of hierarchy, such as responsibility, accountability and decision making, to be released and implemented further down the hierarchy. Empowerment is proposed as inevitable by the protagonists of reengineering:

- “Redistribution of power and authority among functions and levels and even among suppliers and customers is an inevitable outcome of process innovation” (Davenport 1993).
- “People working in a reengineered process are, of necessity, empowered. As process team workers they are both permitted and required to think, interact, use judgment, and make decisions” (Hammer and Champy 1993).
- “Empowering employees will move decision making, communications, and control down to the level where the work is being done. This will make dramatic improvements in process time and efficiency” (Manganelli and Klein 1994).

Communication. Communication is another essential change management tool perceived as very important in facilitating BPR (Davenport, 1993a; Hammer and Stanton, 1995; Carr and Johansson, 1995; Rohm, 1992/93; Arendt *et al.*, 1995). However, it is also considered by organizations to be the most difficult aspect of BPR (CSC Index, 1994). Davenport (1993) emphasizes the need for communication throughout the change process at all levels and for all individuals, and stresses that communication should occur regularly between those in charge of the change initiatives and those affected by them. Early communication and explanation of the urgency of the reengineering projects and their specific objectives are essential to achieve a culture change in the organization. The top executives and other senior management must play an active role in communicating the commitment of the organization to the reengineering project. Effective communication between stakeholders inside and outside the organization is necessary to market a BPR project (Talwar, 1993), to ensure patience and understanding of the structural and cultural changes needed (Berrington, C. and Oblich, R., 1995) as well as the organization’s competitive situation (Cooper and Markus, 1995). Communication should take place frequently (Davenport,

1993, Carr, 1993; Janson, 1992) and in both directions between those in charge of the change initiatives and those affected by them (Davenport, 1993; Talwar, 1993). Communication should be open, honest, and clear (Davenport, 1993; Janson, 1992).

Teamwork. Teamwork creates a learning environment in which team members are encouraged to share knowledge and expertise (Rohm, 1992/93). With empowered team members, teamwork enhances quality of work (Davenport and Nohria, 1994; Davenport, 1993a), and reduces resistance to change, and allows for different perspectives to change (Carr and Johansson, 1995). Successful BPR implementation is highly affected by the way team members are selected and managed (CSC Index, 1994). Johansson *et al.* (1993) view teamwork as the most important value of BPR. Davenport (1993a) assigns three main functions to the BPR team: managing work by making group decisions and coordinating activities; managing relationships by promoting trust, openness, and resolving conflicts; and finally, managing exteriors such as customers, suppliers and market partners. The literature mentions several advantages of teamwork, such as facilitating interactions between functions and speeding up the redesign process (Davenport and Nohria, 1994).

Davenport (1993) and Harrison & Pratt (1993) believe that external consultants should be included in BPR teams since they provide a business-wide view, encourage unity between members, and are usually neutral. External consultants, if employed, help to facilitate and support BPR efforts. Shabana (1996) believes they bring specialized skills, experience and required know-how to organizations, and he suggests a number of reasons for their success and failure in BPR projects. Success can be attributed to consultants' experience of implementing similar projects in other organizations and their ability to direct the reengineering efforts to areas of substantial benefit to the organization. Failure, on the other hand, can be attributed to their limited knowledge of the existing business processes, and that delays are caused by the time they spend familiarizing themselves with these processes.

Deficiencies of the Past Research

It is apparent that there is a consistent need to understand how to conduct BPR and to apply a type of methodology that can guarantee success. This demand is understandable and does make sense. However, process reengineering is very complex. It is difficult, if not impossible, to produce standard "recipes" of success applicable to every business sector. The majority of the methodologies proposed by various academics and practitioners are general guidelines attempting to cover the needs of all or as many as possible organizations. Despite some common principles like planning, monitoring or implementation, it seems that each sector has its own needs and some unique features. What is good for one company may be totally unacceptable for another, as many issues, including cultural differences, management style, and staff relationships, all impact on the adopted method (Parfett, 1994).

Another important observation that constitutes a problem is that most of the methodologies stop at the implementation phase, and consequently seem to be quite static. The exclusion of evaluation and the notion of continuous improvement seem to be inconsistent with the increasing pressures of an ever-changing world and from a highly competitive environment. On the other hand, it is also important to note that, while some of these methodologies or models include some 'soft' elements in their approach (recognizing the importance of

organizational culture, human relationships and resistance to change), many of the currently available tools focus on the harder and more quantifiable elements of the organization (Ruessmann et al., 1994). As a result, there are many tools and methods available in order to model, map and redesign the organizational processes but there are not many methods or tools aimed at identifying human and organizational factors that affect the change process. Many papers and best practices recognize the importance of the human element and of the organizational functions. However, the latter are often not addressed in the proposed solutions and methodologies, and are, therefore, not recognized as being an integral part of the organizational change. Consequently, most of the existing methodologies do not include stages related to human and organizational requirements, although they do recognize their importance.

As it is expressed in the literature, more than 60% of the BPR projects fail due to the reason that people do not want to adapt to the new changes in the organization. The mistake many organizations make is assuming that changing people's habits will be an easy task, but it is not. Getting people inside the company to get used to the new processes to improve the ways they do their jobs is by far a hard challenge. If the company is resistant to change, the BPR project is more likely to fail.

For all the above mentioned reasons, this study attempts to combine the social and the technical aspect of a BPR project to assurance its successful implementation. A framework that will serve as a guideline to BPR project's managers and employees to conduct a successful project will be proposed in the following section.

Conceptual Framework

As it was exposed before, many authors addressed the technical aspect but just a few of them addressed the social part of BPR. After an exhausted research it was determined that little research has been done to combine both aspects; and this may be the cause that most of the BPR projects fail. To fill this gap in BPR and to contribute to an effective project development, taking into account all the resources involved in the process, is that this study proposes a framework to guide all the people involved in the reengineering project.

The Framework

The aim of this study is to build up an effective framework that combines the social and technical aspects to conduct a successful BPR project. Figure 1 presents the conceptual model. It takes into account the two aspects involved in all BPR projects: (i) social and (ii) technical aspects. The social aspect is divided into three categories. First, *the executive management team*, it is fundamental that the top managers support and understand the project. Second, *the managers*, they have to control the project and motivate the employees. That's why they need to have a positive perception of the project and a leadership attitude in order to empower their employees. Third, *the employees* itself, they have to be motivated and committed to the project in order to give their best and to adapt to the new situation. They have to work in teams to share knowledge and to speed up the reengineering process. The last, but one of the most essential factors is the communication. The communication among project managers and employees should be fluent with the aim of assuring the

understanding of the existing processes, the need of change and the function of the new, redesigned processes.

On the other hand, the technical aspect includes six steps in the methodology used to conduct the project. First a *vision* should be created. As exposed above, the communication should be fluent among the people involved in the project, that's why everyone should know the vision and what they want to achieve with the reengineer project as well as where they want to be after the project is done. Afterwards, based on the clear vision, the managers along with the experiences and opinions of the personnel should *select the business processes* that are needed to be redesigned. Then, it is necessary to *define clear and measurable objectives* for redesigning the reinvented processes. The objectives should be determined by all the people involved in the reengineer project. Next, employees need to work in teams to share and propose ideas to *design more accurate processes*. After all the employees understand the new processes, these ones are *implemented*. The *control and improvement* of the new processes should be done periodically, according to experiences and needs of the people involved in the process.

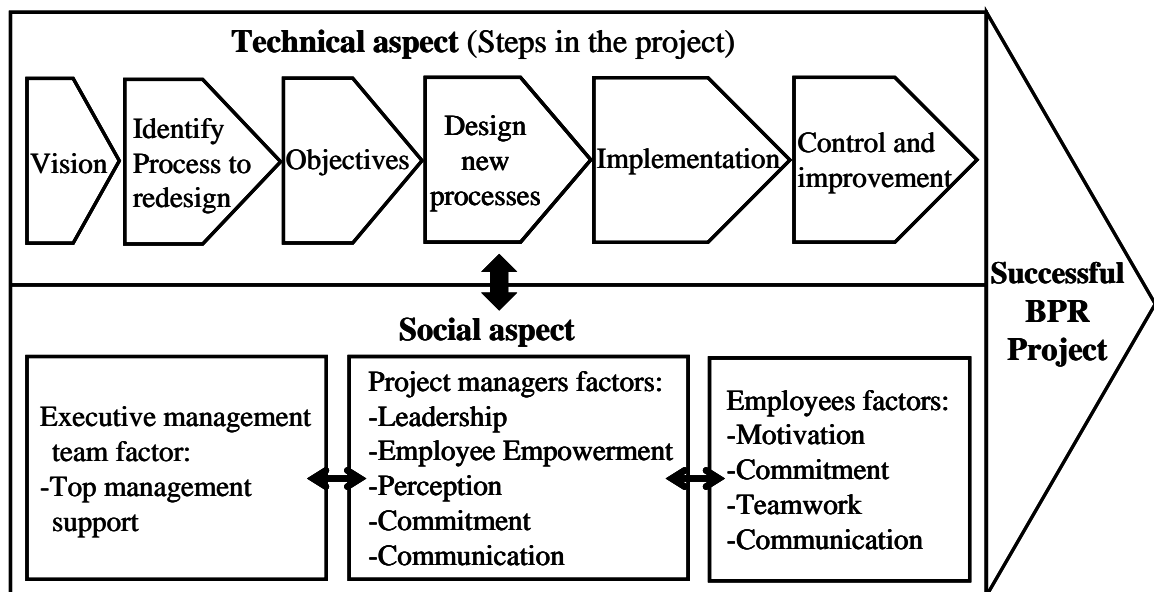


Figure 1 Conceptual framework

Social Aspect

According to past literature, lack of leadership and not motivated employees are frequently causes for the high failure rate of business process reengineering projects. BPR implementation requires top management understanding and support of the project as well as a top-down, directive leadership style. Yet, it also requires the management of motivated, skilled, independent-thinking people doing non-programmable tasks for which a non-directive leadership style is most suited. It can be noticed that the social aspect of BPR involves three categories that are described as follows:

The Executive Management Team: The role of the top executives is fundamental and is the basis for a BPR project to succeed. According to Prosci Research (1998-1999), an industry

leader in business process reengineering, the most critical success factor in this type of project is solid and visible executive support. Strong executive support is essential to keep the project moving forward. They have to understand the need of change in order to support it. They help project managers understand and achieve the project objectives. Top executives usually control a project manager's access to resources which are supervised by functional managers. The level of support provided by the functional manager is usually determined by the level of support from top executives. If the project is part of the functional department, then the availability of resources is not usually an obstacle, because the functional manager is usually also the project manager. (Bellasi and Tukel, 1996).

The Project Manager: A project manager, also known as a project champion is typically someone in management who proposes the business process reengineering initiative. The champion often sees a timely opportunity for the company to increase its competitiveness and performance, or fend off a major crisis in a way that calls for the complete transformation of people, processes and technology. Project Managers are strong advocates for the project with a vested interest in the outcome and use their influence to assure project success. Many factors related to the skills and characteristics of project managers are proposed in the previous framework for the successful completion of BPR projects. In their study, Pinto and Slevin (1989) demonstrated the importance of selecting project managers who possess the necessary technical and administrative skills for successful project termination. They showed that the project manager's commitment and leadership style are the most critical factors during the planning and implementation stages. They should have certain attitudes toward the project, because attitude influence individual behavior. They also need to recognize that their employees react to perceptions, not reality. They need to pay close attention to how employees perceive both their jobs and management practices (Robbins, 1994). Another important characteristic of the project managers is their ability to delegate; this means that they need to empower their employees trusting their decisions. Communication Skills is the most important skill that a Project Manager should have. These deals with keeping all the employees well informed of the project data and update the top executives.

The Employees: The employees are the body of the BPR project, as expressed above the lack of motivation of employees is one of the most frequent causes of the failure of BPR projects. The motivation of the employees usually depends how committed and how motivated is the project manager and how well he can transfer this motivation to his employees. In order to be fully committed they have to understand the existing processes and the need for change. To obtain employee commitment for a major reengineering effort, executives must convey a clear vision characterized by three points. First, they must clearly articulate why such a sweeping change is crucial to the company's overall success. Next, they must convincingly describe what the future looks like when the project is done. Finally, they must provide sufficient detail to enable employees to visualize how they fit into the new organization once it emerges. They should be encouraged to be more aware of how they contribute to the organization. They should also be actively encouraged to develop new ideas and help solve problems within the organization. Teamwork is a key element for the success of the reengineering project. Employees usually work in teams in order to share knowledge and speed up the reengineering process. The competence and

commitment of the team members is also found to be critical factors during the implementation stage, but is important throughout the project duration time.

On the other hand, well established communication channels between the project manager, the organization and the employees are necessary for the success implementation of the BPR project. It is crucial to communicate the necessity for change, the principles of reengineering, and the objectives of the reengineering project to the entire organization, not just those who will ultimately be directly involved. Everyone impacted by the proposed changes must be on board and actively involved throughout the project. Difficulties encountered should not be hidden but should be communicated together with an action plan for their resolution. It is also important that the content of all communications regarding the program is consistent. Inconsistency will undoubtedly undermine the credibility of the project. Communication must also be two-way. Not only must employees be aware of the project, its problems, its progress, and the commitment of management, they must also be part of it.

Technical Aspect

As explained above, project characteristics have long been overlooked in the literature as being critical success factors whereas they constitute one of the essential dimensions of project performance. Among some few studies, BPR researchers identified the creation of the vision and the establishment of measurable objectives as critical factors. Many projects, however, fail due to several other factors inherent in BPR projects, in most of BPR methodologies the control and improvement stage is omitted. For purpose of this study, technical aspect will be defined as the steps or the methodology used throughout the project. Many structure-based methodologies have been proposed for BPR implementation and they were summarized in section 2.2. However, most of them have common elements and view BPR efforts as a top-down implementation project. For purposes of this study, the most common and important steps in existing BPR methodologies were extracted to create a hybrid methodology that combined with the previously explained social factors, will lead to a successful implementation of BPR projects. The inputs for this model were generated from the review of literature. In the proposed framework, six stages or steps are recommended:

Step 1: Develop a business vision: BPR is driven by a business vision that answers the question “Where do we want to go?” Where does the organization as a whole or where do the department undergoing the reengineering project want to go with this change. All the personnel involved in the project should know and understand the business vision, in order to guide the organization toward the same direction.

Step 2: Identify the processes to be redesigned: Not many firms use an exhaustive approach that attempts to identify all the processes within an organization and then prioritize them in order of redesign urgency. As explained in chapter 2, the Japanese word “Gemba” which means “actual place” and is where the value is created, can be used to identify the processes to be redesigned. It is important to identify what processes support the Gemba and what processes do not. The processes that support the Gemba should be at the forefront of any reengineering project.

Step 3: Define objectives: Based on the clear vision and the selected process to redesign, clear and measurable objectives for redesigning the reinvented processes should be defined. These measurable objectives are the specific measures that the company uses to determine whether or not they are successful in achieving the reengineering goal.

Step 4: Design new processes: The actual design should not be viewed as the end of the BPR process (Davenport and Short, 1990). Rather, it should be viewed as a prototype, with successive iterations. Prototypes help produce quick delivery of results when projects are implemented, improving performance and customer satisfaction. On the other hand, employees and customers involved in the previous process should be questioned what are the flaws of the existing process, in order to improve them.

Step 5: Implementation: In order to avoid difficulties, the implementation of new processes had to be carefully planned by the people involved in the reengineering process. Many aspects of the new organization should be monitored after implementation including the performance of the new processes, the organizational culture, and the external environment. A changing or unsatisfactory situation in any of these areas may well indicate a requirement for further reengineering.

Step 6: Control and Improvement: BPR is a successive and ongoing process. BPR should be regarded as an improvement strategy that enables companies to make the move from a traditional functional orientation to one that aligns with strategic business processes (Vakola, M. and Rezgui, Y., 2000). A reengineered process may reach a satisfactory state of efficiency but the organization as a whole will never stop competing in a continuously changing environment which leads to the transformation of business strategy and vision, and as a result to the continuous need for improved organizational processes and functions, this is why this step is so important.

Combining Social and Technical Factors

The BPR project that makes use of the framework proposed in Figure 1 starts with the recognition of the need of change. Usually, the project manager is the one who proposes the business process reengineering initiative. Project Managers transfer their proposition to top executives. The top executives must recognize the need for change; develop a complete understanding of what is BPR, and how they plan to achieve it. The top executives support is essential in this first phase and throughout the whole project. Once the project manager has the support of the top executives, he communicates the idea of the reengineering project to his employees. In this phase, that can be called planning phase, the leadership style of the project manager is very important because he needs to motivate his employees and all of them need to see the value in the need for change and buy into the project. Once the understanding and commitment of the top executives, project manager and employees is guaranteed, the reengineering project starts by creating a vision.

Based on the clear vision, the project manager along with the employees' ideas and suggestions should select business processes that need to be redesigned, define clear and measurable objectives for redesigning the current processes, and form the reengineering

project teams. The literature suggests executives and key staff members from the primary organizational units involved in the processes, as well as from the information systems department, should be included in the teams. Once the teamwork are formed, the project team evaluates and documents current processes, uncovers bottlenecks, and establishes baselines and benchmarks for measuring future improvements. During this phase, the efforts of the project team are focused on identifying breakthrough opportunities and designing new work steps or processes that will create significant gains and competitive advantage.

After gathering all the necessary information and sharing ideas and knowledge among all the personnel involved, the new process are designed led by the project manager. After the design of the new processes is successfully undertaken, they are fully implemented and successfully integrated into the organization. Changes made during this phase may cause resistance or resentment that must be addressed through continual communication among top executives, the project team, and employees. The final phase, involves evaluating the success of the reengineering efforts against the performance objectives previously established. For example, if the reengineering efforts have not achieved all its goals, the processes should be redesigned and modified accordingly. This phase is important as it is one of continuous commitment to the process of reengineering. In this phase, the control of the new processes is necessary in order to determine the existing flaws in the new processes. Communication among the involved parties is also necessary to share new ideas in order to improve the flaws and weaknesses identified in the evaluating phase.

Development of the tool

This section addresses the second objective of this study, in which a tool is developed. The aim of the proposed tool is to recognize the importance of the factors proposed in the framework depicted in Figure 1 and to determine the chance of success of the BPR project. This tool will be conducted among people involved in the project. The tool consists of a list of items, which are measured in a three scenario scale: from the best scenario to the worst. The items are divided into 4 different sections. Each section is related to the different factors described in the previous framework: (i) Factors related to the executive management team (ii) Factors related to project managers (iii) Factors related to employees and (iv) Steps in the project.

Item Development

A list of 30 items was developed as a tool to help the personnel involved in the BPR project determine the chance of success of the project according to the factors existing in it or what will cause the failure according to the elements the project lack of. The tool consists of four sections that should be answered in an honest way to obtain more accurate results. The main idea of each section is exposed as follows:

- (i) *Factors related to the Executive Management Team:* In this section, items about the support of the top management are asked in order to determine how committed they are with the project. From previous literature it was defined that the more committed the top management is with the project, the greater the chance of success.

- (ii) *Factors related to the Project Manager:* In this section, items concerning the project manager's leadership style, motivation and capacity of empowering other are addressed. This section analyzes the fact exposed by various BPR researchers that states that the lack of leadership is frequently a cause for the high failure rate of business process reengineering projects. This section will also determine if empowerment fosters innovation, creativity, motivation and instills shared values to promote and atmosphere for learning and accomplishment in the company.
- (iii) *Factors related to the Employees:* In this section, items related to the motivation and commitment of the employees are asked. This will determine if the project is on the right path to success, because the more motivated and committed the employees are, the more chances of success will be presented. Question regarding the teamwork are also addressed, in order to determine how they share knowledge and ideas. Finally, questions regarding how fluent is the communication between top executives, project managers and employees are also asked. This will help define how committed is each of the parties involved in the project.
- (iv) *Steps in the Project:* This section addressed the methodology used in the project. It guides, step by step, the people involved in the reengineering project in order to assure that all the elements, such as vision, measurable objectives, understanding of existing processes, among other are presented in the project.

Table 2 describes the section and the factor addressed in each item and shows the relationship between the factor and the list of items.

Table 2 Relationship between factor and items

Section	Factor	Item no.
Executive Management Team	Top Management Support	1, 2, 3
Project Manager	Leadership	4, 5, 6
	Employee Empowerment	11, 12
	Perception	9
	Commitment	7, 8
	Communication	10, 19, 20
Employees	Motivation	13
	Commitment	13, 14
	Teamwork	15, 16, 17
	Communication	18, 19, 20
Steps in the Project	Vision	21
	Identify process to redesign	24, 25
	Objectives	22, 23
	Design new processes	26
	Implementation	27, 28

	Control Improvement	and	29, 30
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Measurement Scale Development

Scaling is used in ordering a series of items along a sort of continuum. They are methods of turning a series of qualitative facts into a quantitative series. In order to measure the degree and chance of success of a BPR project, a three scenario measurement scale was added to the items developed and explained in section 4.1. The main idea of the measurement scale is to propose three scenarios (best to worst) and see which of these describe the situation of the company regarding the BPR project. The three proposed scenarios were extracted from the literature review. What the BPR researchers and practitioners recommend for the organization was exposed as the best scenario and what make companies fail a BPR project was proposed as the worst scenario.

Each item developed in the previous section has three possible answers, which are denoted by the letters: a, b and c. Letter “a” corresponds to the best scenario, in other words the idealistic situation of a company regarding the BPR project. Letter “b” corresponds to a scenario that is not the best for the company but can still lead to a successful but long project. Last, letter “c” corresponds to the worst scenario that will lead the company to a fail BPR project. Needless to say, the more numbers of “a” answer will lead the company to the execution of a successful BPR project. The respondent can choose only one answer per question.

An example of the proposed tool is exposed as follows. For the full version on the tool, see appendix A of this paper:

Who decided which processes need to be redesign?

- a. All the people involved in the project, share ideas to determine which processes need to be redesign
- b. The project manager decides which processes need to be redesign.
- c. The top executives decide which processes need to be redesign.

Validity of The Tool

In an effort to ensure the validity of the proposed tool, a *face* and *content validity*, also known as *logical validity*, will be conduct for this study. Face validity is a property of a test intended to measure something. It is the [validity](#) of a test at [face value](#). In other words, a test can be said to have face validity if it "looks like" it is going to measure what it is supposed to measure. On the other hand, [content validity](#) is a non-statistical type of validity that involves "the systematic examination of the test content to determine whether it covers a representative sample of the behavior domain to be measured" (Anastasi and Urbina, 1997). Content validity is most often addressed in academic and vocational testing, where test items need to reflect the knowledge actually required for a given topic area.

One widely used method of measuring validity was developed by C. H. Lawshe. It is essentially a method for gauging agreement among raters or judges regarding how essential a particular item is. Lawshe (1975) proposed that each of the subject matter expert raters (SMEs) on the judging panel respond to the following question for each item: "Is the skill or knowledge measured by this item 'essential,' 'useful, but not essential,' or 'not necessary' to the performance of the construct?" According to Lawshe, if more than half the panelists indicate that an item is essential, that item has at least some content validity.

In order to validate the proposed tool, a face validity and content validity was conducted among five invited subjects. According to their knowledge on BPR, the invited subjects had to choose if they considered that each item in the tool was "essential", "useful but not essential" or "not necessary" to determine if the company is in the right path to a successful BPR project. A content validity was conducted at the end of the questionnaire, in which the judges have to express if they considered that the tool, as a whole, is 'essential', 'useful but not essential' or 'not necessary.' The results derived from the face validity are exposed in Table 3. The content validity of the tool resulted in a ratio of 1.00, since five of five panelist agreed that the 30 items in the tool are "essential" to determine whether the company is in the right path to success or not.

The use of the tool

The tool was designed to be used by any company who is currently carrying out a BPR project. It can be used in the early stages of the project to analyze its current situation and to forecast, based on the existing factors, the outcome of the project. It can also be used at the beginning of the project and it will serve as a check list to assure that the project has all

the elements necessary to succeed. It is recommended to use this tool along with the previously proposed framework for better results.

It is recommended that the tool is filled out by outside consultants hired by the companies who are undergoing a BPR project. The consultants are impartial persons who look at the companies from abroad and therefore they are able to give a more objective opinion of the situation in which the company is positioned regarding the project. Outside consultants bring specialized skills, experience and required know-how to organizations, and a number of reasons for their success and failure in BPR projects exists. Success can be attributed to consultants' experience of implementing similar projects in other organizations and their ability to direct the reengineering efforts to areas of substantial benefit to the organization. Failure, on the other hand, can be attributed to their limited knowledge of the existing business processes, and that delays are caused by the time they spend familiarizing themselves with these processes.

Table 3 Validity Ratio

Section	Factor	Validity Ratio
Executive Management Team	Top Management Support	0.87
Project Manager	Leadership	0.74
	Employee Empowerment	1.00
	Perception	1.00
	Commitment	1.00
	Communication	1.00
Employees	Motivation	0.60
	Commitment	0.80
	Teamwork	0.74
	Communication	1.00
Steps in the Project	Vision	0.60
	Identify process to redesign	0.80
	Objectives	0.80
	Design new processes	0.60
	Implementation	1.00
	Control and Improvement	1.00

In case the company have not hired outside consultants, it is recommended that the tool is completed by the top management, the project manager and employee. The project manager will fill out section 1, 3, 4 corresponding to factors related to the top management,

employees and steps in the project, respectively. The top management or employee will fill out section 2 corresponding to the factors related to the project manager.

In order to determine the degree of success of the project, three possible scenarios were exposed for each question of the tool. As explained above, each scenario was assigned with a letter; from (a) best scenario to (c) worst scenario. Points are also assigned to each scenario in the following way: (a) 3 points, (b) 2 points and (c) 1 point. The maximum score will be 90 points and the minimum will be 30 points.

After completing the questionnaire, the total amounts of points are counted. According to the score, the project may set into one of the following three categories:

80 to 90 points: The company is leading toward a successful BPR project. Even though the 90 points is an idealistic scenario, if the company has over 80 points, they will end up with a successful project. This means the company have taken into account all the success factors for a BPR project and its employees, project manager and top executives are committed, motivated and working hard to reach the common goal.

50 to 79 points: This is an uncertain scenario. The company may be taken into account some successful factors but ignoring another crucial ones. In this case, the questionnaire should be revised and determine which factors are being ignored. Once the factors are identified, they should be incorporated at the earliest opportunity to ensure project success.

30 to 49 points: The company is leading toward a failed BPR project. In this scenario, the project is not given its real importance. The project manager, employees and top executives are not committed or motivated with the project. The first thing to do in this case is to recognize the need of change. After everyone have recognized the need for a change and are committed to the project, the success factors should be identified to guide the project in the path to success.

The possible future research

Davenport (1994) described his vision of BPR's future. He stated that the concepts and practices of BPR are likely to evolve across the following directions to respond to the rapidly changing and diverse world of business: (1) Scope: a shift is likely to be towards changes in the business network for an organization rather than towards internal business processes. (2) Development: efforts may be directed to speeding-up the cycle time for BPR by focusing on rapid implementation of improvements in the context of longer-term and more radical process change. (3) Application: process management is likely to be institutionalized in other management domains like measurement, information systems, and organizational structure. Knowledge work processes such as systems and new product development will also be another rich application area, particularly when ethnographical approaches are used to understand in depth the nature and context of the process under analysis. (4) Integration: BPR may be combined with incremental process changes within the same initiatives or integrated into process management by pulling tools from a variety of process change approaches to build hybrid process design and implementation techniques. It may also become embedded in more conventional strategic planning of departments and approaches.

Some of these concepts and practices have already been applied in BPR, but some of them aren't. This means that BPR hasn't reached its peak yet and there is more to do and explore in this subject. The fear of failure of many companies has made this topic not so popular nowadays, but as more tools are available that help them guide to a successful implementation of the project, companies will feel confident in executing it. This is one of the mayor attempts of this study.

This paper has provided a comprehensive review of literature, bringing together different schools of thought on various BPR-related themes. The overall discussion aimed to propose a framework that, based on past literature, identifies the success factors of a BPR project. It is important to emphasize that the proposed conceptual framework is an idealistic model, that's why a tool was proposed to determine the chance of success of the BPR project if one of the success factor is not present in the project. It can be said that the two proposed instruments complement each other.

Today more and more project managers consider quality to be the most important objective. Quality can be assured by identifying and eliminating the factors that cause poor project performance. Thus, project managers need better understanding of critical success/failure factors and how to measure them. This paper emphasizes the importance of understanding the factors and interactions between them. The present authors expect to see additional future research concentrating on the cause-effect relationship between critical factors and on measurement techniques. Future work may also include assessing the criticality of these factors in BPR implementation based on a global survey of organizations. The last but not least, will be to validate the proposed methodology, which includes the validation of the tool, the items and the score system proposed in this study.

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APPENDIX A

Instructions: Please answer the following questions according to your experience in the BPR project you are currently executing.

PART I: FACTORS RELATED TO THE EXECUTIVE MANAGEMENT TEAM

1. Do you consider that the top management of your company entirely supports the BPR project? If yes, in what degree are they supporting the reengineering effort?
 - a. The top executives support the BPR project and are actively involved in it.
 - b. The top executives support the BPR project but do not get involved in it.
 - c. The top executives don't support the BPR project.
2. What departments of the organization are involved in the reengineering program?
 - a. The BPR project is interdepartmental
 - b. The BPR project occurs in one department
 - c. The BPR project occurs in each department separately
3. Do the top executives have preference for one department over the others?

- a. Top executives support all departments equally.
- b. The tops executives support some departments more than the others.
- c. The top executives do not support any department.

PART II: FACTORS RELATED TO THE PROJECT MANAGER

- 4. Who proposed the BPR initiative?
 - a. The Project Manager proposed the BPR initiative.
 - b. The Top Executives proposed the BPR initiative.
 - c. The employees proposed the BPR initiative.
- 5. Which type of leader is the Project Manager?
 - a. The Project Manager has a combination of transformational and transactional leadership type.
 - b. The Project Manager has a transformational leadership type focusing on people
 - c. The Project Manager has a transactional leadership type focusing on task.
- 6. Which type of style has the Project Manager?
 - a. The Project Manager has a directive leadership style.
 - b. The Project Manager has a non-directive leadership style.
 - c. The Project Manager has an interactive leadership style.
- 7. Do you believe the Project Manager is committed and motivated about the BPR project?
 - a. The project manager is committed and motivated with the project.
 - b. The project manager is committed but not motivated with the project.
 - c. The project manager is motivated but not committed to the project.
- 8. Commitment includes two main actions: supporting and improving. Is the project manager:
 - a. Committed by supporting and improving the project.
 - b. Committed by improving the project.
 - c. Committed by supporting the project.
- 9. What does the project manager do when employees are not motivated or committed?
 - a. The project manager persuades them until they are committed and motivated.
 - b. The project manager forces them to be involved in the project.
 - c. The project manager ignores them.
- 10. How would you describe the communication among top executives and project managers?
 - a. The communication between the top executives and the project manager is fluent.
 - b. The communication between the top executives and the project manager is regular.
 - c. The communication between the top executives and the project manager is null.
- 11. Are employees in the project being empower by the project manager?
 - a. All employees have been empowered.
 - b. Some employees have been empowered.
 - c. None of the employees have been empowered.
- 12. Does the Project Manager fully or partially empowers his employees?
 - a. Employees are fully empowered.
 - b. Employees are partially empowered.
 - c. Employees are not being empowered.

PART III: FACTORS RELATED TO THE EMPLOYEES

13. Do you believe the employees are committed and motivated about the BPR project?
 - a. The employees are committed and motivated with the project.
 - b. The employees are committed but not motivated with the project.
 - c. The employees are motivated but not committed to the project.
14. Are employees committed to the project by supporting it, improving it or both?
 - a. The employees are committed by supporting and improving the project.
 - b. The employees are committed by improving the project.
 - c. The employees are committed by supporting the project.
15. Are employees involved in the project working in team? Are the members of the teamwork from the same department or are they interdepartmental?
 - a. Employees work in interdepartmental teams.
 - b. Employees work in teams by departments.
 - c. Employees do not work in teams.
16. If employees are working in teams, how was the team leader selected?
 - a. The team leader was selected by the team members.
 - b. The team leader was selected by the project manager.
 - c. There is no team leader.
17. Does the team leader delegates and empowers other members of the team?
 - a. The team leader delegates and empowers other team members.
 - b. The team leader gives orders to the other team members.
 - c. There is no team leader.
18. How would you describe the communication among employees and project managers?
 - a. The communication between the employees and the project manager is fluent.
 - b. The communication between the employees and the project manager is regular.
 - c. The communication between the employees and the project manager is null.
19. How is the communication between the three parties involved in the project (top executives, project manager and employees)?
 - a. Communication is hierarchically from top executives to project managers and from project managers to employees.
 - b. Communication is fluent and non-hierarchically between the three parties.
 - c. There is no communication between the three parties.
20. Throughout the execution of a BPR project many conflicts are presented. How do you solve them in your company?
 - a. Conflicts presented throughout the execution of the BPR project are solved by sharing ideas between the employees and the project manager.
 - b. The conflicts presented throughout the execution of the BPR project are solved by the project manager.
 - c. The conflicts presented throughout the execution of the BPR project are ignored.

PART IV: STEPS IN THE PROJECT

21. Was a vision statement created in the first stage of the project? If a vision statement was created, who created it?
 - a. The vision statement was created by all the people involved in the BPR project.
 - b. The vision statement was established by the project manager.

- c. No vision statement was created for the BPR project.
- 22. Were objectives established in the first stage of the project? If the objectives were established, are these measurable?
 - a. Measurable objectives were established for the BPR project.
 - b. The objectives were established for the BPR project but they are not measurable.
 - c. No objectives were established for the BPR project.
- 23. Who participated in the definition of the objectives?
 - a. The objectives were defined by all the people involved in the BPR project.
 - b. The objectives were defined by the project manager.
 - c. The objectives were defined by the top executives.
- 24. How does the project manager assure that all the people involved in the BPR project understand all the existing processes in the organization?
 - a. Before the implementation phase starts, the project manager assures the top executives and all the employees understand the existing processes by analyzing the current processes and identify its flaws.
 - b. Before the implementation phase starts, the project manager assures the top executives and all the employees understand the existing processes by making a quick scan through all the processes.
 - c. The project manager does not assure that people involved in the BPR project understand the existing processes.
- 25. Who decided which processes need to be redesign?
 - a. All the people involved in the project, share ideas to determine which processes need to be redesign
 - b. The project manager decides which processes need to be redesign.
 - c. The top executives decide which processes need to be redesign.
- 26. Who was involved in the design of the new processes?
 - a. All the people involved in the project, share ideas to design the new processes.
 - b. The project manager designs the new processes.
 - c. The top executives design the new processes.
- 27. Most researchers stated that the implementation stage is where reengineering efforts meet the most resistance and hence it is by far the most difficult one. Knowing this, who was or will be involved in the implementation stage?
 - a. Since the implementation phase is where reengineering efforts meet the most resistance and hence it is by far the most difficult one, everyone is involved in this phase.
 - b. Since the implementation phase is where reengineering efforts meet the most resistance and hence it is by far the most difficult one, the project manager is the only one involved in this phase.
 - c. Since the implementation phase is where reengineering efforts meet the most resistance and hence it is by far the most difficult one, the top executives are the only ones involved in this phase.
- 28. What is your next step after the implementation phase?
 - a. After the implementation phase is done, we control and monitor the new processes to identify flaws that will help us to continuously improve our processes.
 - b. After the implementation phase is done, we control the new processes.
 - c. Our BPR project ends in the implementation phase.

29. If you are continuously improving your BPR project, who help overcome the identified flaws?
 - a. The identified flaws are overcome by communication and sharing ideas of all the people involved in the process.
 - b. The identified flaws are overcome by the project manager.
 - c. Our BPR project does not include the continuously improvement phase.
30. From whom do you receive feedback in order to determine if the new processes fulfill all the requirements?
 - a. We receive feedback of the performance of the new processes from our employees and customers.
 - b. We receive feedback of the performance of the new processes from our employees.
 - c. We don't receive feedback of the performance of our new processes.

HRM practices-organisational performance relationship framework refined: a circular model representation

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Category: Literature Review Paper

Introduction

Increasing competition and the continuously changing internal and external environment in the business world, particularly in the service sector, force organizations to implement strategies and take actions aiming at more effective and wise utilization of all production factors. Employees are considered to be an imperative in order to survive and to increase their performance (Armstrong, 2006; Davis et al., 2001; Connolly and McGing, 2007; Yang, 2006; Vlachos, 2009).

Empirical findings during the last few decades, suggest that there is a positive link between Human Resources Management (HRM) practices and Organizational Performance (OP), although it is not clear which particular HRM practices affect and to what extent the organizational performance and why this link exists (Guest, 1997; Pfeffer, 1998; Becker and Gerhard 1996; Vlachos 2009). Moreover, it is not clear if the HRM practices are actually the impact factor in the relationship. Results only show the positive association, but do not prove the actual direction of causation in the relationship. On the contrary, there are studies which claim for the reverse causation in the relationship (OP having an impact on HRM practices) or a bilateral one (Guest, 2001; Katou and Budhwar, 2010).

In the following section the reasons why companies adopt and implement HRM practices are identified, so as to form the basis for the presentation of a brief literature review on the HRM practices and OP relationship. Previous studies suggesting or implying the reverse causation in the relationship will be examined as well. A short discussion of the literature will follow and based on the previous studies in the field a revised model of the HRM practices-OP link will be proposed as a conclusion.

Human Resource Management practices – why is there a need for them?

In a continuously changing global environment of a firm, the need to focus on enhancing firm's competitive advantage emerges. In order to confront any change in their external environment and remain successful firms need to adopt the critical success factors. Ability to embrace change stands as the first one among the three, followed by creativity (combining ideas in a unique or unusual way) and innovation (the ability to diffusing creativity in positive outcomes) and becoming a world-class organisation, namely becoming an organisation which constantly acquires knowledge and uses it in forming its

strategic decisions and planning its actions so as to be the best in the world in its area (Coutler, 2005). Any external change might lead to an organisational change and any successful embracement of this change might lead to an effective performance. Therefore, firms need to identify their competitive advantage as well as the processes and mechanisms by which this advantage leads the firms to higher organisational performance.

According to resource based view (RBV), firm's resources can stand as a sustainable competitive advantage if they are unique. That is firm's resources should accumulate the following characteristics, a) be rare, b) be hard to imitate them, c) add value and d) organisations have the ability to exploit them (Coutler, 2005). In a knowledge economy, employees and in a broader sense, human and intellectual capital of the organisation, emerge as a source of competitive advantage as it concentrates all of the above characteristics (Boxall and Purcell, 2003; Kinnie et al., 2006). Thus, people management should form the main focus area of an organisation which seeks to remain successful.

Policies, practices and organisational or departmental structures concerning employee management constitute the Human Resource Management (HRM) concept (Boxall and Purcell, 2003). A more strategic approach of HRM implies that HRM is comprised of a set of practices applied in an effort to improve organisational performance and effectiveness (Boselie et al., 2005). Therefore, the adoption and implementation of HRM practices is not only necessary for the good management of the company; it is closely linked with the enhancement of employee and organisational performance, either as individual practices or as a bundle of practices (Huselid, 1995; Mondy et al. 2002; Jeffrey and Donald 2003). This more strategic view of HRM in association with the need of a sustainable competitive advantage for the organisation might form the reason why the study of the link between Strategic Human Resource Management (SHRM) and organisational performance has been considered as the "Holy Grail" of the HRM field (Boselie et al., 2005, Purcell and Kinnie, 2007).

Literature Review-The HRM practices-OP relationship

The past few decades, a great number of studies have been conducted in the HRM practices-OP link subject area, both theoretical and empirical ones; most of them supporting the existence of a positive link between HRM and performance. Several comprehensive research reviews have been conducted as well in the field, which are presented afterwards so as to solid basis of previous studies in the field and their results (Becker and Huselid, 2006 Boxall and Purcell, 2008; Combes et al., 2006; Purcell et al., 2008).

Early research in 1980s and 1990s on the linkage of HRM practices and organizational performance has been conducted, in which the HRM practices of selection, training, appraisal and compensation are shown to have an impact on financial performance (Russel et al., 1985, Terpstra and Rozell, 1993, Borman, 1991, Milkovich, 1992, Huselid, 1995, MacDuffie, 1995). The impact of a set/bundle of HR practices on financial performance and market outcomes, and on productivity and quality was emphasized in 1995 by Huselid and MacDuffie as well.

A summary of few previous literature review studies would be helpful so as to identify the trends in the field in more detail. Starting with that of, Purcell (1999), Purcell attempts a literature review in the HRM-performance field focusing particularly on the studies of best practice model. (The best practice approach suggests that specific best practices that have a universal positive impact on organizational performance and are applied in all organizations, across all employees (Kohan and Osterman, 1994; Pfeffer 1994)). He considers high commitment management as the most common and acceptable element in the HRM-performance relationship, but questions the fact that the HR practices form the HR bundle that lead to higher performance as well as the proper diffusion of HRM in companies. It should be mentioned at this point that with the term HR bundle it is meant a set of HR practices which when they are combined together have a positive effect on organizational performance (Subramony, 2009). Several scholars have claimed it exists a specific bundle of HR practices which when adopted by the firm lead always to higher performance. Scholars when adopting this approach deny to consider in their models any impact from the external environment and focus only in the internal environment of the firm and embrace only the internal fit approach. Thus, they support that there is only one and best bundle and ignore any other approach (set of HR practices) which might have positive effects on performance. Based on these two major issues, HR bundle and HRM diffusion, Purcell (1999) raises questions regarding problems of measurement, link to strategy and response to change.

According to Purcell, previous researches are based on single respondents' answers and include a limited number of employees. Moreover, he refers to the Hawthorne effect occurring in several studies. The Hawthorne effect refers to cases in which the behaviour of an individual is changed positively and temporally by observation (Mayo, 1933). The Hawthorne effect only captures the moment and do not allow for the universal applicability of the research results. Flexibility should be considered as the solution to that problem. Having this as a starting point, Purcell implies that the phenomenon of the reverse causality in HRM-performance link might be the case.

Richard and Thompson (1999) conducted a work project-study for the Institute of Personnel and Development (IPD) in the general area of HRM-performance link. They reviewed both the theoretical and empirical literature up to that date. They concluded that 30 empirical studies are pioneering in the field, with the data being collected mainly in USA and with a lower rate in UK. They showed that most of the previous study results are based largely in statistical tests outcomes and that they are not theoretically supported neither they embrace practitioners' view. Their review stands as a start point for both theoretical and empirical developments in the field as it highlights a number of inadequacies in previous studies and needs for future studies.

Firstly, by taking a closer view of the HRM-performance relationship they show that even though a massive number of HR practices have been included in different related studies, it exists no study showing which HR practices (individually or as a bundle) cause exactly which outcomes, behavioural or at a latest stage performance ones. This implies that no satisfactory theoretical basis exists for the classification of HR practices regarding their outcomes. Moreover, previous studies provide no description on the process of how HR strategies are developed and on how they impact on performance. They merely use

different HR practices and policies and test their impact statistically with limited if no control variables.

Based on this finding, it can be concluded that the omission of the process description and other policy areas, apart from HR area, might lead to an overestimation of the contribution of the HR function in organisational performance. Thus, a broader view of the HRM-performance relationship is needed, so as to extend the number of variables used and to consequently to achieve more reliable results. All these omissions in combination with the proliferation of paradigms tested statistically in the field, shows that no solid theoretical framework exists on which empirical work can be based. The fact that many theories have been borrowed from other fields, even from other disciplines to support empirical research for HRM-performance link, indicates that even after so many years of research in the field and with the field being already at its growth stage, theory development for it remains still at an introductory stage.

According to Richard and Thompson (1999), it becomes apparent that a great many HR practices have been used with almost no overlap among the studies. Different HR practices individually or as bundles have been claimed to contribute positively into organisational performance. Moreover, several HR and performance measures have been used with usually no coherence among the two, which have created consequently problems in results' interpretation. The positivistic research designs (which only examined the positive correlations between HR practices and performance) used, hinder any questions about failure of HR practices to produce increased performance. In addition, the different level of analysis as well as the mostly cross-sectional surveys add nothing to the "how" question; namely, how HR practices and polices influence performance, by which mechanisms and though which intervening variables if any. They add no clarity to the question of causality as well. They simply support the hypothesised direction of causation from HR practices to performance, as it is depicted in positivistic designs. Thus, reverse causality (performance outcomes influencing HR adoption and implementation) might also be a possibility in the relationship and should not be excluded by the research design.

Once more, from their empirical research overview, it becomes apparent that purely quantitative studies (conducted up to now), which present and test afterwards positive hypothesis for the linkage are not a lot helpful for practitioners so as to understand the linkage and its successful implementation in the real business environment. For this reason, a more longitudinal approach to studies might be useful, to help researchers take into account the variable of time in their study designs so as to have more valid results. However, despite the fact that Richard and Thompson (1999) are having a critical eye on previous studies in the field, they also hold firm the belief that the better the employees are managed, the better the organisational performance outcomes.

Boselie et al. (2005) in a more recent literature review, examined empirical studies in the field between 1994 and 2003. They concluded that a great number of commonalities among the studies exist, which stand as a hindrance in the adaption of new approaches in future studies. They conclude that most studies are conducted in a quantitative way, using single respondents' answers as data and focusing on organisational, establishment or individual level, ignoring usually the industry level. According to them, most of the studies adopt a

macro approach as they set their theoretical background with one of the, so called, three “big theories” (p: 82), RBV, contingency approach and AMO theory (Abilities, Motivation, Opportunity). A micro theoretical approach, which will embrace organisational behaviour (OB) theories, might provide a more comprehensive view of employees’ experience. In addition, a study of the methodologies used in these studies shows that no specific HR practices and processes are assigned for increase in performance and that there is preference for the use of financial and organisational outcomes. A shift in employing HR outcomes (such as employee commitment and satisfaction) can reveal employee attitudes and behaviours which might form missing variables of the “black box” of HRM-performance linkage. Even though, several studies admit the existence of the “black box” few are the studies which search inside it. In that search, Boselie et al. (2005) suggest strategy and climate as moderator factors that should be considered in future analysis of the “causal distance” (p: 75). Moreover, they propose the testing of the reverse causality based mainly on the fact that positive HR attitudes can be created by successful organisational performance.

Another literature review, conducted the same year by Wall and Wood (2005), show that even though studies assume a positive impact of HRM on performance, the existing empirical evidence are not strong enough to support this universally or at least to support the positive impact when particular contingencies exist. According to Wall and Wood (2005), the most possible reason for this is the methodological approach adopted in previous studies, whereas HRM practices are inadequately measured and in several cases measured with financial performance measures only. Moreover, the absence of longitudinal studies (retrospective or prospective ones) results in no causal conclusions. Previous studies are missing an adequate research design with competitive hypotheses, large response base and independent assessment of HRM practices.

To sum up the literature review studies referred above, regarding the link between HRM and performance four issues/problems have been pointed out (Stiles and Kulvisaechana, 2003): 1) the reverse causation-Does (increased) performance leads to changes in HR practices? If it is so, then there is a need to identify such a direction of this linkage in order for researchers to focus on it and practitioners to take related actions to improve organizational performance. 2) The strategy-firm framework suggests the alignment of HR practices to organizational strategy. But this alignment is questionable in practice where firm-specific context affects the choice and implementation of HR practices. That means that the impact of intervention of context factors might be much more affecting than is the impact of HR practices. 3) Since there are successful organizations that do not adopt and do not apply best HR practices, how then is the HRM-OP linkage verified? That question means that there is much more to be researched as to what individual or bundle of HR practices affect performance. 4) The lack of common measures of HR and organizational performance, the different research methods used (i.e. single/multi-industry, single/multi-respondent, quantitative/qualitative) result in the lack of a coherent theory of the link between HR practices and performance (Becker and Gerhart 1996, Guest, 1997).

From these comprehensive reviews it becomes apparent, what Guest et al. (2003, p: 294) stated: “a large majority of studies find an association between HR practices and firm performance, regardless of whether they are cross-sectional or longitudinal, whether

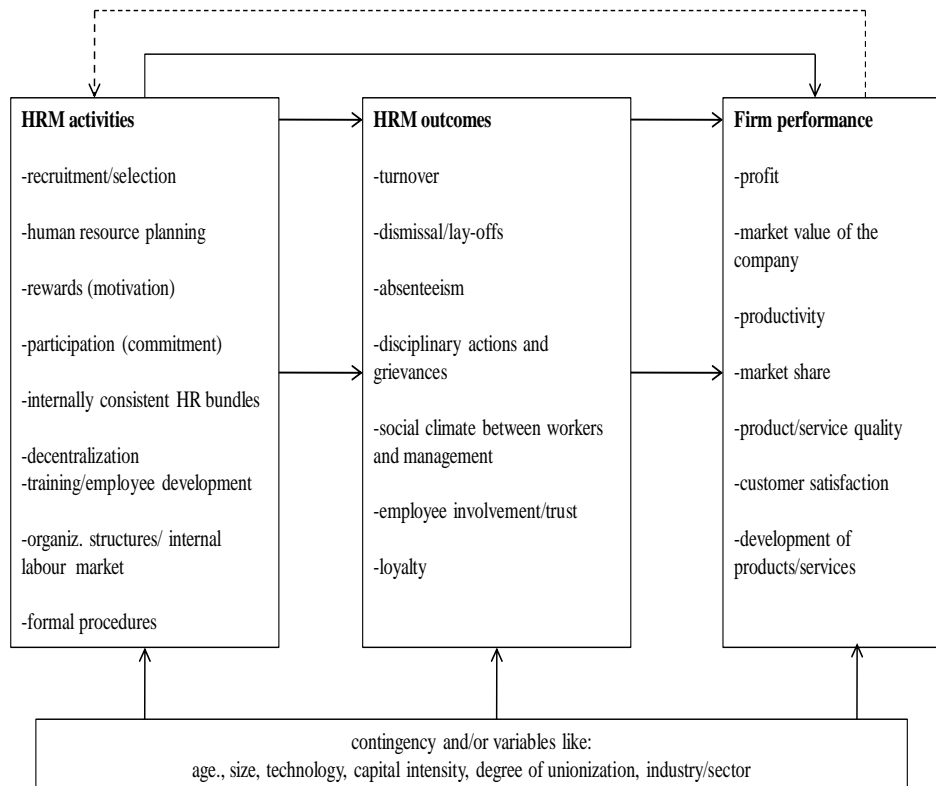
conducted at establishment or company level, whether based on strong performance data or subjective estimates, whatever sector they are based on, whatever operational definition of HR is used and wherever they are conducted”. The study design and the methodology used in previous studies appear as the reasons for this commonly assumed positive association between HR practices and organisational performance. But, no causal order is identified between the HRM practices and performance. In most of them it is assumed that the impact is from HRM practices to firm performance. However, regardless all the different approaches adopted in these studies, a confusion and lack of clarity still exists concerning the causal order of the relationship and the mediating variables influencing it (Gerhart, 2005; Katou, 2008; Wright et al., 2005). It still remains unclear “what causes what”, namely the causal order of variables involved in what is called by several authors the “black box” of the HRM-firm performance relationship (Gerhart, 2005; Katou and Budhwar, 2010; Purcell et al., 2003; Wright and Gardner, 2000; Wright et al., 2003). Hence, it stills remains to be clarified if the high performance and effectiveness of successful and competitive firms stands as the return on investment on managing firm’s human capital or if forms the source for this investment.

Reverse causality studies in HRM-organisational performance field

As stated above, it is not clear if a “forward causality” from HRM policies and practices to organisational performance is the case or a reverse one or even a bilateral one (Guest, 2001; Katou and Budhwar, 2010). Few are the studies which have tested for the opposite causal order, namely when organisational performance influences HRM (Wright and Haggerty, 2005; Wright et al., 2005). But quiet many are those highlighting the importance of reverse or reciprocal causation studies.

More precisely, Paauwe and Richardson (1997) presented a framework, adapted by Hegenzieker and Paauwe (1996), which is based on a sum of empirical studies in the field until that period (Figure 1). In this framework HRM activities are proved to have either a direct or indirect impact on firm performance. A number of control variables are tested as well. In addition, the problem of reverse causation emerges and is depicted in their framework, implying that business performance might cause changes to HRM practices.

Figure 1: A synthesis of empirically based research in the area of HRM and performance



Source: Paauwe and Richardson, 1997, p: 260 (adapted by Hegenzieker and Paauwe, 1996)

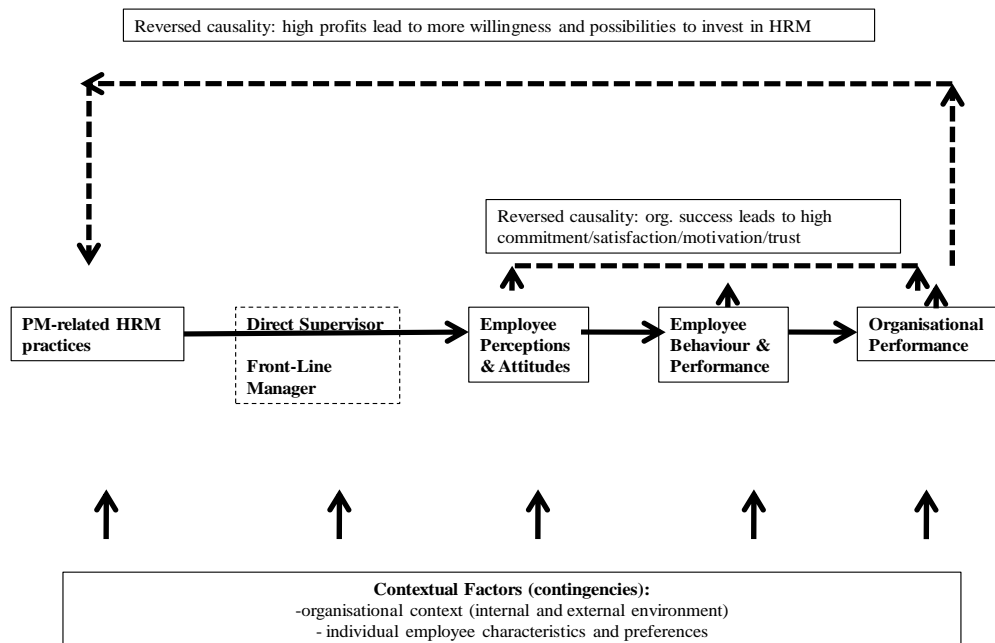
Based on the logical assumption that successful firms invest more in HR practices either to improve performance or to minimise risk or even to fairly distribute earnings, Wright and Gardner (2000) raise the topic of reverse causation and highlight once more, the need of an in depth analysis of the “black box” of HRM-performance relationship to reveal both the process of linkage and the direction of it.

Schneider et al. (2003) in their study focused on the relationship between employee attitudes and organisational financial and market performance. In their research they tested two models, one with a forward impact of employee attitudes on performance and a second one with the reverse impact. The results show that financial and market performance can cause employee attitudes. Their study proves that the belief that high-performance work practices influence employee attitudes and as a result employee and organisational performance, cannot stand any more as the norm in the field (Wright and Gardner, 2000). In addition, their study conducted in the organisational level and based on longitudinal data demonstrates that similar studies based on a single period data might result in misleading findings concerning the causal order of the employee attitudes-performance relationship.

A study based on longitudinal data is that of Guest et al. (2003) which focused on UK companies and examines the association of HRM with both objective and subjective measures of performance measures in a cross-sectional level. The study shows a positive association between HR practices and performance but fails to prove that HR practices lead to enhanced organisational performance. Even though the assumption that prior performance might result to the adoption of specific HR practices, is made, no significant results are reached to confirm the assumption as no evidence concerning the introduction time of HR practices are included in the study (Guest et al., 2003). Thus, future studies should test for the relationship between HRM and performance by examining the results of the implementation of certain HR practices on performance, for a definite time period. It should be also mentioned that Guest et al. (2003) research shows support of the fact that profitability leads to more investment in HRM rather than the opposite.

Den Hartog et al. (2004) propose a more detailed model of HR practices-performance linkage, by including employee attitudes, individual performance and supervisor's role (Figure 2). One of the main of the main assumptions of their model is that of reversed causality, which they examine under a double angle. Firstly, they assume as Wright and Gardner (2000) that successful firms invest more in HRM. Secondly, they presume that high performance leads to increased employee commitment, trust and motivation which impact directly on employee behaviour and productivity (Locke and Latham, 2002).

Figure 2: A model of the HRM and performance relationship from a performance management (PM) perspective

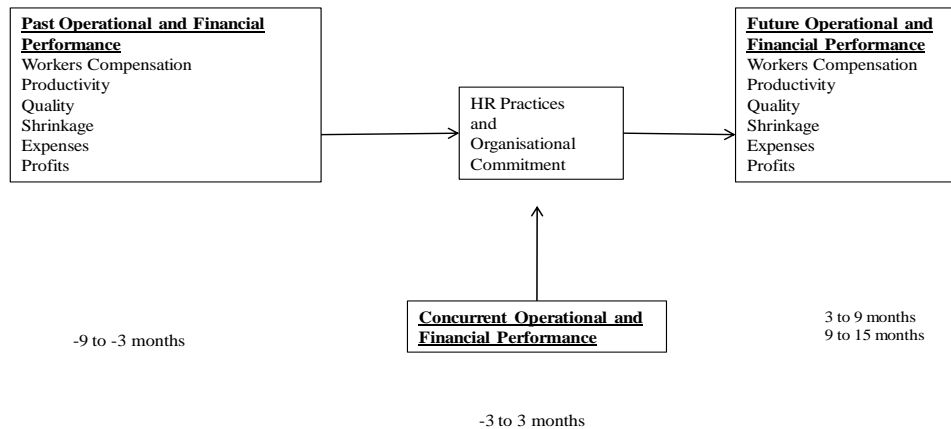


Source: den Hartog et al. (2004), p: 562

Paauwe and Boselie (2005) in their recent review of the literature in the field state the need for multilevel studies, as performance forms a multidimensional concept. Wright and Haggerty (2005), on the other hand, consider cause as one of the missing variables in the relationship. Based mainly on the HRM-economic performance link they imply that since successful firms invest their earnings in the HR department (by distributing bonuses or by investing in HR training and development) reverse causality might be the rule. More specifically, HR practices, such as percentage of total pay and number of training hours are strongly influenced by current and past performance. This in association with the fact that under performing firms decrease their investment in HR department gives support to the reverse causality effect. The development of more complex models, that will include more variables affecting performance, both in the internal and the external environment of the firm, might help revealing the actual direction of the causation of the relationship.

Wright et al. (2005) based on previous studies examined for causal links in the relationship of HR practices and past, current and future performance. They concluded that the majority of the studies in the area are post-predicted, namely examining HR practices after the performance period. Therefore, these studies suggest that HR practices predict past performance. However, even these studies do not examine for the opposite direction of the relationship between HRM and firm performance. According to Wright et al. (2005) only few scholars have attempted to test for the opposite relationship/causation, who measured firm's financial performance, objective and subjective productivity and profitability (Fulmer et al., 2003; Guest et al., 2003; Huselid and Becker, 1997; Watson Wyatt, 2002). These studies indicate once more that there is a level of uncertainty in the field concerning the causal direction of the relationship and also concerning the nature of the relationship, whether it is one way or dual one (Wright et al., 2005). Wright et al. (2005) attempt to clarify the confusion by proposing a model where past and current financial and operational performance cause HR practices and organisational commitment which in turn causes future performance (Figure 3). However, because of the short time period examined in their study they do not conclude in any specific causal direction. Reverse causation is as likely to exist as the forward causation as results show only that HR practices are strongly related with both future and past performance without implying any direction of the link. Furthermore, they observed that many of the studies in the field do not examine for the full set of HRM practices-variables which impact on performance and thus valid results for the direction of causation cannot be inferred (Wright et al., 2005). Previous studies highly ignore external environmental factors and their effect on the HRM-performance link which when considered usually supports the reverse causation. Thus, a need for more in depth research and analysis arises to identify the direction of this relationship and if there is a third variable which causes the direction of relationship of HRM practices and firm performance (Huang, 2000; Subramony, 2009; Subramony et al., 2008; Wright et al., 2005). Indeed, as Harter et al. (2002) propose, evidence for causality is possible only after numerous studies and not after few of them.

Figure 3: The study design

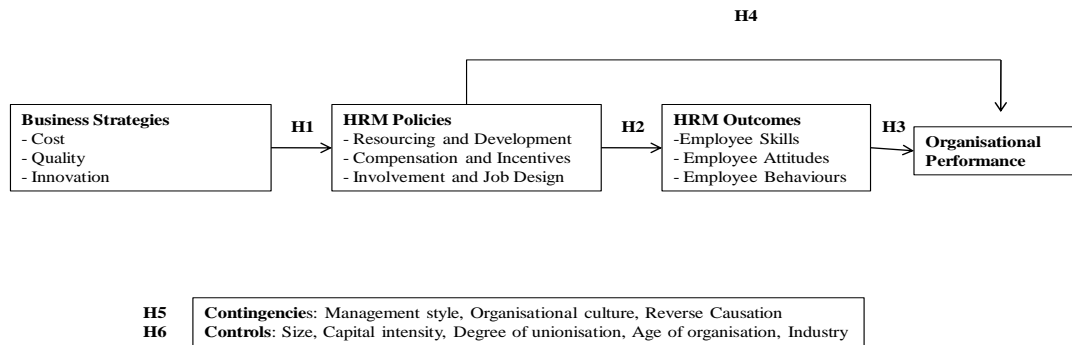


Source: Wright et al. (2005), p: 422

One year later Kinnie et al. (2006) address again the issue of the direction of the causation in HRM-performance relationship as a main methodological problem. They claim that the adoption of specific successful HR practices may be the case only in high-performing firms which have the sources to fund them. In addition, they suggest that the implementation of successful HR practices may only be the result of employee perceptions in successful firms and not the actual case. Finally, they refer to the problem of many factors causing increase in organisational performance apart from HR practices, which should also be examined or controlled.

In a very recent study Katou and Budhwar (2010) proposed a revised operational model of HRM-performance relationship (Figure 4). In this model they included reverse causation as a contingency factor and they tested for it by asking respondents whether they agree or not with the statement that high performing firms' earning causes changes to HRM department and not the opposite. The results show that organisational performance may have a positive impact on HRM. Thus, studies based on more objectives and longitudinal data should be conducted to answer the question of reverse causality as the norm or not.

Figure 4: The operational model for the HRM-performance relationship



Source: Katou and Budhwar (2010), p: 27

From the analysis above it seems, once more, that the direction of the causality in the HRM-performance linkage remains still unclear. More specifically, as it is implied, from the studies examined in this section, it is equally possible to have a reverse causation as the actual causation in the HRM practices-OP relationship. Although, several attempts have taken place to establish the direction of causation, the absence of longitudinal and objective data as well as overlooking external factors or other mediating variables that might impact on HRM-performance linkage and actually cause the linkage, render the question of causation unanswered.

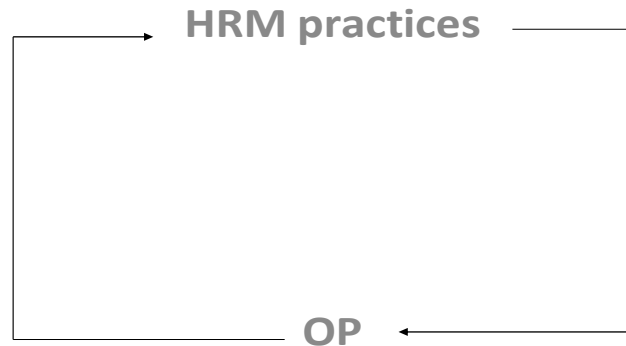
The revised HRM practices-OP relationship model

As it arises from the literature review above, the majority if not all the studies in the field present the link between HRM practices and OP as a linear one. Either they assume a positive forward linear association (Guest, 1997) between the two variables or they claim for the possible existence of a reverse linear association (OP having an impact on HRM practices) (Katou and Budhwar, 2010) or a bilateral one (Wright et al., 2005).

However, taking into consideration results in previous studies, such as a) in the study of Wright and Gardner (2000), in which it is shown that successful firms invest more on HRM practices and as in the study of Pfeffer (1998), in which it is pointed out that several set/bundles of high performing work practices (HPWP) are used by successful organizations and as they have a positive impact on organizational performance irrespective of size, country or sector. These results if examined closely imply that HRM practices adopted and implemented at a different time point (before or after the observation of high

performance rates) indicate a rather different impact/direction of causation in the HRM practices-OP link. Based on this a circular model could be proposed as the one representing the relationship (Figure 5).

Figure 5: A **circular model representation of the HRM-OP relationship**



HRM practices might have been introduced before the measurement of organisational performance and thus be one or the only cause for any change in organisational performance. Or else, HRM practices might have been adopted and implemented after the measurement of organisational performance, which means that they have been carefully selected regarding the organisational performance and the probably new firm goals. This means that reverse causation stands now as a part of the actual model and not just as a contingency factor, as in previous studies (Katou and Budhwar, 2010).

This model stands as a development based also on the findings of the Guest et al. (2003) study, in which he concludes by stating that even though in past studies, the assumption that prior performance might result to the adoption of specific HRM practices, is made, no significant results are reached to confirm the assumption as no evidence concerning the introduction time of HR practices are included in the study (Guest et al., 2003). Furthermore, we should not still exclude the possibility that third factors might have an impact on the relationship or cause the relationship itself. Thus, we should also test the influence of several control factors on the linkage.

Conclusions

From the short and comprehensive literature review in the field, it becomes apparent that previous studies have focused in analyzing the HRM-performance link under several contexts. However, no conclusions about the causality of the relationship and its direction

have been reached. No pure study exists on the reverse causation (from organisational performance on HRM practices). No specific theory has been developed for the link.

As an answer to all the confusion in the field this paper proposes a revised circular model of the HRM practices-OP relationship which includes both directions of causality assumed in past studies. Future research in the field according to this study should focus on examining the impact on firm performance of the implementation of HRM practices in different time periods. Such a development offers a new basis for more theoretical and empirical research in the field and probably a basis for answering what causes what, when, and why.

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Organizational Innovation Capability, Product Platform Development and Performance. The case of Iranian API companies, TAPIC subsidiaries

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Introduction

Technological strategy of a firm is integrated in success of a firm and its competitiveness in the market (Tidd, et al 2005). The firm's technology development can be done by making (doing R&D) or buying of technology (technology transfer) or integration of both of them (Zhao, et al, 2005, Granstrand, et al.,1992, McIvor et al, 1997).

Pharmaceutical industry in Iran like most of other developing countries uses the strategy of imitation for technology development with main focus on producing the generic drug (Cheraghali, 2006). In order to fulfill their technological gap for producing the required drugs, they try to transfer the proper technology from foreign countries or the companies which have the technology and adopt it in the firm (Zuniga et al, 2007). For having a good adaptation of technology in the firm and also indigenizing it, existence of internal capability is an important factor (Kamien and Zang, 2000; Katrak, 1997). Internal capability will increase the absorptive capacity of that to acquire the technology properly (Cohen and Levinthal, 1990) and organizational support to innovation (innovation capability) will create the proper environment for the employees and the firm to develop the technology and increase their product innovativeness as well as their performance (Mone, McKinley & Barker, 1998; Cho & Pucik, 2005, Renko, et al, 2009).

Most of innovations in developing countries are related to the imitative innovations in which the products are new to the firm but they are not new to the market (Garcia and Calantone, 2002) and have the low technological and market innovativeness. The internal ability and innovation capability of a company is important to develop new products after establishment of a new technology platform for producing a family of product which serves a variety of markets (product platform) (Ulrich and Eppinger, 2008).

In this study, a conceptual and analytical model for examining relationship of innovation capability of a firm with product platform development as well as performance of Iranian Active pharmaceutical ingredient (API) producers is developed and tested by using data from TAPIC subsidiaries as the largest conglomerate in production, provision and

distribution of API in Iran. The objective of this study is to gain a better understanding the effect of innovation capability on product platform development and performance. In order to accomplish this objective the research questions are developed, research methods are presented and findings analyzed and discussed.

In the following the theoretical background is discussed.

Theoretical Background

Innovation

In the new era, the competitive advantage of a firm come from the knowledge, technological capabilities and experience by which firm create new products in the market (Tidd, et al, 2005). In the increasing international competition environment, there is special attention to innovation in the firms. Although the R&D is aligned with high risk and high cost, but it is important for the survival of the firm (Veugelers and Cassiman, 1999) and the ability to make new product or doing things better than the others is the powerful source of advantage.

Based on Tidd, et al (2005), the majority of failures in innovation are due to the weakness in the management of innovation process. Innovation should be managed in an integrated way to get the best result, then only managing and developing capabilities of the firm in some areas is not enough.

In the fast technological change, innovation becomes important for the firm to be in front of their competitors, and the technological and managerial innovative capabilities are necessary to success of firm and industry and at last the nation (Soares, et. al.1997).

Based on Ramirez and Wallin (cited in Blois and Ramirez, 2006) capabilities are “repeatable patterns of action in the use of assets to create, produce, and deliver offerings” and they can be defined as a distinctive competencies when their imitation by the competitors are difficult (Blos and Ramirez, 2006).

Innovativeness of a firm is related to capability to employ in innovation (Hult, Hurley & Knight 2004) and is the firm’s tendency to support new ideas, creative processes and novelty Innovativeness relates to a firm’s capability to engage in innovation (Lumpkin & Dess 1996).

Guan and Ma (2003) and Yama, et al, (2004) categorized innovation capabilities into seven dimensions which are learning capability, R&D capability, manufacturing capability, marketing capability, organizational capability, resource exploiting, strategic capability

Chiesa, et al (1996) proposed a model for auditing the innovation capability of a firm based on a process model of technical innovation.

Based on Tidd (2005) successful innovation is:

1. Strategy based (Strategy)
2. Dependent on effective internal and external linkage (Linkage)

3. Dependent on effective mechanism for making changes happen (Process)
4. Happened in a supporting organizational context (Organizational structure)

These four specifications of successful innovation are considered in the context of learning organization.

He used the above mentioned factors for auditing the innovation management of the firm.

Product and Technology Platform Development

Technology is embodied in all activities of a company including primary and supportive activities. Based on Porter's (1995) value chain model, a firm has lots of activities in which at least there is a technology in it. Each technology can have impact on competition of the firm, but there are some technologies which create competitive advantage for the company and these technologies will impact more on competition.

Technological change is a key factor in economic growth, industrial change and international competitiveness. It is the major component responsible for increasing output and income in most industrialized countries (Saad, 2000) and based on Dodgson (2000) technological development is the key source of competitive advantage and the companies should have a strategic approach to their investment in technology.

Each firm's technology strategy is based on funds, structures, and the R&D activities whose mission is to create new pathways for technology (Burgelman R. A. and Rosenbloom R. S. 1989 cited in Dorf, R. C., ed. 2000).

Based on many researchers (Zhao, et al, 2005, Granstrand, et al., 1992, McIvor et al, 1997) for achieving a technology development there are two general strategies

- Internal technology Sourcing strategy (making technology)
- External technology sourcing strategy (buying technology)

Roberts & Berry (1995), Tidd and Trehwella (1997), Roberts (2001), Edler, et. al. (2002), Granstrand et al. (1992) found internal R&D as the most common way for technology acquisition. Ruchala (1997) states internal R&D is an important factor for making core competency and is suitable for growing technology (Welch, et. al. 1992), but it needs strong technical experts and also financial investment (Khalil, 2000).

Technology outsourcing will reduce time to market (Tidd, 2005), reduce the R&D costs (Jonash, 1996) and fulfill the lack of internal capability (Cutler, 1991) and based on McIvor and Humphreys (2000), although the cost saving and more profit is important for short term in external sourcing but the loss of core competencies of the firm should be considered for the long term which is the source of competitive advantage for the company

To get a competitive advantage, firm should improve its technological capabilities by internal R&D or external technology sourcing or both of them. As a matter of fact, each of them will have some advantage and disadvantage for the firm in which firm should regard.

Technology sourcing in the technology based companies will be a critical management issue (Zhao, et al., 2005).

Because the gain of knowledge and experience takes lots of time for a firm and the acquired knowledge and experience is its intangible asset, the firm that commences an industrial field based on a platform technology, gains the technological skills to branch out it into new application and new products. A product platform is a group of related products which satisfy a variety of customers and markets and is manufactured by available and preexisting technological subsystems (a technology platform) (Ulrich and Eppinger, 2008). For developing the technology platform lots of investment and effort has been spent and lots of attempts made to use it for production of different products. “A product platform is a collection of the common elements, especially the underlying core technology, implemented across a range of products” (McGrath 1995).

Meyer and Selinger (1998) described a technological platform as a set of subsystems which function as a structure to produce a stream of derivative products. Based on Wonglimpiyarat (2004) technological platform is a cluster of capabilities or competencies which make firm capable to create competitive advantage in terms of later innovations.

In our view a technological platform is an integrated system of capabilities, physical assets and know-how which is used in order to develop a category of derivative products and the product platform is a variety of products which are produced in the same technology platform but with new application.

Certain technologies have expansive market and technological opportunities and gaining knowledge and experience on these technologies serves as a platform for expansion. In the platform, experience of the firm increases the probability of diversification when the market is favorable (Kim and Kogut, 1996).

A product platform has two modes for derivative product development (Ulrich and Eppinger, 2008). As it has been shown derivative products can be involved in the initial efforts for platform development, it means in the establishment of the platform all of its products are introduced and there is no opportunity to produce the new derivative product on the established platform (see platform A, fig 1). In the other mode, there is opportunity for the firm to develop the other derivative products in the established platform which can be gained within time lapse (platform B, fig 1).

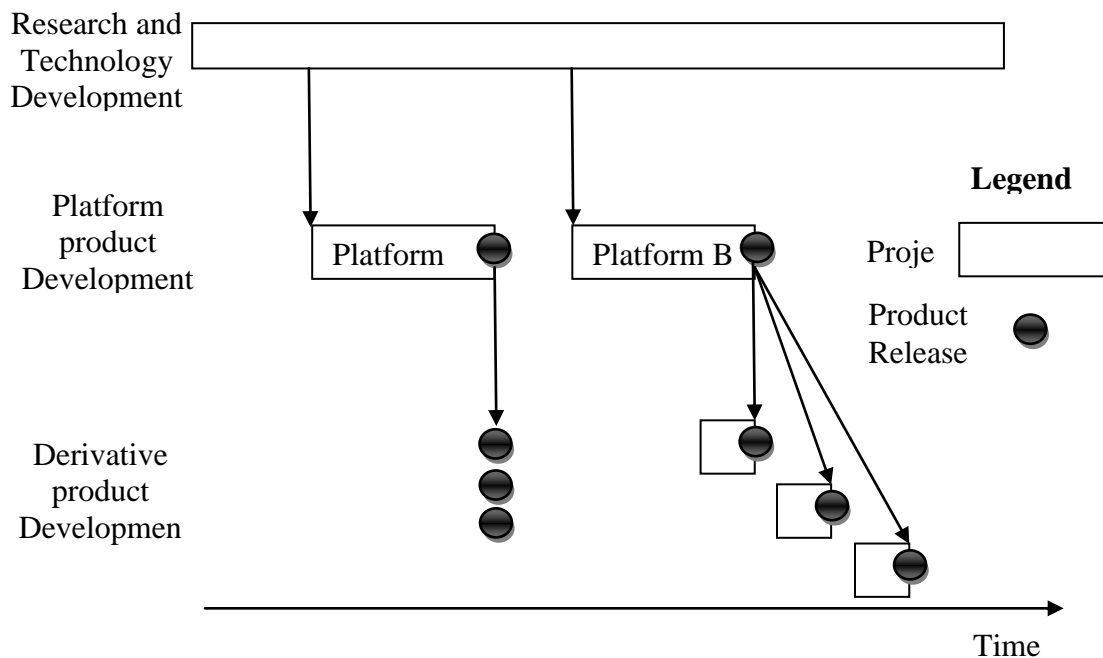


Figure1. A platform development project creates the architecture of a family of products. Derivative products may be included in the initial platform development effort (Platform A) or derivative products may follow thereafter (Platform B).

Source: Ulrich and Eppinger, 2008, p.41

Technology Development in Developing Countries

In most Developing countries, the primary source of technological change comes from industrialized countries through the process of technology transfer. This process can include the application of new technology to a new use for gaining economical profit (Rodrigues, 1985).

Based on Zuniga et al, (2007) in developing countries due to low level of investment in R&D, insufficient human resources, lack of resources and facilities, and weak technological capability, companies don't rely only on their in house R&D, they try to import technologies from foreign companies, then they will use an acquisition technology strategy which fit well with their business strategies. Pharmaceutical industry in majority of developing countries uses the strategy of imitation instead of innovation. For this reason there is a technological gap among the developing countries and developed ones, therefore for filling this gap, firms try to use technology outsourcing besides in house R&D. Using in-house R&D and technology acquisition can be a complementary for each other, e.g. using the capability of R&D can help the firm to choose the appropriate technology, and facilitate the adaptation of the technology in the firm (Kamien and Zang, 2000; Katrak, 1997) and on the other hand, the technology acquisition helps the company to improve its technological capability and optimize the R&D efforts which will lead to internal innovation (Kaiser, 2002; Kamien & Zang, 2000). But there is a dangerous case if the

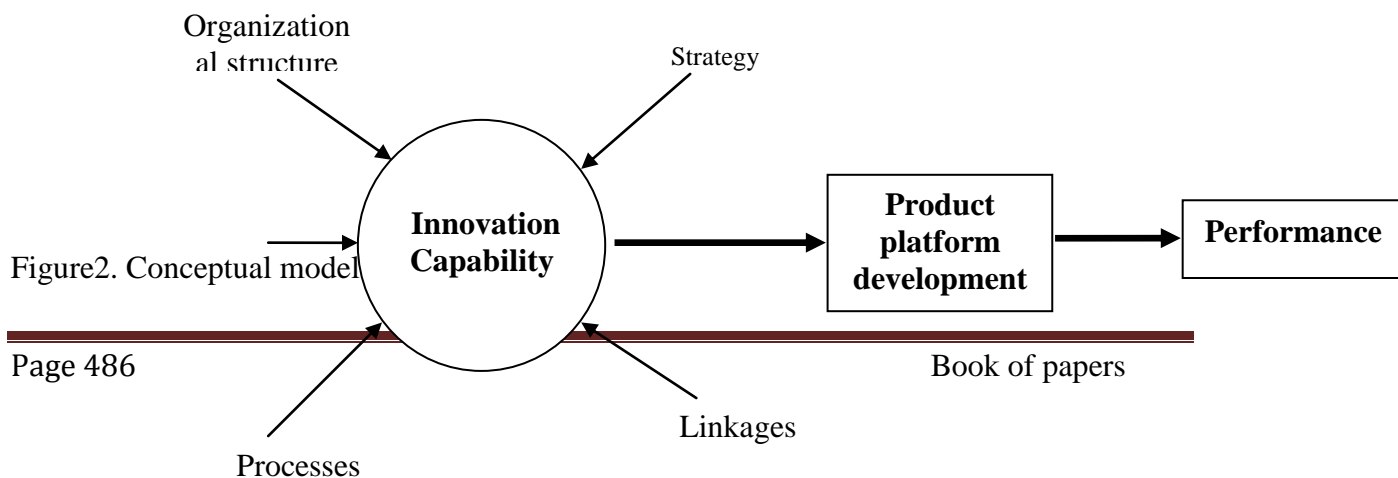
company tries to outsource all of its technological needs instead of using in-house R&D, which causes to be technological dependence and also decrease company innovativeness.

Mytelka (1987) and Pillai (1979) (cited in Katrak, H., 1997) stated the import of technology in developing countries will increase their dependency to import, and in an opposing view Blumenthal (1976), Desai (1989) and Lall (1989), (cited in Katrak, H., 1997) considered technology import as a building block for technology development and increasing internal capabilities.

The Conceptual model and Research questions

One of the important issues which play an important role in the product innovativeness, technological development and performance of the companies is the organizational support to innovation (innovation capability) (Mone, McKinley & Barker, 1998; Cho & Pucik, 2005, Renko et al, 2009). Many researchers found capabilities as the source of performance (Carmeli and Tishler, 2004; Shang and Marlow, 2005). On the other hand, based on Damanpour and Evan (1984) there is positive relationship between organizational innovation and performance and also Subramanian and Nilakanta (1996) found the positive relationship between organizational performance (ROI) and innovativeness of the company. Kleinschmidt and Cooper (1991) investigate impact of product innovativeness on profitability at the firm level.

A firm can get its technological development by the internal or external technology acquisition and many scholars reviewed technology sourcing criteria as well (McIvor and Humphreys, 2000, Granstrand, et al., 1992, Atuaheme-Gima and Patterson, 1993, McIvor et al, 1997). Although the internal R&D is the most common way for technology development (Roberts & Berry,1995; Tidd and Trehwella, 1997; Roberts, 2001; Edler, et al, 2002; Granstrand, et. al, 1992), but in the developing countries, companies acquire their technology by external sourcing from foreign countries (Zuniga et al, 2007) in order to fulfill their technological gap for producing new products. Based on many scholars (Kamien and Zang, 2000, Katrak, 1997, Kaiser, 2002) using technology acquisition and in house R&D can be complementary for each other and technology acquisition helps the company to improve its technological capability to optimize R&D efforts which will lead to internal innovation. But when the companies try to outsource all technological needs from other companies or countries, there is a probability to dependency of the companies to the source of technology which should be considered as a factor to decrease the innovativeness and performance of the companies.



As illustrated in figure 2, the model consists of the following components:

Innovation capability of a company which is a determinant factor is innovativeness of the firm. Innovative organization is not limited to a structure, and it is an integrated set of components in order to create a constructive environment which makes innovation happen. The successful innovation is strategy based which mean how the company develops its policies, plans and strategies to achieve its mission and vision. The mission and vision should be well communicated and people know the influence of innovation on performance and growth of the company. For having a successful innovation, the processes should be facilitated from idea to implementation. Also the organizational structure should support creativity and occurrence of technological change. The internal and external linkage is important to have opportunity to learn from the customers, suppliers and competitors (Tidd et al, 2005). Finally, having a learning organization beside these enablers is also important. Training of employees and increasing their knowledge level, sharing of experience, are good for increasing the learning process.

- Product platform development which is the ability of the company to extend an existing product platform with some new products to address familiar market by using its internal capability of the firm.
- Performance of the firm which is related to the financial ratio of the firm (ROI).

Research method

Study Questions:

The purpose of study can be broken down to the following research questions:

1. What are the common Product and technology platform developments in the TAPIC subsidiaries?
2. What is the difference of successful and unsuccessful companies in the product platform development and innovation capabilities?
3. What is the impact of innovation capabilities on the product platform development?

Research method

Based on purpose, our research type is explanatory. Based on result, our research type is an applied research. Based on kind of data, our study categorized in quantitative research methods, also we applied survey strategy in this research.

Population and Sampling

Population consists of all real or supposed members that we interest to generalize our finding to them.

In this study the questionnaires distributed among the people who are involved in innovation in different departments in eight subsidiaries of Tamin Active Ingredients Investment Company.

The researcher attended in the firm with prior coordination, and then the questionnaires distributed and then gathered. The studied subsidiaries of TAPIC are presented in the table 1.

No.	Name
1	Antibiotic Sazi Iran Company (ASICO)
2	Temad Active Pharmaceutical Ingredients Company
3	Atra Pharmaceutical Complex
4	Darou Pakhsh Pharmaceutical Chemistry Company(DPPC)
5	ChlorPars Company
6	Daana Pharmaceutical Company
7	Rahavard Tamin Chemical Company (RTCC)
8	Tofigh Darou Research and Engineering Company (TODA)

Table1. List of studied subsidiaries

Data Collection

In order to collect data, questionnaire related to innovative capabilities of companies is selected as the main tools to collect data (primary data).

At first by collaboration of TAPIC (the mother company), the researcher is introduced to the eight studied companies, and then the researcher arranged a meeting with the managing directors of each company. After attaining in the meeting and interviewing about product platform development, managing directors are requested to distribute the printed questionnaires among managers and experts in the departments of marketing, R&D, manufacturing, quality control and quality assurance. 200 questionnaires were distributed in the eight companies and 168 filled questionnaires are gathered.

This questionnaire is a valid questionnaire for auditing the firm's innovativeness and is used for identifying their barriers to be innovative. Its variables include:

- 1.Strategy
- 2.Processes
- 3.Linkage
- 4.Organizational structure
- 5.Learning

Scale used in this study is nominal, ordinal, scale and relative. The Likert spectrum for assessing opinions of individuals was used in the questionnaire.

In order to gather data about the product platform development of the companies, the archival documents in TAPIC are studied and also in order to validate the accuracy of data, interview with the managing directors, R&D and manufacturing managers are designed.

For finding the performance of the companies, the financial data sheets in the TAPIC are used to extract the net profit and also their investment in order to find the ROI of companies during 2007, 2008 and 2009.

Results

By using Kolmogorov-Smirnov Test the observed cumulative distribution function for variables with a specified theoretical distribution are compared. The distribution was normal and parametric tests are used in order to study the questions.

First Question: what is the common technology platform development in TAPIC subsidiaries?

Studying the companies in order to find technology platform development, showed that most of companies are using buying strategy for establishment of their basic technologies. In these companies, the main source of new technology platform is outsourcing from foreign countries and two platforms among the existed platforms are internally established by using in-house R&D.

The companies are studied in order to find out how they use the acquired technology to develop their product platform which the results showed that companies try to develop their product platform internally after the establishment of technology platform on their firm.

Generally Iranian pharmaceutical companies use technology transfer from foreign countries in order to fulfill their technology gap as the same as other developing countries (Zuniga et al, 2007) and by transferring the technology, they establish their product platform. But for developing their product platform, they use their internal R&D for developing new product family from their platform which is the complementary use of acquired technology and internal R&D (Kamien and Zang, 2000, Katrak, 1997, Kaiser, 2002).

Second Question: What is the difference of successful and unsuccessful companies in the product platform development and innovation capabilities?

At first the difference of successful and unsuccessful companies in innovation capabilities and then on technology development strategy will be studied.

Difference of successful and unsuccessful companies in innovation capabilities:

For defining the difference innovative capability between successful and unsuccessful companies based on their financial performance, the compare means test is used. This test is used for comparing the means of two groups of high and low performance companies. The first output of compare mean shows the means and differences between means of two groups (low and high performance companies in their innovative capability variables), and

in the second output because significance level is upper than 0.05, the assumption of equal variable is considered to compare which shows in Iranian pharmaceutical companies, high and low performance companies have difference in their innovative capability and its variables (table 2).

Independent Samples Test

		Levene's Test for Equality of Variances		t-test for Equality of Means							Conclusion
		F	Sig.	T	Df	Sig. (2-tailed)	Mean Difference	Std. Error	95% Confidence Interval of the Difference		
									Lower	Upper	
Strategy	Equal variances assumed	1.359	0.245	-7.107	166	0.000	-0.5673	0.07983	-0.72495	-0.40972	Accepted
	Equal variances not assumed			-6.930	131.074	0.000	-0.5673	0.08186	-0.72928	-0.40539	
Processes	Equal variances assumed	0.455	0.501	-7.348	166	0.000	-0.6251	0.08507	-0.79304	-0.45712	Accepted
	Equal variances not assumed			-7.534	155.570	0.000	-0.6251	0.08297	-0.78896	-0.46119	
Organization	Equal variances assumed	0.083	0.774	-5.031	166	0.000	-0.4128	0.08206	-0.57482	-0.25079	Accepted
	Equal variances not assumed			-5.019	142.855	0.000	-0.4128	0.08225	-0.57539	-0.25022	
Learning	Equal variances assumed	1.527	0.218	-6.073	166	0.000	-0.4436	0.07304	-0.58776	-0.29936	Accepted
	Equal variances not assumed			-6.203	153.964	0.000	-0.4436	0.07151	-0.58482	-0.30230	
Linkage	Equal variances assumed	0.141	0.707	-8.279	166	0.000	-0.6337	0.07655	-0.78485	-0.48259	Accepted
	Equal variances not assumed			-8.161	136.711	0.000	-0.6337	0.07765	-0.78727	-0.48017	
Innovation Capability	Equal variances assumed	0.276	0.600	-8.373	166	0.000	-0.5356	0.06397	-0.66192	-0.40932	Accepted
	Equal variances not assumed			-8.357	143.096	0.000	-0.5356	0.06409	-0.66230	-0.40893	

Table 2. Independent sample test

By using the Chi-square test (χ^2), the relationship between performance and innovation capability are studied. The results confirm existence of relationship between the performance and innovative capability variables because the Asymp. Sig. (2-tailed) for all variables are lower than 0.05.

Variables		Pearson Chi-Square	Likelihood Ratio	Linear-by-Linear Association	N of Valid Cases
Strategy	Value	74.1	93.6	38.9	168
	Df	25	25	1	
	Asymp. Sig. (2-tailed)	0.000	0.000	0.000	
Process	Value	63.1	75.8	40.9	168
	Df	23	23	1	
	Asymp. Sig. (2-tailed)	0.000	0.000	0.000	
Organization	Value	38.3	47.4	22.1	168
	Df	23	23	1	
	Asymp. Sig. (2-tailed)	0.024	0.002	0.000	
Learning	Value	62.3	73.9	30.4	168
	Df	21	21	1	
	Asymp. Sig. (2-tailed)	0.000	0.000	0.000	
Linkage	Value	68.1	79.9	48.8	168
	Df	20	20	1	
	Asymp. Sig. (2-tailed)	0.000	0.000	0.000	
Innovation Capability	Value	150.8	203.0	49.6	168
	Df	87	87	1	
	Asymp. Sig. (2-tailed)	0.000	0.000	0.000	

Table 3. Chi-Square Tests

Difference of successful and unsuccessful companies in product platform technology development

For studying the difference of technology platform development of high and low performance companies the cross tabulation table between strategy and performance of companies are done which shows the companies with low performance use buying

strategy and companies with high performance use both of buying and making strategies.

		Technology platform sourcing	
		buying technology platform	making technology platform
Performance	Low		-
	High		

Table 4. Cross tabulation of performance and sourcing strategy

In studying the difference of product platform technology development between high and low performance companies the cross tabulation table (table 5) between the performance of companies and the question " how many products are developed internally in the product platform? " is done which shows most of high performance companies have developed the acquired technology to more products than the low performance companies.

Company	Performance	Number of developed products internally on the acquired technology platform	
		First technology platform	Second technology platform
C	Low	1	-
A	Low	1	0
G	Low	2	-
D	Low	0	-
B	High	5	5
H	High	5	6
F	High	3	4
E	High	0	-

Table 5.18 Cross tabulation of performance and number of internally developed products

Although E company is a high performance company but does not have any internally developed product. The reason to this exception is that the type of product platform in the E company does not have any opportunity to develop new derivative product on it, and all of the derivative products are developed in the initial establishment of product platform.

Finally we can

1. There is positive relationship between innovation capability and the performance of Iranian API producer companies and the Iranian high and low performance API producer companies have difference on innovation capabilities with each others, and high performance companies are better than the low performance in the innovation capability and its variables. The innovation capability of the firms are the determinant factor in performance of the companies (Cho & Pucik, 2005, Renko et al, 2009) and there is positive relationship between organizational innovation capability and performance of them.
2. It has been shown that like the other researcher (Kleinschmidt and Cooper,1991; Cho & Pucik, 2005; Lages, et al, 2009) the product innovativeness of the firms is an effective factor on the performance of the companies and there is a positive relationship among them. In here although, technology sourcing strategies by both of them are almost the same but the high performance companies use the acquired technology and also acquired capabilities in an efficient way which causes to develop more new product from the technology platform. And their innovativeness in their product platform development can cause to have a better performance than the companies which are weak on it.

The firms which are good in their innovation capability in which they have well communicated vision and mission, clear organizational purpose, long term commitment to the main projects, effective mechanisms to implement the innovation, systematic problem solving, proper organizational context, proper working structure, reward system, effective internal and external organizational systems, close relationship with customers, supplier and partners, commitment to training and development have the great probability to develop their product platform better as well as their organizational performance than those companies which do not have proper organizational innovation capability.

Third Question: The impact of innovation capabilities on the product platform development

In order to answer to this research question we choose the companies in which their product platform have the opportunity to develop derivative products. Because there was a company in which all the product are developed by its initial establishment of the platform and it does not have any opportunity to develop new product in it and for new product they should establish a new platform. But the other seven companies have the opportunity to develop new derivative products on the existing platform and for the analysis of this question, we considered these seven companies.

Because the number of the developed product in each company differs, then we used ANOVA Test to compare the several independent groups. The One Way ANOVA is used when the means from several independent groups have difference. In the following table the output of One Way ANOVA between the innovation capability variable and the number of developed products are presented.

		Sum Squares	of Df	Mean Square	F	Sig.
Strategy	Between Groups	13.296	4	3.324	14.474	0.000
	Within Groups	31.691	138	0.230		
	Total	44.986	142			
Processes	Between Groups	20.136	4	5.034	24.452	0.000
	Within Groups	28.411	138	0.206		
	Total	48.546	142			
Organization	Between Groups	8.788	4	2.197	8.523	0.000
	Within Groups	35.573	138	0.258		
	Total	44.361	142			
Learning	Between Groups	9.388	4	2.347	12.490	0.000
	Within Groups	25.932	138	0.188		
	Total	35.321	142			
Linkage	Between Groups	15.378	4	3.845	16.962	0.000
	Within Groups	31.279	138	0.227		
	Total	46.657	142			
Innovation	Between Groups	11.703	4	2.926	19.884	0.000

Capability	Within Groups	20.306	138	0.147		
	Total	32.009	142			

Table 6. The One Way ANOVA output

The results of analysis showed that there is significant effect between the innovation capability variables and the number of developed products. If the significance level is lower than 0.05, it means that there can be relationship between number of developed products and each of variables. As it has been shown in the table, the calculated amount of significance level for all variables is less than 0.05, and then there is relationship between innovative capabilities and number of developed products for companies.

The innovative capability of the firms can have a positive effect on the product quality and innovativeness (Cho and Pucik, 2005; Lages, et al, 2009) and As the results showed there is positive relationship between innovation capability of the companies and their product platform development in which the companies with better innovation capabilities could use better from the opportunities to develop more products in the existing product platform.

Discussion:

Findings for researchers will be mentioned in the following:

1. Most of Iranian API companies buy the required technology in order to establish a new product platform in which the successful and unsuccessful companies are almost the same in this action same as most of developing countries (Zuniga et al, 2007), but their difference is in using the acquired technology in order to develop derivative products internally, The successful API producers (high performance) because of having better innovation capability are prone to use the opportunities to develop the new product derivatives, which can increase the sale and also the profit of company as well as its performance.
2. There is a positive relationship between the organizational innovation capability and product platform development of the companies, and the firms which are better in innovation capability are prone to develop more products (derivatives) in the existing product platform when there is opportunity to develop new products and also there is a positive relationship between the

performance of the companies and their innovation capabilities too, In which the firms which have the better innovation capabilities, have the better performance.

3. The firms which are good in their innovation capability in which they have well communicated vision and mission, clear organizational purpose, long term commitment to the main projects, effective mechanisms to implement the innovation, systematic problem solving, proper organizational context, proper working structure, reward system, effective internal and external organizational systems, close relationship with customers, supplier and partners, commitment to training and development have the great probability to develop their product platform as well as their organizational performance than those companies which do not have proper organizational innovation capability as it has been mentioned by Antoncic et al, 2007; Cho and Pucik, 2005; Lages, et al, 2009

Recommendation:

Most of Iranian API producers are sourcing the basic technology for establishment of new product platform from foreign countries and in order to use effectively the acquired technology and indigenize the technology and external capability in the company, it is important that the companies improve their innovativeness environment, innovation capability and also their internal capability. It is better for these companies to use external technological capabilities as complementary for the internal one.

There is positive relationship between innovation capabilities, product platform development and performance; API producer companies in order to increase innovativeness should improve their innovative capabilities. The most effective factors in high performance companies are strategy, learning capacity and processes (based on Friedman test) in which the low performance companies are weak on it. Therefore, the low performance companies should increase their capabilities in these categories. In order to have an innovative management, the companies should well communicate the company's vision about innovation, the threats and opportunities should be detected and proper action be done, top management should have commitment on innovation, commitment to training and improving employees capabilities and share experiences in order to learn from the mistakes.

By having a learning organization, the internal capacity to acquire the external technological capabilities will increase and capability to get transfer of technology completely and developing that will be increased.

Based on Zuniga, et al, (2007) in developing countries companies for filling the technological gap with developed countries try to transfer technology from them and in order to prevent dependency to external sources of technology, it is important that Iranian API producer companies manifest their internal capabilities, and use technological outsourcing as complementary for their internal capability and in-house R&D.

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Factors Affecting the Sustainability of Quality Management Practices: An Agenda for Future Research

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Key words: Quality management, quality award model, key success factors, sustainability.

Introduction

Quality management is broadly recognized around the world as a very important competitive priority for the long-term success of an organization over several decades. However, the recognition of the successes through using the quality management approach historically has been made by obtain national quality or excellence awards (Laszlo, 1996). The national quality or excellence awards programs are the next major quality management event following TQM (Vora, 2002; McAdam et al., 1998). Therefore, for many organizations participating in national quality or excellence award program is a way to support their TQM practices towards achieving world-class statue (Yusof & Aspinwall, 2000) Puay et al,1998, Adebajo, 2001, Grigg & Mann, 2008a).However, to get significant benefit and the best result, organizations must maintaining the practices with the awards principles for the long-term on the competitive path and made it a part of their organizational culture. Studies by Coulambidou & Dale (1995) and Angell & Corbett (2009) support this view.

Today, the national quality/excellence frameworks and their criteria have been commonly accepted by many organizations as a powerful tool for assessing an organization along the quality and excellence path (Meers & Samson, 2003). Therefore, given today's business climate, it would be hard to find an organization to ignore the practice on quality management approaches. However, achieving excellence is hard enough at the best of times; sustaining it in today's world of increasing global competition, rapid technological innovation, changing processes and frequent movement in economic, social and customer environments, is even harder.

Literature Review

After the successful of quality management practices in Japan several countries established national quality/excellence award programs to pursue excellence in an effective way and to recognize which organizations employed the best quality

management practices. All awards principles are strongly grouped based on the core of key principles and major constitutes of TQM (Ghobadian & Woo, 1994, Ghobadian & Galliar, 1997, Thompson & Simmons, 1997, Hendricks & Singhal, 1999, Zairi, 2001, Tan et al. 2003). Therefore, getting a national quality/excellence award is a confirmation for TQM implementation successfully (Hendricks & Singhal ,1996); Ghobadian & Galliar ,2001; and Eriksson ,2004). Improvements as assessed against the quality/excellence framework will lead to long-term business success. As a result, there has been a trend in organizations to use quality-based initiatives as a source of competitive advantage.

The literature suggests that the success of an organization by using the quality-based initiatives does not depend on individual quality tools and techniques, but it much depends on a range of general management practices, including: top management commitment and support, establishment of trust and communication, employee empowerment and motivation, common metrics across the organization, a stepwise problem solving approach, and standardised analysis using quality tools (Choo et al., 2007; Easton & Jarrell, 1999; Ehigie & McAndrew, 2005; Hodgetts et al.,1999; Powell, 1995; Soltani et al., 2005; Venkateswarlu & Nilakant, 2005). Business excellence or organizational excellence and all round growth have been the spicy subject of discussion among management academics at the recent years. The first major study on the concept of ‘business excellence’ as a topic of academic research was undertaken by Peters and Waterman (1982) in the famous book, *In Search of Excellence—Lessons from America’s Best-run Companies*. This investigation, designed to understand what some leading US organizations were doing to succeed in the face of the Japanese-led quality revolution. They provide many suggestions for success criteria behind business excellence concept for ‘excellent organisations’.

TQM versus Business Excellence

TQM as the fourth level of quality management (Van der Wiele et al., 1997) has been one of the major intuitive for improved productivity for almost over three decades ago. Although TQM is much older than that, the ‘total quality movement’ really picked up steam in the late 1970s and early 1980s when several large American corporations adopted the techniques that enabled the Japanese to be so successful. There is clear evidence that many organizations view TQM as the basis for excellence (Adebanjo, 2005). Business excellence is the goal of every modern organization and can be defined as the next step after TQM, for the success of enterprise on the competitive path (Vora, 2002; McAdam et al., 1998).The use of excellence models is popular for the same

reasons that TQM became unpopular. (Adebanjo, 2005).The term of Organizational Excellence or Business Excellence is generally associated with the European Fundamental for Quality Management (EFQM) excellence model. EFQM to provide a model that ideally represents the business excellence philosophy that can be applied in practice to all organizations irrespective of country, size, sector or stage along their journey to excellence (Dommartin, 2000).

Table 1 shows a review of the philosophy, principles, process , performance, and problem indicators of both reveals that business excellence was and still is fundamentally based on the quality management concept and practices. On the other hand, the business excellence model provides a clear road sign for organizations to follow towards excellence, we may also note that both TQM and business excellence stress primarily the importance of continuous improvement.

Table 1: TQM versus Business Excellence

Concepts(5 Ps)	Total Quality Management (TQM)	Business Excellence (EFQM Model)
Philosophy	To combine people and quality techniques to achieve continuous improvement in the quality of the product and hence in all aspects of the operation (Harriss, 1995).	To assist organization to participate in improvement activities leading ultimately to excellence results and driving force for sustainable excellence (EFQM 2010).
Principles	Customer focused, leadership, involvement people, process approaches, continual improvement, and supplier relationship.	Result orientation, Customer focus, leadership and constancy of purpose, management by process and facts, people development and involvement, continuous learning, innovation and improvement, partnership development, and public responsibility.
Process	SPC Statistical Process Control) P-D-S-A (Plan, Do, Study, Act)	RADAR (Results, Approach, Deployment, Assessment, and Review).
performance	Continuous improvement of the organization, Customer satisfaction, and employee development.	Customer results, people results, and society results. Key performance results.
Problem	TQM is conceptual and philosophical. Its strong Ideological and culture perspective cannot be easily developed in companies (Salengun & Fazel, 2000)	Business excellence needs to avoid evolving into a purely scoring, short-term oriented mechanism, losing the fundamentals of the quality focus.

The Dubai Quality Award (DQA)

Dubai Quality Award Secretariat adopted the excellence model based on European Foundation for Quality Management (EFQM) excellence model. The latter has been successfully applied in European private and public sector organizations since 1992. This model provides a holistic framework for organizational excellence. All nine criteria work as one complete system, such that any deficiency in one area will affect the score in other areas. Applicant of the DQA must demonstrate sustained continual improvement. They should focus on the improvement process and not only on winning the award trophy.

DQA is not a process of generating winners and losers; it is a process of recognizing role model organizations (DQA, 2010). It is also a process for providing organizations with a ‘roadmap to achieve excellence through the adoption of good practices and soundly-based approaches that are deployed systematically and are continuously measured and improved. That is because the journey for excellence and improvement activities will be much more valuable for organizations than winning a trophy.

From the award secretariats perspective, recipient of the award represent role model organizations in the sectors they operate in. Therefore, in order to maintain the credibility and high standing of the award, it is important for the organizations to demonstrate sustained improvement activities with the results reflecting favorable trends over three to five consecutive years.

Keeping in view local environment and organizational set up, three award categories were developed as Gold, Dubai Quality Award (DQA) and Dubai Quality Appreciation program (DQAP) category. Since then, this award is conferred to winner organizations from various organizational sectors including Construction, Finance, Health Care, Manufacturing, Professional, Real Estate, Service, Tourism and Trade. Dubai Quality Award is open to private, public and government authorities. Figure 1 presents overview of the DQA categories and its score.

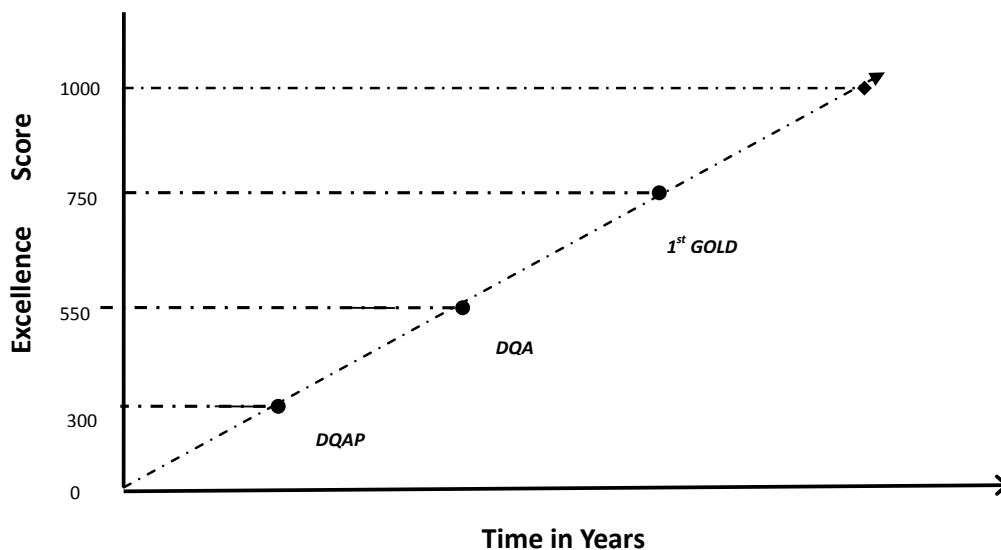


Figure 1: Role Model Organizations Consideration in DQA

Source: DQA Criteria Booklet (2010)

Key Common Success Factors of BX

This section presents a review of the key common success factors or constructs of organizational excellence developed and utilized by researchers in previous studies. Because of limited resources, it is always not feasible for organizations to devote their efforts to concurrently address all the success factors. Key common success factors or contributing variables or critical factors or enablers, in this study can be viewed as those things that must go right in order to ensure the successful implementation of quality management concepts such as Business Excellence (BX). In this paper, we tried to investigate key common success factors for BX based on extant literature review. The investigation of the key common success factors for successful the practices of BX are presented in Table 2.

Various studies have been carried out for the identification of those factors of successful BX practices, from three different areas: contributions from quality gurus, formal evaluation BX models and empirical research. Out of the 38 different critical factors developed by the researchers, 11 were found to be the most popular critical factors for TQM, meanwhile 7 were found to be the most popular critical factors for BX. They are all critical factors for TQM and BX, ranked from the highest to the lowest level of popularity:

1. Top management commitment/support.
2. Product/service design.
3. Supplier quality management (some researchers used different terms such as vendor quality management; supplier chain management; supplier quality assurance; cooperative supplier relations; supplier management).
4. Process management (includes process knowledge, process control and improvement, process analysis and improvement, process focus).
5. Human resource management (includes employee relations, employee empowerment, employee involvement, employee participation, employee management, providing assurance to employees, human resource development, employment continuity, work force commitment).
6. Use of tool and technique.
7. Work environment and culture.
8. Continuous improvement.
9. Customer focus (customer driven processes, customer orientation, customer satisfaction/involvement).
10. Leadership.
11. Training and education.

From the review, it can be summarized that critical factors for successful TQM implementation can be classified into three groups of researchers: Group researchers I: 'soft' factors and 'hard' factors (Ahire et al. 1996; Thiagaragan et al. 2001; Lau & Idris, 2002; Tari & Sabater, 2004; Rahman & Bullock, 2005; Vouzas & Psychogios, 2007; Fotopoulos & Psomas, 2009); Group researchers II: TQM factors can be divided into strategic factors, tactical factors, and operational factors (Salaheldin, 2009); and Group researchers III comprises the TQM framework into organizing, systems and techniques, measurement and feedback, and culture and people (Chin et al. 2002).

The most important factors in the successful implementation of TQM are full management support and commitment and giving the correct training to the right people at the right time (McQuater et al. 1995; Bunney & Dale, 1997). Managers must understand the importance of their commitment in order to spread the use of these tools and techniques and to improve the TQM level & TQM results (Tari & Sabater, 2004). However, tools alone cannot provide results by themselves. They must be developed to reflect the companies' culture and management vision (Govers, 2001). Tools and techniques also can be used to reinforce recommendations made to managers (McQuater et al. 1995). The key to improvement is to focus on the improvement objectives and recommendations, and use tools and techniques as an aid for that purpose.

Table 2: Key Success Factors of Business Excellence Practices Developed and Utilized by Researchers

No .	Key Common Success Factors	Business Excellence Sustainability (BES)											freq	
		I	II	III	IV	V	VI	VII	VIII	IX	X	XI		
1	Top management commitment/support	+	+	+	+		+	+	+	+	+	+	+	11
2	People management	+		+	+	+		+	+	+	+		+	9
3	Middle management involvement	+	+	+	+	+		+	+		+	+		9
4	Training and education	+	+	+		+			+		+		+	7
5	Reward and recognition	+	+		+		+	+			+		+	7
6	Teamwork and cooperation		+	+	+		+	+	+		+	+	+	9
7	Quality policy and strategic planning	+		+	+		+		+		+		+	7
8	Communicating for quality relationship	+			+			+			+		+	5
9	Supplier management	+		+		+		+						4
10	Accredited quality management systems		+			+			+			+		4
11	Organizing for quality		+		+			+					+	4
12	Managing by process	+		+				+		+				4
13	Benchmarking	+				+					+			3
14	Self-assessment		+						+				+	3
15	Cost of quality		+									+		2
16	Quality control techniques	+		+	+			+			+	+		7
17	Measuring customer wants and satisfaction	+		+		+	+		+		+	+		7

The most important factors in the successful implementation of BX are full management support and commitment and giving the correct training to the right people at the right time (McQuater et al. 1995; Bunney & Dale, 1997). Managers must understand the importance of their commitment in order to spread the use of these tools

and techniques and to improve the TQM level and TQM results (Tari & Sabater, 2004). However, tools alone cannot provide results by themselves. They must be developed to reflect the companies' culture and management vision (Govers, 2001). Tools and techniques also can be used to reinforce recommendations made to managers (McQuater et al. 1995). The key to improvement is to focus on the improvement objectives and recommendations, and use tools and techniques as an aid for that purpose.

As can be seen from the review, the CSFs for BX sustainability are very similar to the CSFs for TQM implementation due to its close. The proposed critical factors for effective implementation of BX sustainability are summarized in Table 3.

Table 3: the proposed key factors for effective BES

Key factors (criteria)	Sub-factors (sub-criteria)
Management responsibility	Strategic quality planning/quality policy; the role of divisional top management; top management commitment/support; internal stakeholders' involvement (middle management involvement)
Resource management	Technology-and production related resources; financial-related resources; information and communication-related resources
People management	Employee involvement/empowerment; education; and training; teamwork and cooperation; work environment culture
Quality in design and process	Process management/operating procedures; role of quality department; product design; process analysis and improvement; applied quality tools and techniques
Measurement, analysis & feedback	Quality measurement, feedback and benchmarking; continuous improvement; performance measurement: external and internal; quality data and reporting; communication to improve quality; recognition and rewards; quality systems
Supplier management	Supplier quality management/supplier chain management; contact with supplier and professional associates
Customer focus	Customer involvement/satisfaction/orientation; customer driven processes

Discussions and Future Research

A review of the literature shows that, TQM is rather than a mere set of factors, a network of interdependent components, a management system consisting of critical factors, techniques and tools (Hellsten & Klefsjo, 2000).

These techniques and tools are vital to support and develop the quality improvement process (Bunney & Dale, 1997; Hellsten & Klefsjo, 2000; Curry & Kadasah, 2002; Tari, 2005). BX in general and its principles and criteria in particular are, alongside critical factors, another important component of TQM, which emphasizes their importance for the improvement of quality of business and results. Tari and Sabater (2004) suggested that firms must develop both the hard and the soft parts of TQM in order to succeed. With the passage of time and with changing customer's needs and expectations the word of 'quality' has been replaced by 'excellence'. As part of this quality progress, business or organizational excellence has become a recent goal of quality management movement (Fang Zhao, 2004). Therefore, business excellence practice can be named as the fifth level of quality management and next step after TQM, for the success of an organization (McAdam et al., 1998; Vora, 2002; TH-05, 2001) in this never-ending journey. However, there has been a lack of empirical and published research and any comprehensive studies reported in the literature focusing on and revealing factors affecting implementation of BX principles at management level of winner organizations.

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Introduction of debate as a teaching method in university curriculums

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Shortcomings of methods of education used today

When we talk about why it is necessary to improve the system of higher education in Serbia, one of the main often stated reasons is the inefficiency of this system. The proof of this claim lies in the fact that the average duration of the study is almost two times longer than it should be (Ministry of Education, 2005). In addition, about two-thirds of the students give up entirely on the studies: each year, on average, 33,000 students are enrolled, and only 12,000 graduates (Ministry of Education, 2003).

The roots of inefficiency in the system of education are very complex, and there is a significant, although unexplored, the impact of various "external" factors: socioeconomic status of students, the general state of society (in economic and social terms), the problems carried over from previous education (mainly secondary) and so on. However, the inefficiency of higher education is partly determined also by the "internal" factors, related to the organization of studies, the regime of the studies, insufficient compliance of curriculums with the exam criteria, the number and volume of study subjects, the mutual compatibility of study subjects within the same study program, number of students and their readiness to follow the lessons, the number of teachers and their qualifications for teaching, and so on.

Part of these problems should have been solved by adequate implementation of the Law on Higher Education, which entered into force in September 2005, since it envisaged the change of the regime of studies, introduction of the ECTS credits, as well as the definition of the learning outcomes, which was supposed to change the very essence of the current system of education.

Misunderstanding of the essence of the educational process is reflected in the following:

- The teaching methods, within which the *ex cathedra* method is predominant;
- The focus is on the activity of teachers and not on the activity of students;
- The pressure both on teachers and on students is primarily to formally cover the study materials and not to "learn something";
- Often mismatch between what is taught in class and what is asked on the exam;
- Exams are performed in a limited number of ways – periodic tests, written or oral exams conducted through testing, resolving of assignments or oral / written reply to a combination of pre-designed questions - and therefore testing only a limited set of acquired competencies¹⁵

It is significant to note that, during their education, better part of the students will not acquire, among other things, required practical experience (i.e. how to apply the acquired knowledge in practice). There are only few cases in which the needs of the labor market and consultations with employers are considered during the creation of study programs. In addition, only few of the higher education institutions keep records of employment of its graduates.

Considerable uniformity in terms of teaching methods can also be detected. On most of the study programs, (i.e. in the vast majority of the classes), the only teaching method is *ex cathedra*. Too little room is left for discussion with students, and in the number of cases even for the students' questions related to clarifying the content of lectures. If the goal of higher education is merely for students to develop the ability for sitting and listening, with the eventual development of the ability to keep the notes, then the *ex cathedra* method is the right solution. However, it is impossible for students to develop various skills and abilities by using only one teaching method.

¹⁵ In accordance with the EU methodology, during 2005 and 2006 the Center for Education Policy AAEN carried out the regional Tuning project related to social and humanistic sciences, entitled "Regional alignment of curriculums - towards the European area of Higher Education."

Learning outcomes are the essential element of the curriculum, but their formulation in practice is often reduced to mere satisfaction of forms prescribed by the Bologna Process or by the Law on Higher Education (Article 28). However, learning outcomes harbor the potential for a fundamental change in the educational process. Such potential of the learning outcomes stems primarily from a new philosophy of education, which involves changing the focus of education from the process of lecturing / classes to the learning process.

If we agree with the fact that the student and the learning process (rather than the process of teaching) are in the focus of education and curriculum development, the first step in the development of a new kind of curriculum is a departure from the final outcome, i.e. from defining the competencies that a student should possess upon completion of the study program. And here we encounter a problem related to the very notion of competence. The term competencies usually include knowledge, skills and abilities that a person acquires or develops, and which are enabling that person to do something. Educational system in which the focus is on the student *inter alia* aims to provide that students are competent at the end of the educational process, i.e. that students will have certain knowledge, skills and abilities. Competencies in this sense represent a dynamic combination of knowledge and its application, attitudes and responsibilities that reflect the results of educational program.

There are different divisions of competencies. Below are divisions emerged within the Tuning project, with this division primarily dividing the competencies on general (or generic) and professional:

- Generic competencies should be obtained by ones who finish a certain level of education regardless of science or industry you are dealing with (such as foreign language skills, knowledge application in practice, computer literacy)
- Subject specific competencies are identified for each subject or field of study and they are more specific.

The Tuning project defines three groups of generic competencies - instrumental, interpersonal and systemic. Instrumental competences, among others, include the ability to analyze and synthesize¹⁶.

If, for example, the transitional nature of society and recent history of the region are taken into account, the competencies such as social responsibility and critical thinking

¹⁶ Julia Gonzales, Robert Wagenaar (editors), Tuning Educational Structures in Europe II: Universities' Contribution to the Bologna Process, University of Deusto, University of Groningen, 2005.

and reading (developed through the debate as a teaching method) can also be considered as important.

A particular challenge in this regard is the change in attitude and mindset. This change is often considered as “mission impossible”, because the existing attitudes and mindsets are being developed over the long period of time, during which the system of higher education did not change in response to changes in the environment, or did change in a way that it was more isolated from the same environment. What is important to emphasize here is that a change in mindset and approach to higher education as such (as by the academic community and by the students, employers and society as a whole) can come only through broader change in the understanding of the role of education in general. In this context, it is a debate that allows the change in thinking and attitude towards all processes in the society – educational, political, social, economic and other.

Challenges facing education today

Information age has reshaped our society, changed the way we acquire information and changed the labour market in the span of a decade. The workplaces we are preparing our students to fill come with a broadband connection, and data has become the realm of hard drives, not humans. Workers are no longer asked to know everything, but to know how to find out quickly. These changes came about through couple of trends brought by the information age, we will examine a few.

Information overload. It is said that more information can be found on the pages of the NY Times than what was available to an average 19th century person during their whole lifetime. The amount of data available on the web is increasing exponentially. As with every information explosion, problems of managing all the new data arise. This means two things:

1. Workers are more productive if they know how to find good information quickly, then if you specialize them they will find out all the information on their own.
2. Once a worker is delegated to find out certain information, it is lucrative for him/her to know how to filter, organize and present that information to others.

The job of University professors is to prepare their students to be as productive and valuable as possible, hence the need to include education in developing these skills.

Persuasion science has advanced to the point where we are bombarded with messages trying to influence us into doing something. Marketing agencies try to sell us their products, paid experts try to convince us into their points of view, trained negotiators try to bully us into concessions at the negotiating table. This trend calls for several things:

1. Critical thinking is beneficial in the workplace. Critical thinkers will represent the company's interests better against competing interests.
2. Persuasion methods are beneficial once the tables turn, as the worker is able to acquire more concessions than the others can.
3. In every day life, students versed in persuasion skills will be able to see through companies and people trying to influence them, and to preserve their own interests better.

Globalization has brought companies and workers on different continents under the influence of the same forces. The sub-prime mortgage loans bubble in America, and the global economic crisis that followed it in 2008 are proof of this. This trend brings into light more qualities as beneficial to a today's worker:

1. Knowledge of the world problems, which provides opportunity to foresee those problems spreading locally, and then act accordingly, and
2. Communicating with members of drastically different cultures in a super-cultural context, which enables workers to understand and be understood when cooperating with companies from other cultural frameworks.

New media is quickly replacing the old as the provider of the information. Google, blogs, websites and wikis become the go-to places where people find information. However, most of this new media is agenda driven, not accountable. The trend has become so prevalent that some old media, such as television channels and some newspapers, are abandoning the mantra of objectivity and fact checking, for agenda pushing. Agenda driven media can continue to exist as long as there is no objective confrontation of conflicting agendas to the viewer. As that never happens, it is left to the viewer to cut through the agenda driven propaganda into the core of the issue, weather it is a citizen trying to vote, or an investor trying to find a suitable investment. [1]

How does debating as a teaching method rise to the challenges of today's education?

Participation in academic debating creates numerous benefits for the students. Some of them we will outline here, as they respond to the exact requirements posed by the previous chapter.

Data analysis is an essential debating tool. Debaters must learn how to find the relevant information on the topic when they're researching possible motions for a tournament, analyze and save or remember their results. After debating for some time, debaters collect a lot of information, but they will always encounter new topics, where they will have to quickly utilize the data they know in a new problem.

Presentation of knowledge is required from debaters in a limited time frame. Debaters learn how to present vast amounts of knowledge briefly, effectively and to the point.

Critical thinking is forced onto debaters, and debaters quickly adopt it. Sides are randomly assigned in a debate, therefore debaters must know how to argue, analyze and assess opposing sides of any argument.

Knowledge of the world problems is necessary in the international debating scene, as the topics must be drawn from a pool of issues which are equally important to all the countries which are participating.

Finding the right information is important because facts count in debate. Most global debates have competing schools of thought, often with competing information. Debaters need to know how to weigh authorities, how to compare sources and spot when information is biased.

Intercultural communication is developed and trained in debate, as judges come from different cultural backgrounds, as well as the opposition teams. That means debaters train to be understood, as well as to understand.

Persuasion is a peripheral skill for debaters. In theory debates should be judged by completely objective judges. As this cannot be the case, advance debating classes cover persuasion methods as a manner of gaining that last bit of competitive edge. [1]

Outcomes of teaching through debating as a teaching method in universities

International research

After properly defining the outcomes of learning, it is necessary to approach the development of methods of teaching and grading that will enable the fulfillment of those outcomes. Achieving well defined outcomes of learning involves students understanding the teaching as a process in which they question their understanding of concepts and processes and/or create new concepts and understand connections between them. To make this possible, it is necessary for the lecturer's goal to be more than going over matter, but to accomplish "interactive" teaching, through debating to the topic which is planned to be taught by the curriculum. This chapter highlights the results of research that confirms the importance of introducing debate as a teaching method.

Heads of Urban Debating League in Minnesota found that students who have practiced debate had 36% better results in reading tests than before they had debate training, in addition to showing faster progress than the control group. All the debaters showed increased interest in the curriculum. 87 % of debaters analyzed information better than the control group. Positive influence of debate training on academic performance was confirmed by Barfield (1989) who found significant increases in cumulative GPAs with students who had debate training. Debaters will also be favoured in certain professions, as proved for jobs in civil service by Pollock (1982), in the legal field by Church (1975), and educational administrators by Schroeder and Schroeder (1995). Colbert and Biggers conclude that debate experience is highly valued in the business world and they find unequivocally that debate training will help students get a job.

Debate training requires application of knowledge from a wide array of social sciences, and this is why Robinson (1956) describes debate as "introduction into social sciences". In addition to this, Semlak and Shields (1997) determined that debaters are significantly better at analysis, delivery and organization of content.

One of the best researched benefits correlated to debate training is critical thinking. Students with debate training are significantly ahead of control group in regards to critical thinking scores (Brembeck, 1949). Colbert and Barfield confirm these conclusions in 1987. These studies were disputed on several grounds, so Allan et al. started a study to remedy the shortcomings. In 1995 they proved that students with debate participation were ahead of the group who listened to lectures on argumentation. A meta-analysis of studies in 1999 proved further the link between communication skills and critical thinking.

People with good communication skills are rated more highly by their peers, as was proved by Pollock (1982). Pollock also makes the connection of forensic activities with

developing communication skills, as do Colbert and Biggers (1985) who conclude that debate training improves communication skills, as well as the skill of public speech. High verbal skills are correlated with decrease in physical aggression (Boone and Montare 1976.).

Once someone feels capable of responding verbally they feel less inclined to resort to physical force. On top of that debaters learn to respect the opposite side, because of protocol and because they might be in their spot in the next tournament. Debate training increases argumentativeness without increasing verbal aggression (Colbert, 1993, 1994).

Best learning happens when students are asked to organize information and think of alternatives (Newmann and Wehlage), which is exactly what debating is about. In order to learn, students need to be immersed into an interactive experience that must be rich and real, there must be a personally relevant challenge, and there must be intense analysis in order to present the student with other options and approaches (Caine and Caine, 1991). Recommendations of Caine and Caine correlate to debate perfectly: interactive experience is provided through competition with fellow students, even if the grading system doesn't provide a challenge to the student, personal motivation to compete with peers does, and judge's feedback provides exactly the kind of analysis Caine and Caine call for.

In summation we can conclude that debating as a teaching method is supported by scholars who have researched effects of debating training on students, and the scholars who have researched the process of teaching recommend actions that debating fulfills.
[2]

Research at the Faculty of Organizational Sciences

Students of the third year of the Faculty of organizational sciences, majoring Informational Technologies, can choose debating as an activity at their course of Legal Basis for Informational systems. They are introduced to debating for the first time ever in their schooling. They undergo a week of training by the debaters in the faculty's debate club. The topic is given in advance, and they are prepared for that particular topic.

The goal of the research was to determine whether this method of teaching was successful. In order to measure successfulness certain criteria was set, some of which were how much knowledge of facts in regards to the topic the students attained, how do students cope with opposing opinions, how do they rate their knowledge of the topic, in

which degree they felt interested in the topic, how skillful were they in arguing their positions, and whether they supported this method of teaching.

Legal Basis for informational Systems is taken by some 180 students and they were the sample of the research. These were divided into three groups: **participants** in the debate, **audience** of the debate, and those who **did not attend** the debate. The research set out to determine differences in the quality of the way the topic in question was conveyed to students, through the criteria mentioned above.

Students were distributed a 12 question anonymous questionnaire on the classes that followed the debate. 120 students attended those classes, 60% of which did not attend, 36% were the audience and 4% were the participants in the debate. Debate in question was nationalization of the national telecommunication company.

Students supported debate as a teaching method. 80% of those who participated stated they gained something through debating, of which 60% could explain what it was they thought they gained. The remaining 20% did not have an attitude towards this question. Among the audience only 8% felt they've lost something, and among those were the ones who claimed they lost their time. No students felt disadvantaged because the topic wasn't covered in the traditional teaching method, and 68% claimed they gained something in debate. Those who could explain what they gained mostly claimed it was information on the topic. Majority of those who did not attend did not have a stance, but slightly more (6%) of them said they lamented the fact they did not attend the debate.

Students were asked to say whether they are for or against the sale of the company which was the topic of the debate, and then asked to explain why. Later in the text, the same mechanism was used again with a different issue that was discussed in the debate. Participants did significantly better than the other two groups, on average some 2 points out of 12 ahead of the other groups. The audience and those who did not attend were on par, differentiating only by a couple of tenths of a point per question. This signaled the need to introduce ways of including the audience into a more active role in the debates.

Even though the audience was no better than those who did not attend at explaining their stances, it did not stop them from rating their competence in the issue 0.7 points out of 12 higher on average than those who did not attend. Participants in the debate were even more self confident, on average rating themselves as a whole 4 points out of 12 more competent in the issue than the audience. This signified that debating as a

method seemed understandable to students, even though, as we concluded previously they did not engage enough to actually advance their knowledge as audience.

We've discussed that one of proven benefits of debating is learning how to deal with opposing opinions. This research suggests that this trait needs to be nurtured over time, as the participants did not do better than the other group when it comes to displaying aggression towards people with different attitudes. Key group we identified as the problematic in this research were those students who, when asked what they think of those with different stances on the issue, and why might they think differently, replied in an insulting, derogatory manner, and attributed malicious attributes to the people who have opposing stances, not being able to imagine that someone might have a good reason to think differently than them. This group was 15% of those who did not attend, 9% of the audience, and 20% of the participants. The group was reshaped the most over the three categories of students was the group that said they had no interest in people who thought differently, non-existent in the participants, but larger in the audience than those who did not attend. It seems that, once confronted with people who advocate a view opposed to theirs large portion of those who otherwise would not reply to this question skipped into stating "they don't care about those people category", however this cannot be proven by this research. What we can conclude is that there is no immediate benefit of debating when it comes to confronting people who think opposite to one self.

Future goals

If there is one thing people who are involved in academic debate love, whether they're judges, debaters, or professors, it's to talk about how transformative experience debate is. Sharing enthusiasm among friends is not enough, and we must seek scientific proof in order to gain backing to introduce institutionalize debate in universities. Research on the Faculty of Organizational Sciences has shown that there are some benefits from introducing even a week of debate training into students curriculum. Further research needs to prove that constant debate training yields even greater benefits and mandates introduction of debate, either across the curriculum, or as an elective.

No research to date suggests what would be the optimal time frame for developing debating skills in an academic setting. It is suggested that debating should be an overarching method for the entire curriculum, others suggest electives. These two should be rivaled. Comparisons with other methods of teaching should be made. Long term development of students who start debating in earlier years of studies should be

researched in comparison to students of same faculties who don't pick up debate. There is no scientific evidence on how well debaters do once they begin their professional carriers, except for anecdotal evidence. The more information we obtain on these issues, the more compelling the case for introduction of debate into universities becomes.

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Visual planning applied in a research environment

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Category: Research paper

Introduction

Production rate is a well-known construct among today's manufacturing companies. The construct is also regarded as something positive among employees since it brings forth an optimized and evened up workflow that does not result in an unreasonable individual pressure. It all started at Toyota as a part of the Toyota Production System to produce and deliver exactly what the customers want at the time they want it by avoiding over production and minimizing repositories [0].

In service and development processes this way of thinking is more unusual even though it becomes more and more common in development processes to work with visual plans instead of using software support such as Microsoft project. In the product development concept Lean Product Development for example one of the core principles deals with application of Visual Planning in the project planning [0, 0, 0, 0]. These processes though include process flows that are not as visible as is the case in production processes when the flow composes of a physical product that processes through a manufacturing process. On the other hand application in service processes is not that different than manufacturing processes regarding classification of activities even though it is about realizing activities in document or answering on telephone calls or E-mail. The difficulty with development processes is rather the fact that this kind of process normally includes creativity and innovation activities which are really hard to predict regarding size and time consumption.

The fundamental attitude in this article is therefore that a rated visual plan is useful in development projects even though it is harder to find the optimal balance between freedom and structure in complex and creative development projects. The focus in this article is the author's research program at the Royal Institute of Technology regarding

product development. Since a research program is about developing new research results it turns out to be extremely similar to a development project regarding structure, organization and challenges. The purpose with the article is therefor to apply the advocated method in the authors' research field product development and especially in Lean Product Development, namely Visual Planning (VP). Visual planning is initially an important part of Scrum, a popular approach in development projects which in turn is built up on Lean and the Agile manifesto [0]. Visual planning is applied on the research projects to try out the method and exemplify the application in a development environment. In this article also self-experienced advantages and disadvantages with the method are presented.

The article is structured as follows. First the used method is described follow by fundamental theories about Scrum. The presentation of the actual Scrum application on the research program is divided into three sessions: description of the actual state of the Scrum application, presentation of implemented improvements of the application and description of planned future improvements. Finally an experience discussion is performed including a summary of positive and negative experiences as well as challenges with applying the method. The paper then end with conclusions.

Method

Based on the Scrum theories an adjusted application of the method have been developed and applied on the authors' research program. Also to simplify the realization of the method firstly Scrum is applied in a visual way inspired also by visual planning and secondly this application includes reservation of activities to individuals. The research is conducted in accordance to the action research method since the researchers themselves are actually performing the application of the method and supremely parts of the process [0, **Error! Reference source not found.**].

The visualization of research projects by using Scrum thinking with a visual planning perspective has been realized as an action research project since one year. During this time the policies around the method have became more and clearly structured. Also there is an ongoing work with continuous improvement in the proeject and the methods of the application is updated and improved in connection to every renewal of another four weeks sprint.

Theories about Scrum

Scrum is an incremental project management framework frequently occurring within agile software development. Initially it is used to reveal new ways of developing software with focus on: individual and interactions, working software customer collaboration and responding to change. The physical solutions of processes and tools, comprehensive documentation, contract negotiation and the following of a plan are subordinated [0].

According to Sebestyén [0] visualization is important when working with production, product development as well as with any other part of the organization. Looking away from the traditional application of visual planning (VP) in production, the realization in product development organizations is rather commonly advocated by [0, 0, 0, 0] and then performed from a perspective to front pull results by ordering results to move on the project. Instead of working with requirement specifications, product- and effect goals are applied to make the organization knowledge oriented and to create a common apprehension of what to reach and how to reach it [0].

This could be straightforward when performing one project at a time but in service or development organizations multi project management is common. Traditional multi project management is about operating several parallel projects that affect each other [0]. Such project characterizes of continuity and links between projects since it endeavors for reuse between projects due to the concept's descent from Japanese automotive industry [0].

In pushing production system the check points related to gates and milestones are not commonly restrictive and projects often continue without waiting for a gate decision. In Lean Product Development with the support of a visual pulse board promotes a pulling production system. On the pulse board it can be seen which results are missing and information about actual problems that need to be solved before the project can process. Thus the pulse board also is about minimizing waiting time. Having internal stocks increases the lead time and bring forth costs for reproduction and accumulation of capital but these semi active projects also thieves energy from the organization [0]. When organizations become over stressed cycle time is multiplied, the focus of personnel is disrupted, lead time increases and quality of the products decrease which brings them into a vicious circle [0]. Driving two projects in parallel fosters that happening. By driving two projects serial instead would result in both of them reaching the market faster but also a bigger flexibility since the decision of the final content of the second project is postponed [0].

Description of the actual state of the Scrum application

The actual realization of visualizing research projects is performed in 4 week session sprints inspired by the Scrum method described in [0]. The difference compared with Scrum is the dedication of activities to specific individuals already during the sprint planning event. This is performed twofold purpose, to secure the best knowledge realizing an activity and to be able to distribute learning tasks to individuals within activities. Planning and visualization of the implementation of planned activities is actualized by a pulse board proposed by [0] as can be seen in Figure 28.

The pulse board is physically located on one of the walls in the corridor of the department. This placement is chosen to make it visible both for the participating Ph.D. students and its supervisors but also for other colleagues at the department. In Figure 28 the realization of the pulse board can be seen. The board summarizes all the participating Ph.D. students' ongoing activities for the moment. Each research project has its own row, and there is one row for Ph.D. courses seminars etc. and one for other institutional administrative activities such as master thesis supervision, teaching etc.



Figure 28 – Visualizing board of research projects

As can be seen in Figure 28, the pulse board at first glance looks rather complex. Basically it is built of different rows in yellow and green, one for each project. The white column to the left provides information about each project regarding: name of the project, project participants, the project manager responsibility, project deadline and target publication forum.

The planning is conducted in four week sessions and each week includes one pair of a red and a blue square on top of the wall. These squares refer to planned activities (red) of the week and finished activities (blue). Finally the red column to the right is used to collect upcoming ideas and unscheduled activities that are realized need to be performed later.

Individual coloured post-it notes are used for each Ph.D. student to facilitate distinction of one's individual activities from one others. Information about estimated time of how many hours the realization of each activity would take is also provided on the post-its. When an activity is done the actual required time for that activity is summarized on that activity's post-it note. There are also a code system to indicate activities that result in physical absence from the office, delayed activities or activities that are difficult to estimate their time consumption. Such activities are coloured marked with fluorescent pen frames to indicate prioritization of delayed activities or the "scope creeper" effect of an literature search activity that might result in several articles to read. Internal deadlines during a sprint are marked using large yellow post-IT notes. On these notes the deadline and its planned deliverable is stated.

A Scrum sprint

The planning of a scrum sprint is conducted in a group meeting with all participating PhD students but not necessarily the supervisor in front of the board every 4th week. All meetings and activities that are known throughout the forthcoming timeperiod is planned first. After that external and internal deadlines are applied and activities are prioritized in according to them. If it is unclear how to prioritize the supervisor, comparable with an R&D manager, is involved to discuss possible solutions and potential outcomes. During this process also each activity's required time of human effort is estimated. The target is not to schedule more than 32 hours each week since unplanned activities such as mail management and unforeseen events always appear. In joint projects between several of the visual planning participants, activities can be moved between the participants to even out work efforts.

Practically, the work day for the participants start with a morning meeting in front of the pulse board. During this meeting the activities of the day is defined. The activities corresponding post-it notes are moved to the white column which symbolize that these activities should be performed at that current day. Gradually activities are finished and then moved back to the blue column of the current week. As finishing an activity the real operating time is registered on the post-it note beside the planned operating time.

Every Monday a following up activity of the previous week is realized in front of the pulse board. This meeting composes the reporting to the supercisor about how the work and general and each project in particullar is performing. To this meeting each participant prepares a sumary of its individual outcome of work load compared to plan of the previous week. This information is also summarized in a diagram, see Figure 29.

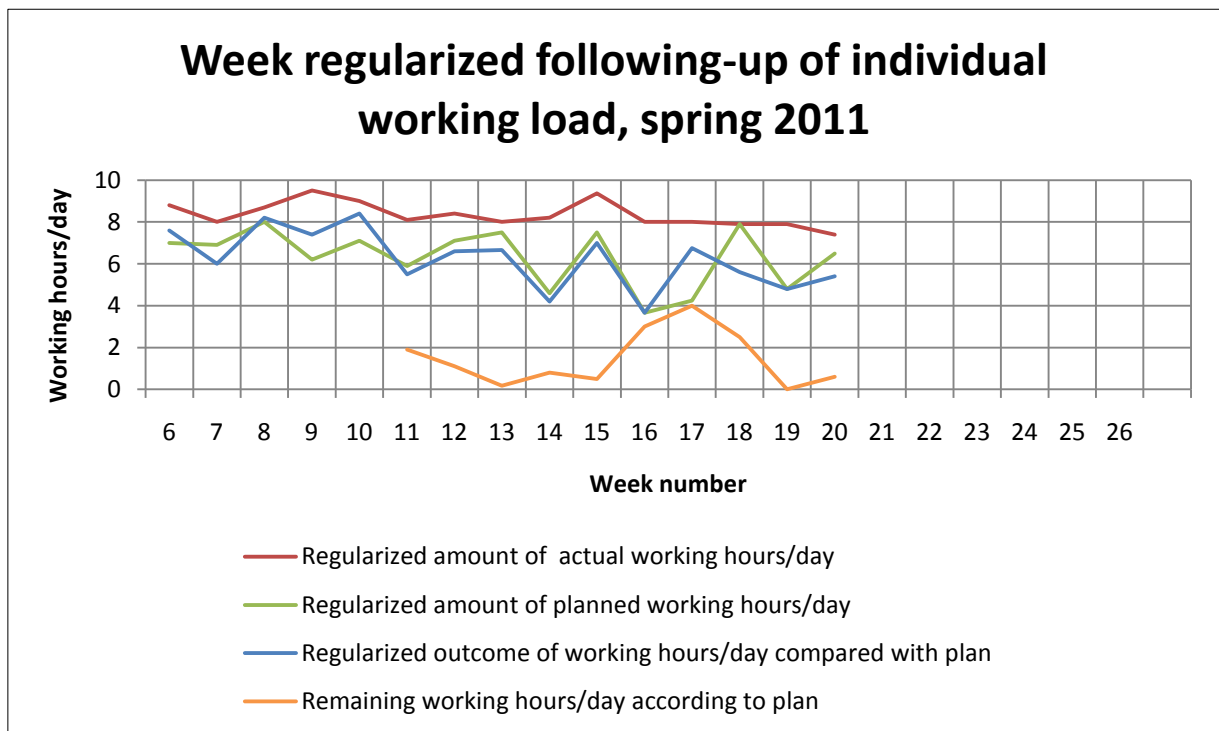


Figure 29 – Follow up of planned time for activities versus outcome and unfinished activities

Concretely the meeting consist of a short summary for the supervisor of how each project is going, what was done in each project and what is left compared to plan. Also, possible faced problems, the outcome of time estimations of activities and what should be done the actual week are disputed. If there is a need to move activites, for instance if there is an unfinished activity, replanning of the forthcoming weeks is performed during the meeting. The supervisor provides its opinion about prioritization of project and/or activities and can also questioning the amount of scheduled time for the participants

during a week or involvement in a specific project. During this following up meeting potential future process improvements of the pulse board can be discussed even though this discussion preferably are performed in conjunction with the planning of a new sprint.

Long-term goals

Research programs as well as product development projects are long-term activities with normal average project times of some years. It is common that a product development project last at least two years and a research program is normally defined in between three and five years. Thus the pulse board with short Scrum sprints have to be supported by long-term goals. Such a solution for one of the participating Ph.D. students in this research project can be seen in Figure 30. Here are the knowledge goals for the student's research project categorized and specified depending on to which extent the Ph.D. student is expected to control each subject. The long term goal composes a great support for the Ph.D. student as well as for the supervisor when it come to prioritizing of the participation in projects.

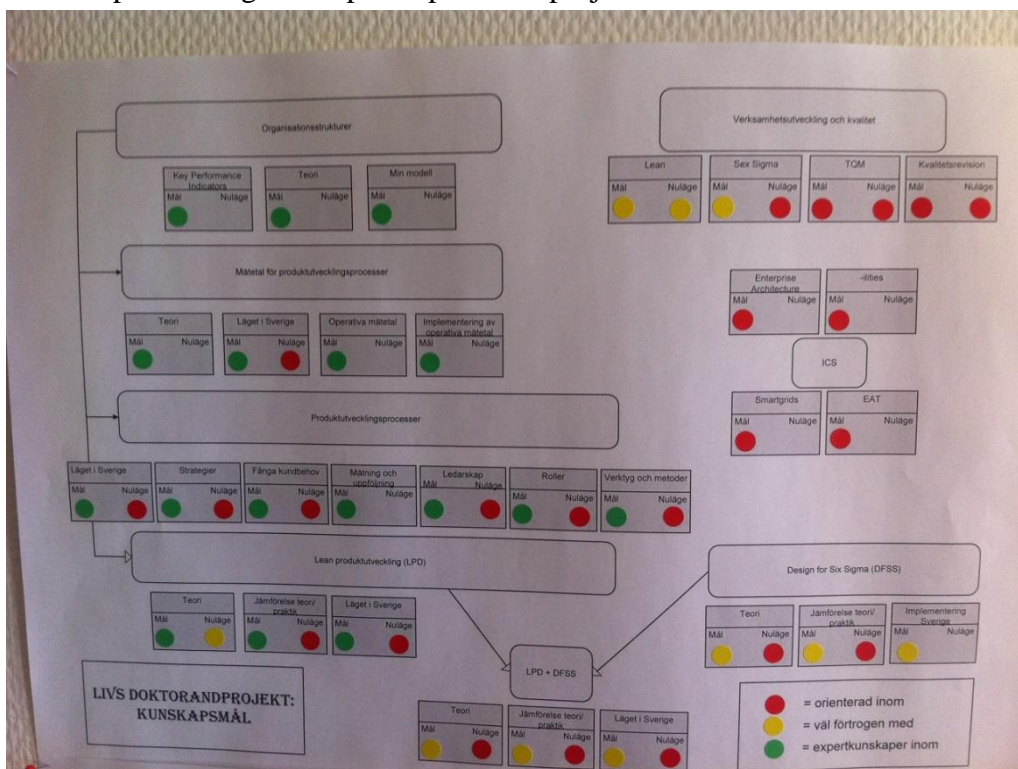


Figure 30 – Long-term goals of a research project

Implemented improvements to the Scrum application

Since the project with scrum pulse board started a lot of improvements of the method have been realized. These are of course included in the description of the actual state

above but to illustrate the development of the method the most important improvements are presented below.

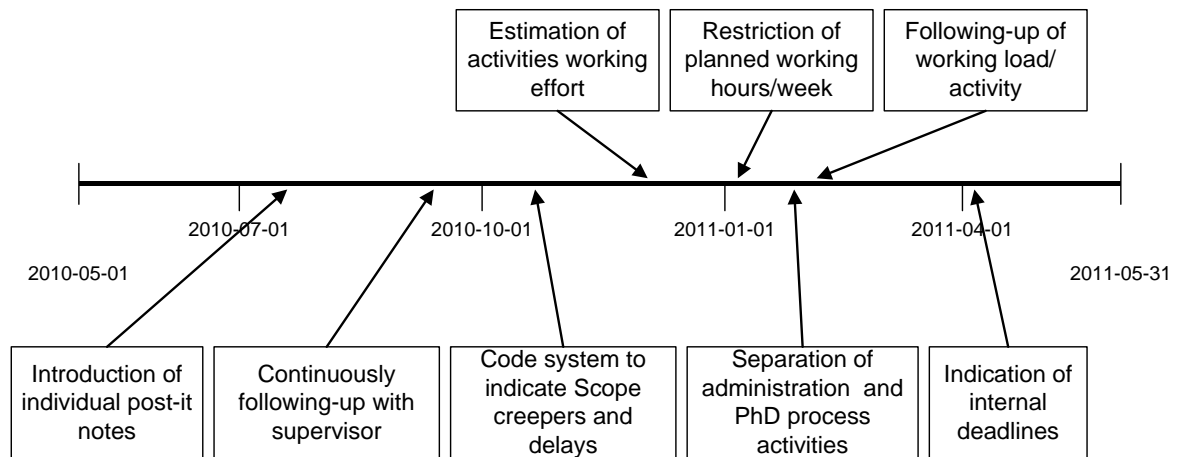


Figure 31 – Process of carried out improvement of the scrum pulse board

As can be seen in Figure 31 two different kinds of improvement have been performed. The activities compiled above the time-line deals with measurement and follow-up of the outcome whilst the activities below the line treat physical adjustment of the realization of the method.

A natural development of the work with continuous improvement is initiating physical adjustments which probably will be a continuous work as long as the method is applied. This improvement primarily deal with technical solution as a new coding system, for activities, dadlines etc. On the other hand it do also include the improvement to initiate structured and regular follow-up activities together with the supervisor in front of the visual board.

The other part of improvements, dealing with measurement and follow-up is an essential experienced after some sprints. The activity of initiating competely new parts to the method is only done once. However, the concrete realization of it still needs further development and one experience so far is that the optimal amount of measurment and follow-up is extremely individual which need procedures to control.

Experience Discussion

There are several advantages with the Scrum board. To be aware of which activities that consumes working hours and which projects that are on track in which process step is learnable. Still several challenges remain. To secure the focus on the long-term goals

and the overall process whether it is development or research it is important to restrict the amount of parallel project. Even though there is no physical adjustment times in development or research projects the human brain requires extra energy for adjustments. Also, since it always appear new urgent fires that need to be solved it is necessary to have energy left to convert for solving these problems.

When it comes to finishing projects, project management literature propose the importance of kick-out as on the same relevance as kicking of in the beginning of a project. However, this is much more difficult to realize when participats already are in to new projects when it is time to refine the pulse board with another print and take away the finished activity. To be able to perform the kick-off of finished projects but also th reduce waste within the visual planning method it is necessary to use the long term goals and to reserve time for the next planning session within the actual sprint.

Early in the specific application of a visual Scrum board as described in this article the need for some measurement follow-up appeared. As described above actual required time is measured and compared with working hours and planned consumption. This acting is based on participants estimating their expected human effort for each activity, which at least in the beginning is really difficult. Of course it becomes easier after some applications but there is a tight balance in this acting. How to be honest to yourself without planning to short time or too much time for performing an activity? Depending on personal properties you have easier to fall in one or the other trench. Thus it is important to evaluate the deviation relative plan when following up these measurements. It is very easy to foster an overloaded schedule by always encourage a fast acting which often bring about less quality on the outcome.

Thus, measurement and follow-up on the visual scrum method described in this article is necessary but it is not obvious how to conduct that in a strengthening way that stimulate both effective and lazy personalities rather than burn-out the participants. More concrete the pro's and con's with the method is summarized in Table 13 below.

Applying Scrum visualized in a research environment	
Positive effects	Negative effects
Helps structuring the working days.	Stressing with a lot of remaining activities at the end of the week.
Visualize "time thieves".	Fully planned weeks foster cheat-working without defining activities on the pulse board
Creates awareness of timescales in the process and its activities.	Easy to over load the weeks with activities.
Provides immediate feedback by clarifying	Fires during a sprint are killed without re-

what the working time is used to.	planning the sprint and eliminating some activities.
Enables rating between projects.	Difficult to concretize activities and make them all on the same detail level.
Visualize work distribution between projects.	Over-loaded plans foster a stressed realization of activities.
Smoothing of time between participants in and between projects	
Foster increased structure since reflection of internal process between activities is necessary.	

Table 13 – Experiences of applying a Scrum inspired visual board in a research environment

Individual experiences from a supervisor perspective

This approach is appreciated from a sponsor perspective. After the implementation of visual pulse board the quality of discussions at the weekly follow-up meetings have solidly increased compared to before when they were realized in an office. It is easy to see when the participants have a problem and reserve a separate meeting discussing that problem. The disadvantage is that it is easy for the participants to schedule too much activities, but they learn through the continuous process improvements. It is also very obvious when one participant is faster than the others. It is tempting to praise such a behavior, but thoroughness, time to think, originality and quality can not be forgotten as well as the health of the Ph.D. students. As a sponsor you need to be aware of who is doing more than they should, and that someone does not feel bad because others seem more productive. One advantage is that it is easy to keep track of the participants, and to discuss the relevance of different projects they are spending time on.

Conclusions

It is obvious that research processes and product development processes are rather similar. Both businesses differ from production processes with a standardized and well-tried product portfolio since part of these businesses' "production processes" is about developing new and creative solutions. Creativity and innovation activities are subjective and many times dependent on the personal feeling and however more difficult to rate. Nevertheless the method of visual scrum sprints turns out to be useful in the described environment within this article. There are though some necessary success factors that has to be considered:

- The method requires training.

- It causes big positive effects after a while, thus the investments will pay off after some time but requires patience.
- Requires honest and open-mindedness to both oneself and the project team. On the other hand the method contributes to creation of such a project climate.
- A strong, committed and accessible sponsor is necessary.
- Individual adaptation of the method is required.

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The EFQM excellence model and innovation; the key role of Human Resources Practices (HRP)

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Introduction

Total Quality Management (TQM) and particularly the adoption of the EFQM Excellence Model have turned into a competitive advantage for organisations in changing and complex environments. Those organisations have succeeded because they are flexible and efficient at the same time. As present environments can be defined as turbulent (they are complex, dynamic and uncertain) firms must be adaptable and able to give quick responses (Andersen, 2000 and 2004; Bueno and Ordoñez, 2004; Brews and Hunt, 1999; Hendry, 2000; Mintzberg and Lampel, 1999; Rico, 2000). The EFQM Excellence Model encourages firms to be excellent and flexible, promoting the use of a participative management, oriented to customer service and excellence. This work tries to analyse the use of some Human Resources Practices (HRP) as empowerment,

autonomy and participation that are encouraged by the EFQM Excellence Model, and if the use of those practices has any influence on innovation.

The capacity of generating innovations becomes the basis for competitiveness, and a key factor for surviving in actual environment (Baumol 2004; Danneels 2002). And HRP can help to promote the innovation process in the firm. Literature shows different innovation models that reveal the need of specific HRP to develop abilities, knowledge and behaviour oriented to innovation (Tang 1998). Specific HRP as participation, rewarding systems or performance assessment can affect employees' creativity, giving as a result an increase of product and process innovation and, consequently, an improvement of organisational results (Beugelsdijk, 2008). And, as we have pointed out, the application of the EFQM Excellence Model facilitates the adoption of those HRP.

Taking all these considerations as an starting point, the objective of our work is to analyse if HRP encouraged by the EFQM Excellence Model have an influence on the innovation process. With this objective in mind, the work has been structured in different sections: firstly, we have developed the literature review related with the different concepts analysed, namely, EFQM Model, HRP and innovation. We propose two hypotheses and a research question, and explain the methodology used. After, we describe the results of the empirical analysis and present some conclusions, limitations and future research lines.

Theoretical Framework

TQM, the use of EFQM excellence model and human resource practices (KRP)

TQM has represented a real innovation in management practices in the two last decades in Europe, and Spanish organisations are not an exception. The application of TQM, or the use of the EFQM Excellence Model, was initially considered as “fashionable”; but this approach has turned strategic from a managerial point of view, and has been accepted and recognised as a useful and effective management practice by European firms.

An effective implementation of a quality management system requires that every employee (from top managers to the lower levels of the organisation) develops his commitment to the organisation as a fundamental part of his work (Soltani, 2005). As a consequence, it's absolutely necessary to develop a quality culture in the firm (Dale *et*

al., 1997). Although TQM and the use of the EFQM model have been recognised as useful strategic frameworks with positive effects on performance (Sousa and Voss, 2002), other authors try to show opposite evidence (Hill and Wilkinson, 1995; Wilkinson *et al.*, 1998; Yong and Wilkinson, 1999). Particularly, they state that TQM has been understood as mainly focused on the production process and on achieving conformity and zero defects, what implies a more bureaucratic approach, more concentrated on following some internal procedures than developing high quality goods and services (Seddon, 2004).

TQM is based on customer orientation, continuous improvement and people development (Dean and Bowen, 1994; Perdomo et al, 2009). And, consequently, the adoption of a TQM approach has several implications for human resources in the firm. But, literature on TQM approaches this phenomenon with a very restrictive perspective. Quality literature argues that HRP have relevant implications for reinforcing the implementation of a TQM approach. Prescriptive literature on TQM considers commitment as a relevant topic, but doesn't say many things about how to achieve commitment or which problems organisations may have when trying to increase the degree of commitment of the employees (CIP, 1996; Snape et al., 1995; Wilkinson et al., 1998). The most frequent argument of TQM literature is that commitment and involvement of the employees (from bottom-line workers to supervisors and managers) must be increased through the leadership style, training processes and recognition (Oakland, 1993). In the framework of the TQM approach, excellence models (as the EFQM or the Malcolm Baldrige) show in their criteria the relevance of people assessment, rewarding and participation to promote learning, teamwork and motivation (Sousa and Voss, 2002; Perdomo et al, 2009). Consequently, it would be very interesting to analyse to which extent participation, improvement suggestions, and rewarding and recognition systems have an influence on organisational results.

Excellence models are considered strategic tools in the framework of a TQM approach. Excellence models are normally associated to quality awards and also can be used as important tools for managers. Specifically, the EFQM Excellence Model is used in the framework of the European Excellence Award. This model proposes a framework that is not prescriptive and it is based on nine criteria that can be employed to assess the progress of an organisation to Excellence. Criteria are grouped into two different categories: Enablers and Results. The former analyse how the organisation is managed; the latter are focused on the consequences of the managerial actions. In the *enablers* criteria we can found the "People" criterion, which is referred to human resource

policies coherent with a TQM approach; these policies can drive an improvement on organisational results (EFQM, 2010).

In particular, the “People” criterion makes reference, among other topics: to the need of the firm to assess and reward its employees in order to facilitate the alignment of individual goals with organisational objectives (and, as a consequence, maintaining the level of involvement of employees), using interactive tools to obtain information from people; to put the emphasis on knowledge creation and development, focusing on the need of achieving abilities and competence that help people to achieve the strategic objectives of the organisation; to the need of people to be committed, involved and empowered, creating a culture that encourages talent, creativity and innovation to promote changes in the different parts of the organisation; to encouraging people to share information, and to create active communication flows, in both bottom-up and top-down directions (EFQM, 2010: 15).

Advancing one step further and from a contingent perspective, we want to analyse the relationship between HRP (autonomy, participation and rewarding) in the framework of the EFQM Excellence Model and product innovation. In this respect, Beugelsdijk (2008) showed the existence of a positive relationship between these practices and results in terms of product innovation. So, in the following section we will analyse the concept of innovation and its relationship with HRP.

Human Resources Practices (HRP) and innovation

Van de Ven (1986) defines innovation as a process that includes the generation, development and implementation of new ideas and behaviour. Literature distinguishes among different types of innovation. Product innovation means important changes in products or in service capabilities. It includes both totally new goods and services and important improvements of the existing products. Process innovation implies significant changes in the production methods and delivery systems (Oslo, 2005). We focus on both types of innovation, process and product.

Strategic management literature has thought explicitly about the relationship between human resource management and innovation and the positive effect that a particular way of managing human resources can have on innovation (Laursen, 2002; Laursen and Foss 2003; Terrien and Léonard de 2003; Lau and NGO de 2004; Pini and Santangelo 2005). Innovation has been related to the learning processes that can take place in organizations (Shipton 2005, 2006 a & b). Some HRP can help to the development of

skills and knowledge that fosters innovation (Perdomo et al, 2009; Tang, 1998). Beugelsdijk (2008) also analysed the relationship between some HRP (training, job autonomy, work timetable flexibility and reward systems) and product innovation, obtaining as a result a positive relationship among training, autonomy and rewards systems on innovation. Other works, as Ortín and Santamaría (2009) have concentrated on analysing HRP in the R&D departments. Data showed that certain practices as recruiting or the organization of the work must be adapted to the characteristics of the people working in that department. Weia et al. (2011) have analysed the relationship between human resource management system and product innovation, obtaining a positive relationship that increases with an organizational culture oriented to development.

Taking all those arguments into account, our objective is to analyse the way in which the EFQM Excellence Model facilitates specific HRP (autonomy, participation and reward systems oriented to participation) that have a positive relationship to process and product innovation.

According to this objective, and to the arguments developed in the theoretical framework of this paper, we formulate the following hypothesis:

***H.1.-** HHRR practices developed in the framework of the EFQM Excellence Model (autonomy, participation and reward systems) are positively related to innovation results (product)*

***H.2.-** HHRR practices developed in the framework of the EFQM Excellence Model (autonomy, participation and reward systems) are positively related to innovation results (processes)*

As a research questions, we have also considered:

***RQ.1.-** ¿To wich extent can the proposed relationships change with more experience in the use of the EFQM Excellence Model?*

Research methodology

We have used a quantitative methodology in order to analyse the hypotheses and research questions formulated. The population of the study was formed by Spanish firms included in the EFQM web, because those firms had participated in a process of recognition (531 organizations). The data come initially from a broad project financed by the Local Government of Valencia. The process of gathering data was developed in

2009; we obtained 104 valid questionnaires where a 75% of the organizations belong to the services sector.

Variables measurement

The analysed variables in this study are autonomy, participation and reward systems as independent variables; and innovation results as dependent variables.

We analysed the reliability of the scales measuring autonomy, participation and reward systems. Reliability was measured through the analysis of Cronbach's alpha to evaluate the internal consistency of the scale (Nunnally, 1978). The interviewed organisations should indicate their degree of agreement with different sentences that made reference to the degree of autonomy, participation and reward systems in the framework of the application of the EFQM Excellence Model. We used a five-point Likert scale. The questionnaire items were based on the EFQM Model criteria (EFQM, 2003) following other works (Bou Llusar et al, 2005).

The construct *autonomy* includes items related to autonomy and decisions on strategic subjects, and on the employee's degree of autonomy over the development of his/her activity and their degree of self-management. The Cronbach's alpha of this construct is 0,733. The construct *participation* refers to the process of generation of initiatives on the part of the employee, analysing if they participate in the decisions over their own work and on specific decisions over firm's strategy; Cronbach's alpha for this construct is 0,874. Finally, the construct reward system has a Cronbach's alpha of 0,894.

Table I.- Reliability analysis

Construct	Cronbach's Alpha
Autonomy	0,733
Participation	0,874
Reward systems	0,894

With respect to the *innovation processes*, they are measured in terms of participation on improvement suggestions; on improvement processes; and on knowledge generation processes. And *product innovation* was measured analysing the degree of introduction of new products in the market.

Results

To contrast the hypotheses we developed a correlation analysis among the different variables that make reference to the constructs: autonomy, participation and reward systems and innovation. The results of the correlation analysis are showed in the following table (See Table II):

Analysing results we can conclude that, in general, some of the HHRR practices encouraged by the EFQM Excellence Model affect positively the innovation products and processes what sustain partially our hypotheses. Particularly, and as Table II shows, we observe a positive and significant correlation between the variables that make reference to participation and those that measure process innovation (H2) (degree of generation of suggestions or the involvement of people in improvement actions for the organization).

On the other hand, we observe how the reward and recognition systems give support to process improvement, showing also a positive and significant relationship with the new product launch. These results support partially (as autonomy in a EFQM context does not show a relevant influence on innovation) the formulated hypotheses. With respect to Hypothesis 1 we must point out that only the variable “reward systems that encourage participation” supports this Hypothesis.

Table II: Correlation analysis between HHRR practices encouraged by the EFQM Excellence Model and Innovation

CORRELATIONS N=101	Improvement suggestions developed by employees	Degree of involvement in improvement actions	Degree of involvement in actions for knowledge generation	Evolution of the degree of new product launch
Autonomy and decision making capacity on strategy	0,130	0,149	0,098	0,124
Autonomy and decision making capacity on work organisation	0,042	0,168	0,083	0,145
Involvement and self-management of the work	0,132	0,092	0,144	0,161
Participation and initiative with respect to the organisation of the work	0,179†	0,249*	0,183†	0,029
Participation and initiative at a strategic level	0,214*	0,173	0,128	0,164
Employees can make suggestions and their opinion is considered with respect to the work	0,166	0,136	0,035	0,137
Employees can make suggestions and their opinion is considered with respect to future strategy	0,216*	0,281**	0,171	0,101
Reward systems and recognition that support participation in the organisation of the work	0,125	0,171†	0,153	0,215†
Reward systems and recognition that support participation in the strategy	0,201†	0,102	0,037	0,161

† p < 0,10 correlation is significant at a level 0,1; * p < 0,05 correlation is significant at a level 0,05; ** p < 0,01 correlation is significant at a level 0,01.

To answer the Research Question (RQ1) we analyse the existence of positive correlations depending on the level of experience that the firm shows with respect to the use of the EFQM Excellence Model.

We considered a low degree of experience if the Model has been used 2 years or less, and high degree of experience if it has been used more than two years. results are summarised in table 3.

Table III: Correlations among the variables autonomy, participation and reward systems with product and process innovation in firms with low experience in the use of the EFQM Excellence Model

Low experience in EFQM N=18	Improvement suggestions developed by employees	Degree of involment in improvement actions	Degree of involvement in actions for knowledge generation	Evolution of the degree of new product launch
Autonomy and decision making capacity on strategy	0,167	-0,181	-0,074	0,285
Autonomy and decision making capacity on work organisation	-0,093	0,162	-0,447†	-0,223
Involvement and self-management of the work	0,190	-0,061	0,105	0,493*
Participation and initiative with respect to the organisation of the work	0,035	0,175	0,431†	-0,026
Participation and initiative at a strategic level	-0,087	0,044	0,241	0,226
Employees can make suggestions and their opinion is considered with respect to the work	0,41	0,213	0,432†	0,152
Employees can make suggestions and their opinion is considered with respect to future strategy	0,424†	0,186	0,323	0,098
Reward systems and	0,140	0,141	-0,109	0,209

recognition that support participation in the organisation of the work				
Reward systems and recognition that support participation in the strategy	0,271	0,026	-0,096	0,128

† p< 0,10 correlation is significant at a level 0,1; * p<0,05 correlation is significant at a level 0,05; ** p<0,01 correlation is significant at a level 0,01.

Results show the existence of a positive relationship between participation in the definition of future strategy and improvement suggestions, and also between participation in the decisions that affect the workplace and the degree of involvement in actions oriented to knowledge creation, what will facilitate process innovation.

We observe also a positive and significant relationship between self-management of the work and the degree of new products launch (product innovation). However, results show a negative correlation among the variable *autonomy and decision making capacity on work organisation* and knowledge creation for firms with lower experience in the use of the Model. We could understand that this limited degree of autonomy can inhibit the knowledge creation process. This negative relationship is not observed in the case of firms with higher levels of experience in the use of the Model (Table IV), perhaps because relatively the levels of autonomy are higher, although referred to the workplace only.

Table IV shows the same relationships for higher levels of experience in the use of the European Excellence Model. This table shows again positive and significant relationships among the variables related to participation and the ones that measure process innovation. The table shows also a positive influence of the reward and recognition practices that sustain participation in the organization of the work on process innovation (suggestions). Additionally, results show a positive relationship between work autonomy and the degree of generation of new products.

Table IV: Correlations among the variables autonomy, participation and reward systems with product and process innovation in firms with high experience in the use of the EFQM Excellence Model

High experience in EFQM N=80	Improvement suggestions developed by employees	Degree of involment in improvement actions	Degree of involvement in actions for knowledge generation	Evolution of the degree of new product launch
Autonomy and decision making capacity on strategy	0,126	0,184	0,113	0,093
Autonomy and decision making capacity on work organisation	0,079	0,158	0,181	0,216†
Involvement and self-management of the work	0,120	0,124	0,152	0,082
Participation and initiative with respect to the organisation of the work	0,208†	0,267*	0,148	0,046
Participation and initiative at a strategic level	0,279*	0,198†	0,110	0,160
Employees can make suggestions and their opinion is considered with respect to the work	0,190	0,125	-0,027	0,118
Employees can make suggestions and their opinion is considered with respect to future strategy	0,170	0,293**	0,136	0,100
Reward systems and recognition that support participation in the organisation of the work	0,224†	0,162	0,182	0,192
Reward systems and recognition that support participation in the strategy	0,099	0,096	0,034	0,146

† p < 0,10 correlation is significant at a level 0,1; * p < 0,05 correlation is significant at a level 0,05; ** p < 0,01 correlation is significant at a level 0,01.

In both tables (Table III and Table IV) autonomy shows a positive relationship with product innovation. On the other hand, we can say that the higher the level of experience in the use of the Model, the higher the effects of the HHRR practices on suggestions and participation of improvement plans (that measure process innovation).

As a result, we can say that the relationships among the variables that measure HRRR practices and innovation results have changed when introducing Experience in EFQM, so Experience is a relevant variable in this study.

If we compare the initial results (Table II) with the results obtained when we introduce the variable “experience in the use of the EFQM Model” (Tables 3 & 4) we observe that the variable “autonomy” turns significant with respect to product innovation in the group of firms with experience in the use of the Model. Experience in the use of the Model gives the employees more training and capabilities; consequently, autonomy can generate in this situation the expected effect on innovation.

Involvement and self-management show also significant results on innovation in the sample that has less experience in the use of EFQM Excellence Model; probably these employees are more motivated to generate ideas that lead to product innovation. Anyway, the consideration of the variable “Experience in the use of the EFQM Excellence Model” reveals the importance of the variable “autonomy” that was no relevant in the initial analysis.

Conclusions

The contribution of this work basically lies in the fact that analyses the relationship between several motivational HRP and the generation of innovation in the particular context of those firms that apply the EFQM Excellence Model with a strategic perspective.

This Model, employed under the TQM framework, is a tool that allows the firm to search for the continuous improvement of the business through product and processes improvement and giving, as a result, an increase of organisational performance. As we commented in the theoretical framework, there is literature that shows a positive relationship among autonomy, participation, performance-based rewarding systems and product innovation processes (Beugeiskijk, 2008). Also, we have seen that a context or culture facilitating participation and HRP contributes to generate innovation (Weia et al., 2011).

Our results support these arguments and show how some HRP such as participation or rewarding systems oriented to reinforce participation are positively related to innovation, both in the form of processes improvement as well as the creation and launch of new products. It is noteworthy to say that autonomy and self-management

variables play a relevant role if we consider the experience in the application of the EFQM Excellence Model. Such as the specialist literature pinpoints, the application of this model generates a positive context and a culture based on commitment that contributes to reinforce the effect of HRP on innovation results.

Thus, from a managerial perspective we argue that the use of the EFQM model facilitates and reinforces the relationships between participation and autonomy and innovation results and processes. However, rewarding systems become more motivational when the variable *experience* is not considered, perhaps because the continuous employment of rewarding and recognition systems makes them decrease their effectiveness.

This study is a preliminary approach to our object of analysis, namely, the relationship between HRP and creativity and innovation concepts. As a future research line, we intend to develop a theoretical model which allows us to analyse causal relationships among the different constructs, also including other business performance measures (profitability, sales growth, market share) as well as society results in terms of positioning and image. To do so, we have the intention of making bigger our database and, as a consequence, we will be able to carry out a rigorous quantitative analysis. Also, another future research line has to do with the study in greater depth of the relationship between creativity and innovation, trying to separate empirically both concepts (this question is not clearly studied by the specialist literature). Due to the complexity of the concepts to be analysed, this study could be initially carried out through the application of a qualitative methodology.

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A new model for predicting international students satisfaction: Malaysian universities case

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Introduction:

Customer satisfaction has become a requirement for all successful firms and organizations to remain competitive (Dawkins and Reichheld, 1990). Many researchers have emphasized the importance of capturing customer satisfaction initiatives which have resulted in improving firm performance, and behavioral intentions like customer retention (Abratt et al. 2008, Powers and Valentine, 2008). Given that higher education is a service section which students see themselves as consumers, it has become an increasingly competitive market (Angell *et al.*, 2008). It is becoming increasingly difficult for universities, as the core of higher educational institutions, to manage their students' satisfaction. In the literature there is much emphasis on the importance of managing student satisfaction in educational institutions (Franklin, and Shemwell, 1995, Douglas et al., 2007).

The main aim should be to aspire to maximize students' satisfaction with their experience even as they are at university in order to preserve students. Next aim should be to improve the institutions' performance by providing a number of league tables, and so aid recruitment. In this line, the development of a statistical model and its application within higher education (HE) highlights the critical drivers of satisfaction with international student experience and this has been created out of this study. Deployment of a successfully validated model could improve the quality of both

teaching and learning and various supplementary services by providing a guidance framework that would allow a focusing of limited resources and improvement efforts towards those areas that will impact most on student satisfaction, i.e. to increase satisfaction.

Literature Review:

A recent study by IDP Australia forecasts that the global demand for international higher education (i.e. international mobility of students) will increase from a base of 2.173 million in 2005 to 3.720 million by 2025 – an increase of more than 1.5 million students seeking higher education overseas by 2025 (International Development Programs (IDP), 2007). In this market, most universities that offer services in international level try to gain competitive advantage by increasing their student satisfaction level.

An interesting paradigm that investigates student satisfaction considers the student as a consumer (Chadwick and Ward, 1987; Christensen and Philbrick, 1993; Franklin and Shemwell, 1995). From the perspective of theories of this school of thought, higher education can be considered as a business. This attitude focuses to make the case for examining the student as a consumer and the ways that institutions can assess their service in an age where quality, measurement and accountability are usual and very important (Brown, 1979; Glenn, 1997; Rawls, 1998). From this perspective, students should receive positive service to satisfy their college experiences as valued consumers. Otherwise, they will easily transfer to another college (Casto, 1995; Edwards, 1993; Stalnaker, 1994).

On the other hand, behavioral consequences of satisfaction are crucial. Enrolling often is mentioned as a consequence of satisfaction (Chadwick and Ward, 1987; Cooper and Bradshaw, 1984; Liu and Jung, 1980; Wince and Borden, 1995). Students may appeal to an institution because of good word from satisfied students. The more students testify to satisfaction with higher education institutions, the more likely they are to continue. Satisfied students are more likely to return for more education and more inclined to recommend the institution to others. In marketing literature, student satisfaction is accompanied by another important notion, i.e. service quality. This relation has been discussed in next section.

Customer satisfaction and service quality are usually adherent in higher education marketing literature. There are two approaches used for measuring quality of education:

mechanistic and humanistic (Li, 2005). Research assessment exercise or Quality assurance assessment is a tool of the mechanistic approach performed by the experts and agencies. The humanistic approach focuses on students' perspectives, most researchers in this approach use SERVQUAL (Sunanto, 2007). This research utilizes last approach for measuring service quality.

Satisfaction and Quality:

Satisfaction and quality are usually used by non-academic staff interchangeably; nevertheless they have distinct definitions in marketing literature. It is basically accepted that the two concepts are fundamentally different in terms of their underlying causes and outcomes. Satisfaction can be considered an extensive concept while service quality measurement focuses specifically on dimensions of services (Harris, 2002). In addition, Bolton and Drew (1991) uncovered both perceptions and disconfirmation to have a straight effect on overall service quality. After distinguishing between these two concepts, researchers encountered another question: What is the order of their occurrence in the customer's mind?

First, most researchers had proposed that customer satisfaction with a given service experience would lead to an overall evaluation/attitude about service quality eventually (Bitner, 1990; Bitner *et al.*, 1990; Brady *et al.*, 2002; Hernon *et al.*, 1999; Oliver, 1981; Parasuraman *et al.*, 1988). After that, Dabholker (1995) maintained that the relationship is situation specific and depends on the context of the service encounter. He suggested customers who think cognitively about the encounter, service quality precedes satisfaction. If the customer approaches the encounter emotionally, satisfaction is the antecedent of service quality. Several researchers such as Anderson and Sullivan (1993), Oliver (1993), and Spreng and Mackoy (1996) have found empirical support for this model, wherein customer satisfaction is a consequence of service quality. With consideration to the above, the following framework is adopted for doing the research, i.e. satisfaction is a consequence of service quality.

In addition, Dabholkar *et al.* (2000) mentions the importance of measuring customer satisfaction separately from service quality when the aim is to determine customer evaluations of service. In their article they concluded that customer satisfaction is a much better forecaster of behavioral intentions. They found constructs of service quality and satisfaction is distinct, even if highly correlated (Dabholkar *et al.*, 2000). In their article, Ruyter *et al.* (1997) described a number of differences between service satisfaction and service quality:

-Satisfaction is directly influenced by the intervening variable of disconfirmation;

-In order to achieve satisfaction customers must have experienced a service;

-Satisfaction expectations are predictive, service quality expectations are based on an ideal standard;

-Satisfaction can result from a large variety of dimensions, service quality dimensions are specific; and

-Satisfaction is influenced by cognitive and affective processes, service quality is influenced solely by forms of communication.

Methodology:

Parasuraman *et al.* (1985, 1988) argued that in order to measure service quality, customers' expectations compared to perceived service quality levels should be evaluated. To gain a better understanding of service quality in an educational situation, this study seeks to examine international students' expectations and perceptions of educational services rendered by five Malaysian universities. Using stratified sampling based on gender and level of study, 522 international postgraduate students were selected to participate in this study.

A modified SERVQUAL questionnaire comprising 35 items was used as the survey instrument to collect data. The items were found to be consistent with findings from studies by Boulding *et al.* (1993), Ham (2003), Hampton (1993), and Harris (2002). Subsequently, a panel of four professors in the faculties of education and management in Universiti Teknologi Malaysia conducted content validity on the instrument. The panel recommended several amendments which were incorporated into the finalized questionnaire. The instrument was administered to 30 postgraduate international students enrolled in Universiti Teknologi Malaysia to test the instrument for face validity.

The finalized instrument consists of an introduction and three sections. The cover letter provides information on the research. The second section consists of 35 items with two separate sub-sections to assess the respondents' expectations and perceptions. Each of the items in the first section is anchored on a five-point Likert scale to measure the respondent's agreement to the item posed. The third section contains demographic questions.

According to Buttle (1995), SERVQUAL gap can be determined based on three methods: (a) item-by-item analysis (e.g., P1 – E1, P2 – E2,P35– E35); (b)

construct-by-construct analysis (e.g., $(P1 + P2 + P3 + P4)/4 - (E1 + E2 + E3 + E4)/4$), where P1 to P4, and E1 to E4 represent the four perception and expectation statements relating to a particular construct); and (c) computation of an overall single measure of service quality $[(P1 + P2 + P3 + \dots + P35)/35] - (E1 + E2 + E3 + \dots + E35)/35$). For purpose of this study, all the three methods to determine the gaps were used. The means of perceptions and expectations were calculated for all 35 items, 5 constructs, and the overall service quality. Furthermore main hypothesis for this research is as followed:

Ho₁ : Satisfaction can be predicted by SQ dimensions, i.e. professionalism, reliability, hospitality, tangibles, and commitment.

Findings:

Factor analyses

To verify the dimensionality of the education service quality construct in the SERVQUAL, a factor analysis, using the principal components extraction technique, was performed on students' gap scores, calculated by perception-minus-expectation mean scores. Because we used only one source (the student), who provided his or her assessment of the dependent and independent variables, we acknowledge the possibility of common method bias (CMB). We applied counter mechanisms suggested by Podsakoff (2003) by ensuring respondent anonymity in order to reduce evaluate apprehension as well as counterbalancing question order in the instrument. The analysis made use of the Varimax factor rotation procedure in line with the approach used by Parasuraman *et al.* (1988) in their initial SERVQUAL study.

The results of the factor analysis in terms of factor name, rotated factor loading matrices, the variance explained by each factor, and the results of reliability test coefficient alphas can be seen in another paper by authors of this article (Shekarchizadeh, et. al. 2011). In the current study, the five factors were defined as:

- (1) professionalism (items 22-35)
- (2) reliability (items 4 and 9-13)
- (3) hospitality (14-21)
- (4) tangibles (items 1-3); and
- (5) commitment (items 5-8)

Here, the tangibles in the higher education context means the quality of university facilities i.e. classrooms, computer labs, and the campus library. This is in line with

suggested definition of tangibles in a higher education context by Franklin and Shemwell (1995). Reliability is the consistency of performance and dependability. Professionalism is possessing the required skills and knowledge to perform the service. Commitment is the apparent commitment of employees to their work. Hospitality is warmth and personal approachability, cheerful attitude. These findings confirm with findings by Douglas et al. (2007). All the factors and their related items has been exhibited in the Appendix table.

The relationship between education service quality and on a separate measure of the overall satisfaction of students was examined. Regression analyses were administered using mean of satisfaction items as the dependent variable and the five perception-expectation factors resulted from factor analyses as the predictors. There are four assumptions for using regression: Linearity, independence, normality and equal variance. In cross-sectional data, as this study, the assumption of independence is not relevant since the observations are not made in any meaningful sequence (Carver and Nash, 2009).

The stepwise regression with stepping method criteria was performed between satisfaction as the dependent variable and professionalism, commitment, hospitality, reliability and tangibles as independent variables. Stepwise regression approach attempts to find the best regression model without examining all possible models. For this study, probability of F to entry a variable was selected at 0.05 and for removal variable was selected at 0.10 levels.

Table 1 shows the means of all IVs and DV, the standard deviations, and the inter-correlations among the variables. Inter-correlations among variables were performed at 0.01 significant level (two tailed).

As Table 2 depicts, there are two models. Multiple correlation coefficient (R), can be interpreted as the simple correlation between observed satisfaction level and satisfaction level predicted with the regression equation. Furthermore, coefficient of determination, R^2 indicates proportion of the variance of the dependent variable is explained by the independent variables. Also, in the table, adjusted R^2 based on the number of independent variables and the number of cases, is shown, respectively 0.211. As Table 2 demonstrates, model 2 is the best based on the biggest R^2 earlier.

Table 3 contains the results of the analysis of variance. In this analysis, the null hypothesis, states that all regression coefficients, with the exception of the intercept,

equal zero. The alternative hypothesis H_1 states that at least one regression coefficient differs from zero. As Table 3 presents, the significance level is 0.000. Applying $p < 0.05$ criterion, leads to rejection of the null hypothesis. In other words, at least one regression coefficient, and the R^2 as well, significantly differs from zero.

As Table 3 depicts, only two of the Independent Variables (IVs) contributed significantly to prediction of satisfaction level of students. Based on the following table, the regression equation representing model 2 is

$$\text{Satisfaction} = 3.047 + 0.289 \text{ Professionalism} + 0.207 \text{ Reliability}$$

One important problem in the application of multiple regression analysis involves the possible collinearity of the independent variables. According to Snee (1973), if the maximum VIF exceeds 5, alternatives to least-squares regression are recommended.

As Table 5 depicts, all the VIF values are less than 5.0, implying the absence of multicollinearity among the Professionalism and Reliability. Alternatively, Table 4.25 represents standardized coefficients, Beta, to facilitate comparisons among the regression coefficients. As reflected in the Table, professionalism has 40 percent more importance than reliability dimension. Besides, Table 4.25 presents results of T-test for coefficients. In this test, the null hypothesis H_0 states that a regression coefficient is zero. The alternative hypothesis H_1 states that a regression coefficient differs from zero. The last column of the table 4.25 contains the two-tailed significance level for the computed T-value. Applying a critical α of 0.05, we reject the null hypothesis that the regression coefficient equals zero, for independent variables and the intercept.

Discussion:

The findings of this study, suggest that professionalism is the most important in assessing service quality and student satisfaction in Malaysian universities. Interestingly, this finding is comparable with finding by Yang (2008), who reported commitment and professionalism are significant predictors of overall satisfaction. Interestingly, there are two common items in professionalism dimension that was found by Yang (2008) in a higher education field in East culture and professionalism that was found in current study. These common items are:

Item 22: Members of my faculty are well dressed

Item 32: My faculty has the knowledge to answer students' questions

It is noteworthy from a managerial perspective, in the current study that the strongest predictor of overall satisfaction, the professional dimension, also tended to show a significant negative gap scores regarding student perceptions. All of the items scores for the professionalism construct were not poor. However, the students' ratings of perceptions of performance were considerably lower than their expectations. This reveals the problem managers may have with performance-only evaluations (Yang, 2008).

Conclusion:

As attention to improving quality in higher education is increasing, there needs to be a correspondent increase in the use of its assessment tools. This research began with the basic SERVQUAL survey instrument. A main purpose of the survey was to provide information for predicting student satisfaction in a Malaysian context.

The results from such a survey can be used to identify areas of priority. The use of stepwise regression provides an analysis in identifying the significance of individual attributes to overall student satisfaction. The above analyses provide information useful for university administrators in decision making. The focus of this research had been on both the acculturated survey as well as the derived methodology.

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Table 1 Means of IVs and DV Std. Deviations, and the Inter-Correlations

DV/IVs	Mean	Std. Deviation	P-value	Inter-correlations with DV
Satisfaction	3.034	0.929	0.000	-
Professionalism	-0.394	0.887	0.000	0.441
Reliability	-0.479	1.011	0.000	0.408
Hospitality	-0.509	0.910	0.000	0.377
Tangibles	-0.305	1.090	0.000	0.280
Commitment	-0.361	0.960	0.000	0.352

Table 2 Regression Model Summary

Model	R	R Square	Adjusted R Square	Std. Error of the Estimate
1	0.442(a)	0.195	0.193	0.8370013
2	0.463(b)	0.214	0.211	0.8276866

a Predictors: (Constant), Centralized professionalism

b Predictors: (Constant), Centralized professionalism, Centralized Reliability

Table 3 ANOVA(c) Result from Regression Analysis

Model		Sum of Squares	df	Mean Square	F	Sig.
1	Regression	80.097	1	80.097	114.332	.000(a)
	Residual	330.670	472	.701		
	Total	410.767	473			
2	Regression	88.101	2	44.051	64.301	.000(b)
	Residual	322.666	471	.685		
	Total	410.767	473			

a Predictors: (Constant), professionalism

b Predictors: (Constant), professionalism, Reliability

c Dependent Variable: Mean of Satisfaction

Table 4 Coefficients of Regression Analysis

Model	Unstandardized Coefficients		Standardized Coefficients	t	Sig.
	B	Std. Error	Beta		
1 (Constant)	3.047	0.038		79.257	.000
centralized					
2 (Constant)	3.047	0.038		80.137	.000
Professionalism gap	0.301	0.063	.289		.000
Reliability gap	0.190	0.056	.207	4.769	.001

Table 5 Collinearity Statistics

Model	Collinearity Statistics	
	Tolerance	VIF
1 (Constant)		
Centralized	1.000	1.000
2 (Constant)		
professionalism	.455	2.199
Reliability	.455	2.199

Appendix:

No.	Statement	Factors Emerged
22	Members of faculty are well dressed	Professionalism
23	Faculty provided services at time promised	
24	Faculty performed service right first time	
25	Faculty maintained error free records	
26	Faculty told exactly when services were done	
27	Faculty gave prompt services to you	
28	Faculty readily helped	
29	Faculty responded to requests promptly	
30	Faculty behavior instilled confidence in you	
31	Faculty consistently were polite with you	
32	Faculty had knowledge to answer your	
33	Faculty gave you intellectual attention	
34	Faculty had your best interests at heart	
35	Faculty understood your specific needs	
4	Promised to do something and did so	
9	Staff provided services at time promised	
10	Staff performed service right first time	
11	Staff maintained error free records	
12	Staff told exactly when services were done	
13	Staff gave prompt service to you	Hospitality
14	Staff willing to help	
15	Staff respond to request all the time	
16	Staff behavior instilled confidence in you	
17	Staff consistently courteous to you	
18	Staff had knowledge to answer your	
19	Staff gave you individual attention	
20	Staff had your best interest in heart	
21	Staff understood your specific needs	Tangibles
1	Uses modern equipment and technology	
2	Physical facilities visually appearing	
3	Materials visually appealing	Commitment
5	Showed honest interest solving your problem	
6	Felt save in learning environment	
7	Operating hours were convenient for you	
8	Support staff are well dressed	

Management Systems and Organizational Improvement

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Key words: Environmental management system, integrated management system, occupational health and safety management system, quality management system.

Introduction:

Developing and implementing a management system is a continuous improvement process that involves several key steps. Quality, Environmental, Occupational Health and safety (OH&S) and.... management systems play an important role in today's organizations. They include planning, implementing, monitoring and measuring, and revising-or quite simply “plan, do, measure, and revise”. The public sectors can also include the concepts of quality, best management practices, and continuous improvement in their planning efforts.

Also, increasing accountability for product (service) quality, tighter environmental controls and tough safety requirements, mean companies cannot afford to be complacent in these areas. Management systems provide a framework to ensure companies minimise potential risks to their customers, employees and environment.

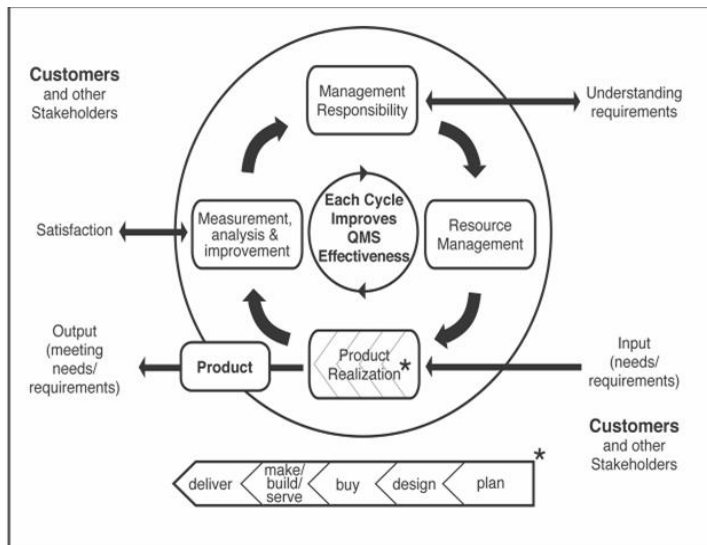
An organization's performance can be greatly enhanced by increased employee involvement and commitment. But while this aspect is critical, it is also imperative that managers commit to any new system and properly implement its initiatives. When management systems are understood and implemented correctly, they produce better job processes, eliminate unnecessary steps, reduce errors, and create an overall work environment that is truly motivational.

A management system consists of four essential parts:

1. Policy and objectives to guide the organization
2. Responsibilities defined so that people know what is expected

3. Defined processes linking people to business objectives
4. Data shared and analyzed to improve the performance of the company

(1). The System Model



Every organization is unique, so while every company has a management system that consists of these four elements, no two management systems are alike. That is why:

1. Every company must develop their own system so it can be used and improved.
2. Management systems cannot be bought, downloaded or created by consultants every company must do it for themselves “of course, sometimes with the help of a consultant!”.

Nowadays, organizations use of different kinds of systems. In addition there is now a move toward “integrating” management systems, especially when seeking combined certification against more than one external standard, based on an external assessment of a single system description. But the word “integrated”, which suggests you take discrete systems and some how combine them, can obscure the fundamental principles involved in running a business. How ever a management system that integrates all of your systems and processes into one complete frame work, enabling you to work as a single unit with unified objectives.

Therefore implementing a management system gives you the opportunity to focus on optimising the most important areas for you and your stakeholders.

This paper:

- Explains briefly management systems and their advantages
- Illustrates the benefits associated with integrating management systems
- Presents one example of the development and implementation of an integrated management system at health care organization “Imam Khomeini Hospital” and its outcomes

Concepts & definitions:

Management system

A management system is a proven framework for managing and continually improving an organization's policies, procedures and processes. Also, a system is for managing a particular activity or a specific type of asset. It means to manage all relevant areas of operation, often in relation to a specific aspect for example: quality, environment, information security...

Considerable management system advantages

Taking a systematic approach to management makes managing your business both easier and more effective. You work out the best way to handle each key activity and make sure that everyone uses the same approach every time.

The advantages of a management system include: increased employee enthusiasm and motivation toward doing a job well. Incorporating pride in public service, ownership in the job, and quality into the job processes adds value without costing additional labour. The results are quality projects completed on time and within budget and highly satisfied clients.

Quality management system

An ongoing effort to provide services that meet or exceed customer expectations through a structured, systematic process for creating organizational participation in planning and implementing quality improvements. (Goonan, 1995), (Gitlow, 2001)

Implementing an effective quality management system can help you to:

- Increased efficiency
- Increased revenue

- Employee morale
- International recognition
- Factual approach to decision making
- Supplier Relationships
- Consistency
- Customer satisfaction
- Improvement processes (Gitlow, 2001), (www.iso.org, 2004)

Environmental Management System (EMS)

Part of management system of an organization used to develop and implement its environmental policy and manage its environmental aspects. An Environmental Management System “EMS” is a set of cohesive elements that an organization may use to minimize its impact on the environment and also a continuous cycle of planning, implementing, reviewing and improving the actions that an organization takes to meet its environmental obligations. (Federal Facilities Council, 1999)

The benefits of having an EMS are numerous:

- Helps staff track environmental compliance requirements.
- Increases environmental awareness on grounds.
- Requires designation roles and responsibilities so the proper people can be notified in case of a problem or emergency.
- Requires training to ensure that everyone knows about the EMS and their individual role.
- Requires training to ensure that everyone who performs a task related to a significant aspect is properly trained so as to minimize any potential impacts associated with that activity.
- Provides a means by which employees and staff can offer suggestions on ways to improve the Organization.
- Ensures Organization facilities are closely examining their operations and looking for ways to minimize their impact on the environment thus promoting sustainability within our community.
- May result in a cost savings as wasteful practices are replaced.
- Is a key part of the Organization's overall sustainability commitment. (Federal Facilities Council, 1999), (www.iso.org, 2004)

OH&S Management system

Part of management system of an organization used to develop and implement its OH&S policy and manage its OH&S risks. OH&S management is a management tool which ensures focus on all major aspects of the working environment. (Reese, 2003)

OH&S Management system benefits

A consistent approach like this reduces the number of mistakes and the cost of correcting problems. It also reduces the level of risk and ensures that you comply with legislation. This can positively influence your business:

- Improved health and safety performance by your business will reduce the costs associated with accidents and incidents.
- Improved awareness of regulatory requirements reduces the chance that you will commit any offences. The Health & Safety Executive will generally regulate your business with a lighter touch if it is well managed.
- If employees see that you are actively looking after their health and safety, relations and morale will improve.
- Improving the efficiency of your business reduces your costs.
- You can demonstrate to your insurers that you are controlling risk effectively. This may help lower your insurance premiums.
- Banks and investors will be more willing to finance your business if you can show that it is well managed.
- Business partners have more confidence in your business. Larger companies and government agencies may only buy from businesses that can show effective management systems. (Reese, 2003), ([www.OHSAS](http://www.OHSAS.com). 18001, 2007)

Integrated Management system

An integrated management system is a management system which integrates all components of a business into one coherent system so as to enable the achievement of its purpose and mission. (Smith, 2001)

With an integrated system, your organization becomes a unified whole, with each function aligned behind a single goal: improving the performance of the entire organisation. Instead of “silos” you have a genuinely co-ordinated system: one that is greater than the sum of its parts, and can achieve more than ever before. An integrated

system provides a clear, holistic picture of all aspects of your organization, how they affect each other, and their associated risks. There is less duplication, and it becomes easier to adopt new systems in future.

An integrated management system allows a management team to create one structure that can help to effectively and efficiently deliver objectives of an organization. (Sadeghi Fard, Namazi, 2008)

From managing employees' needs, to monitoring competitors' activities, from encouraging best practice to minimizing risks and maximizing resources, an integrated approach can help an organization achieve their objectives. (Smith, 2001), (Sadeghi Fard, Namazi, 2008)

Key advantages of Integrated Management System

- Encourages risk management
 - Gives you a competitive edge
 - Attracts investment
 - Improves and protects brand reputation
 - Raises stakeholder perception and satisfaction
- So with an integrated management system:
- There is less duplication of efforts
 - Lower operation cost than supporting overlapping or redundant systems
 - There is a simpler documentation system with one quality manual and one set of standard procedures
 - There is a more complete compliance to the multiple standards (Smith, 2001), (Xiaojiang, 2007)

In this section, we focus on healthcare system

Today's healthcare system has evolved as a complex and tightly coupled system.

The challenge ahead

One of the fastest growing industries in the service sector is health care and also this rapid growth has been accompanied by dramatic changes in environment. These forces of changes include that growing demand for health care, rising costs, constrained resources, competitive pressure and monitoring by public and private groups and a

markedly better informed client have begun to exert extra pressure on health care managers to reassess their strategies. (Lighter, Fair, 2004)

Introduce Imam Khomeini Hospital as one example implementation of such systems

Imam Khomeini Hospital “I.KH.H” affiliated with social security organization and was located in Arak– Iran. It is a 160 bed, general Medical Surgical hospital.

The strategy of this hospital is to excel at quality development by constantly orientating towards and taking actions to fulfil the needs and expectations of its patients

The hospital systems has been designed individually and I.KH.H achieved independent certification for each system ⁽¹⁷⁾ under relevant ISO from IMQ Management service “the Italian company”. Then, I.KH.H opted to integrate, to the extent possible, its systems for quality, environmental and occupational health and safety.

Management systems in Imam Khomeini Hospital:

Management systems provide the important framework to ensure hospital manage the quality of its health care services, the safety of its employees and the impact to the surrounding environment. Management systems are fundamentally concerned with what this hospital needs to do to manage the processes involved with health care quality, environment and safety. (Lighter, Fair, 2004)

Whilst different management systems have several unique elements, they also have many common ones such as policy development, documentation and reporting, auditing, emergency and awareness, operational procedures and process control and training and awareness. For these reasons, I.KH.H decided to integrated 3 its systems.

Background of Imam Khomeini Hospital

There were apparent gaps in this hospital and its management before implementing management systems. Some of important gaps included:

- Poor hospital management system

¹⁷- Hospital systems include : 1) ISO 9001 : 2008

2) ISO 14001 : 2004

3) OHSAS 18001 : 2007

- Poor strategic and operational planning
- Lack of teamwork approach
- Poor communication and information systems
- Budgetary constraints and inappropriate utilization of resources
- Fragmented health information and medical record system

Besides, this hospital did not think it needed to integrate these systems after implementing them. “We are a good hospital”, top management asserted. “We like the way we do things, so we will just add the requirements to our standard operation procedures.” So, along with regular meeting, top management had to conduct three additional management reviews with the organisation's quality, environmental and occupational health and Safety management system leaders. Each of these reviews required long presentations and separate action plans.

Thus, to run the situation around, the hospital integrated the requirements of ISO 9001, ISO 14001 and OHSAS 18001 into the business reviews already conducted by top management. All the requirements were not examined during every monthly review, but they were covered at a rate that seemed more reasonable to management. In this way (after implementing and integrating of management systems), three meeting were integrated into one business review meeting and resulted in one action plan. This created less confusion and cost less to implement and maintain. Rather than problem solving for three standards as well as normal operational concern, top management could focus on the most effective solutions for the integrated issues discussed at the one meeting.

KH.H systems consist:

Quality management system

In this hospital, health care quality management is tried to continuously improve the quality of health care services by:

- ✓ Establishing the system more responsive to patient needs.
- ✓ Providing cost effective health care solutions.
- ✓ Supporting the health care service performs correctly and dependably at the first time.
- ✓ Increasing the patients satisfaction by emphasizing the patients needs and expectations.

Imam Khomeini Hospital has adopted the ISO 9001: 2008 standard as a key tool in its commitment to continuously improving health care quality and patient satisfaction.

The hospital has identified the key processes necessary to ensure patient satisfaction and continuous improvement of the IMS. Also the hospital has established a set of corporate objectives which are supported by the following quality objectives:

- | |
|---|
| <ul style="list-style-type: none">- Reduce the cost of quality “health care quality”- Maintain and grow the Integrated Management system <p>This system with input from patients, employees and suppliers using a structured problem solving methodology</p> |
|---|

- ✓- Developing and deploying basic quality training for all employees
- ✓- Reducing waiting time at the emergency ward
- ✓- Reducing waiting time for admitting & discharging
- ✓- Reducing unnecessary cancellations of general operations
- ✓- Lowering the rate of caesarean sections
- ✓- Decreasing mortality and morbidity in the health care processes

Environmental management system

I.KH.H takes its obligation to responsibly manage its environmental impacts⁽¹⁸⁾ seriously and it has adopted the ISO 14001:2004 standard as the foundation of its Environmental care system.

The requirements of the IMS for Environmental care apply to all hospital wards and administrative departments and to all operations conducted within the physical bounds of those wards & departments. This hospital is dedicated to the protection through the implementation of responsible environmental practices. Continuous improvement, waste minimization, pollution prevention, as well as commitment of its employees are the basis for implementation of this system. Therefore they perform:

- | |
|--|
| <ul style="list-style-type: none">- Maintain compliance with all applicable regulatory requirements. |
|--|

¹⁸- Environmental impact: Any change to the environment, whether adverse or beneficial, wholly or partially resulting from activities of an organization, products, or services.

- Determine those activities that can have a significant impact on the environment and identify ways to improve them.
- Exercise care in how they use materials and energy and minimize waste.

The structure of EMS in this hospital is based on Plan-Do-Check-Act “PDCA” cycle:

- ✓- Identifying hospital activities impacts on the environment & providing and developing a list of Environmental aspects ⁽¹⁹⁾ by every hospital ward
- ✓- Identifying risks of every activities in hospital
- ✓- Identifying applicable legal requirements
- ✓- Defining objectives and targets “such as: reduction in energy consumption”
- ✓- Setting up control plans to achieve the objectives and targets include: establishing of some procedures for controlling of significant aspects
- ✓- Preparing emergency response plan
- ✓- Verifying achievement of objectives and targets
- ✓- Continuously improve control plans, objectives and targets

Adherence of this system to ISO 14001 will definitely help to sustain their long-term competitiveness, as discerning patients around the country are becoming more environmentally conscious.

Occupational health and Safety management system

This hospital has adopted the OHSAS 18001: 2007 standard with the benefits, such as:

- Fewer accidents and fewer interruptions of services through better control of workplace related hazards.
- Reduced likelihood of occupational disease and better working conditions.
- Consideration of employee needs creates a stable and motivated workforce.
- Ensure legal compliance with minimum of administrative effort.
- Support of sustainable hospital development by reducing costs caused by accidents and emergencies.

I.KH.H developed, established and implemented OH&S Objectives. This objectives concluded:

¹⁹- Environmental aspect: An element of an organization 's activities, products, or services that can interact with the environment.

- ✓-Reducing number of patients and employees “Doctors, nurses,” injuries
- ✓-Decreasing costs due to personnel injury
- ✓-Reducing personnel compensation insurance costs
- ✓-Minimizing resource constraints from personnel injuries
- ✓- Increasing employee safety awareness and improving employee motivation
- ✓-Identifying and accessing the legal and compliance requirements of OH&S
- ✓-Identifying of hazards and safety risks in every ward of hospital

Management systems outcomes in Imam Khomeini Hospital:

For management systems to function effectively they need to be utilised by all employees “such as: doctors, nurses, ...”. The management framework that each system subscribes to need to be incorporated into daily activities of all employees. These systems will fail to protect hospital from quality, environmental and safety nonconformist unless adopted by all employees and all requirements of the individual system are adhered to.

Significant results of these efforts are: maturity of system and implement of hospital management system and hospital information system, responsive to patient needs with special attention, identify areas requiring immediate improvements and use of teamwork approach.

On the other hand, the first hurdle was that adopting and certifying three individual management system was not only a timely and costly exercise, it might also required employees to undertake similar tasks for the separate management systems.

These tasks, especially where duplicated between systems could seem unnecessary and wasteful of employee resources, to avoid this problem, this hospital applied to IMS.

Integration of the quality, environmental and OH&S management systems has been a way the hospital has reduced of inappropriate work of three individual systems. The integration of management systems allowed the common elements of the systems to be identify and merge as one, whilst still recognized individual requirements that each system would have.

Other recognised associated with management systems include:

I. CONSIDERABLE IMS OUTCOMES

1	- Managing social, environmental and financial risks
2	- Improving operational effectiveness
3	- Reduction costs
4	- Increasing patient and stakeholder satisfaction
5	- Promoting innovation
6	- Improved hospital performance.

Conclusion:

Hospitals have a great responsibility in our community to provide and offer health care and medical services with high quality, to meet all environmental requirements and to ensure the safety of their patients and employees. It is these responsibilities that have led most hospitals to implement quality, environmental and OH&S management systems into their daily operations.

Today, companies regardless of size, face ever increasing demands for profitability, quality, and technology that contributes to sustainable development. As a manager looking to turn these pressures into a competitive advantage, you need to develop an efficient management system tailored to your business processes and use it systematically to maintain and constantly improve your company's overall performance.

Thus a well-developed management system is the tool all in the organization use to communicate the interdependency of people, processes and the system and make informed decisions affecting profitability.

Also integration of management systems is a logical step for every organization such as: hospital, that have or are or seeking to implement one or more certifiable systems.

The successful integration of management systems depends on a variety of factors. However the most important is acceptance and willingness to use by all members of staff.

Therefore it is essential for the integrated system to be easy to use, whilst still satisfying all requirements of each management system. Of course, implementing an integrated management system for quality, environment, health and safety is not a simple task.

Implemented carefully it can yield a rapid return in investment in conjunction with a better grip on operation.

With an ongoing continual improvement to the integrated management system framework the use of IMS will have enormous benefits in the way organizations are able to manage their quality, environmental and OH&S responsibilities.

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Quality Control and Capability Improvement for Advance CDSEM Measurement

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Key words: CD-SEM, SPC, EWMA, Carry over, QC monitor, Capability, GR&R

Introduction

Minimizing tool induced metrology errors becomes more and more critical as processes evolve to 40 nm and beyond. According to the National Technology Roadmap for semiconductor, the use of CD-SEM requires special attention with respect to the precise, tight, and accurate monitoring associated with advanced process quality control. And, small CD measurement bias contributes to significant device shift (ex, from 40nm process, 3A mis-matched bias causes device performance shift ~1%). How to monitor CD and assure CD-SEM capability (Precision, Accuracy, Stability and Matching) is the most important research. Monitoring CDSEM capability and quality control in many fabs today relies on X-bar and S chart for daily pitch QC monitor. However, though it ensures stable scan calibration, pitch monitor is not sensitive in beam quality. This is because repeated e-beam measurement on the same location induces carbon build-up which is often called carryover, physically deposits carbon atoms where e-beam strikes the surface, and changes CD line. This carryover makes it impossible to set a tight spec to assure CDSEM capability for effective CD line QC monitor. Further, if more tools are to be matched, the same places will also have to be strike many times. It is difficult to know the true bias between tools. Minimizing carryover and the bias evaluation of different tool types are also important for matching, in addition to its usefulness in CD line monitor. The paper describes the usefulness and feasibility of the approach

determined using technical and statistical methodologies to reduce carry over effect and monitor CD line effectively.

In addition, CD-SEM still needs improvement in many areas of performance to keep pace with the technology roadmap. The specification addresses each area for improvement in a separate section. The critical areas addressed, are, GR&R, precision, stability and tool performance matching. Goals of this specification are to outline needed capabilities of CDSEM, and to set forth methods and KPI (key performance index) for evaluation these capabilities. This paper presents the complete solution that would enable CD-SEM quality control and capability

Methodology

In order to fulfill the rigorous requirements of advanced process control and increasingly tighter device, this paper interprets and discusses new approaches to investigate three factors, including carryover reduction, QC monitor methodology and CD-SEM capability CIP (continuous improvement plan). The following semiconductor technical and statistical methodologies were chosen for consideration.

Carryover Reduction Methodology

The CD line QC monitor methods, including GRR, accuracy and stability are repeated measurement induces charging due to carryover effect when tool variation is dominated by QC wafer noise. Carryover effect is a complex phenomenon occurring in the course of the interaction of the electron beam with the sample to be measured. It is usually linked to carbonization, contamination, heating and charging. A typical manifestation of the carryover effect is the charge in the critical dimension measured. A very well known but not widely studied phenomenon, related to the sample damage, which directly affects the capability and quality control of CD-SEM measurement. We investigate the carryover in an attempt to reduce the effect of sample degradation by repeated measurement and improve measurement precision

Short-term repeatability- Regression Model GR&R

We compare to typical GR&R by sigma. Typical %R&R is larger than 30% will fail GR&R to total variation in advance process poly line CD measurement is dominated from QC wafer noise.

Regression model GR&R application is based on the linear regression mode and hypothesis linear mode with p-value <0.05. The assumed linear model to predict the daily target, \hat{y}_i denoted as $\hat{y}_i = \hat{\beta}_0 + \hat{\beta}_1 t_i$, and where $\hat{\beta}_0$ is the initial value of control wafer, $\hat{\beta}_1$ is the rate of growth per one measurement and $t_i = i$, $i = 1, 2, \dots, a$ is the frequency of measurements. The regressed target is estimated by means of daily iterating the historical line measurement data, where the solid diamond line represents the original measurement data and vacant square line is regressed target. The bias value that equal to the delta of measurement data and regressed target can be generated simultaneously, therefore can be converted the bias data to bias control chart.

The linear regression model is diagnosed by p-value and RSQ to ensure the estimated bias data at 95% or better confidence level. In general, if RSQ is close to 1 and P-value less than 0.05, then the linear slope ($\hat{\beta}_1$) is considered “Significant”. In other words, if p-value less than 0.05, bias values are meaningful in statistics. It means CD line measurement is fitted very well by the linear regression model. RSQ and P-value formula can be expressed as (Eq.1), (Eq.2)

$$R - \text{square} = \frac{\sum_i^a (\hat{y}_i - \bar{y})^2}{\sum_i^a (y_i - \bar{y})^2} \quad (\text{Eq.1})$$

$$p - \text{value} = FDIST\left(\frac{\sum_i^a (\hat{y}_i - \bar{y})^2}{\sum_i^a (y_i - \hat{y}_i)^2 / (a - 2)}, 1, (a - 2)\right) \quad (\text{Eq.2})$$

We got the result is regression model %R&R is <10% passed GR&R to total variation.

	Typical Model	Regression Model
EV	19.22%	3.44%
PV	6.94%	18.44%
%R&R	49.08%	8.59%

Table 1: Regression Model and Typical Model GR&R

Long-term repeatability - Advanced EWMA and Range chart

Figure 1 is an example of CDSEM daily CD line monitor trend chart in the same reference wafer. The carryover induces by carbon build-up could be approximated by a gradual linear model with the frequency of measurements as the independent variable.

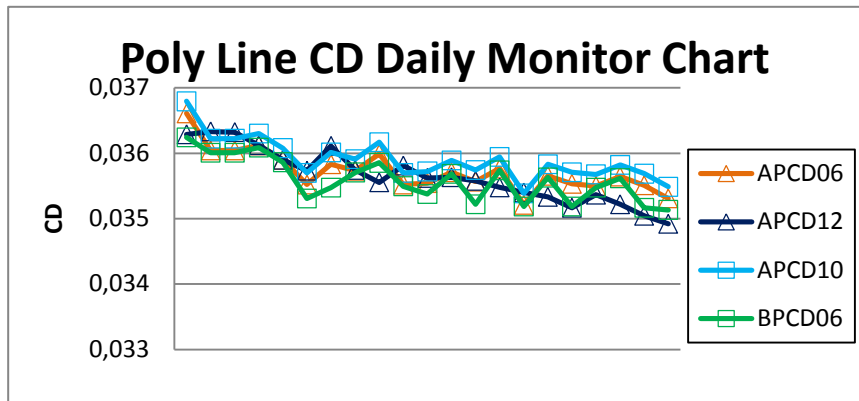


Figure 1: Poly raw line CD daily monitor trend chart

Exponentially Weighted Moving Average (EWMA) control chart was employed, to detect the measurement small shifts (generally shifts less than 1.5σ) of the measurement process. The series was generated that derived from $(Bias)_i$ to be as (Eq.3)

$$EWMA((Bias)_i) = \lambda \times (Bias)_i + (1 - \lambda) \times EWMA((Bias)_{i-1}), \quad i = 1, 2, \dots, a. \quad (Eq. 3)$$

and $EWMA((Bias)_0) = 0$ is the target of measurement process. and where λ is the so-called smoothing parameter, ranging $[0,1]$.

Figure2 shows QC CD line monitor data from four CDSEM tools can be collected and evaluated through applications Advanced EWMA. With the stability quantified and carryover trend compensated, it is now straight forward to quantify all CDSEM line CD measurement performance in-line. The chart is within the control limit as reset the linear regression model.

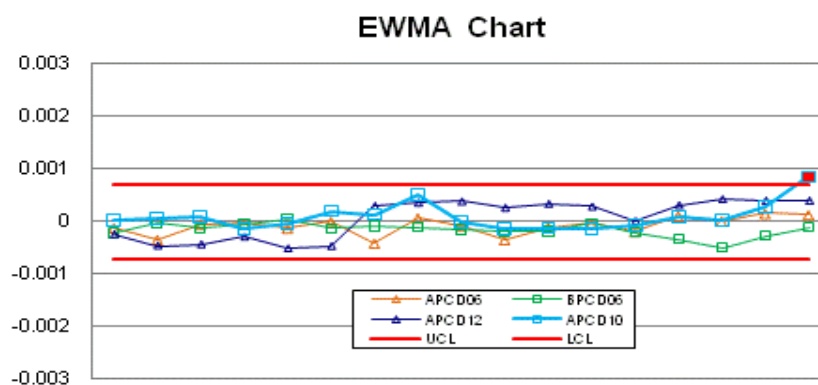


Figure 2: Daily $EWMA((Bias)_i)$ chart control for multiple CDSEM tools

Figure3 shows range from CDSEM tools, with it, we can further ensure that all CDSEM tools are tied together well for tool performance matching to meet device tight requirements.

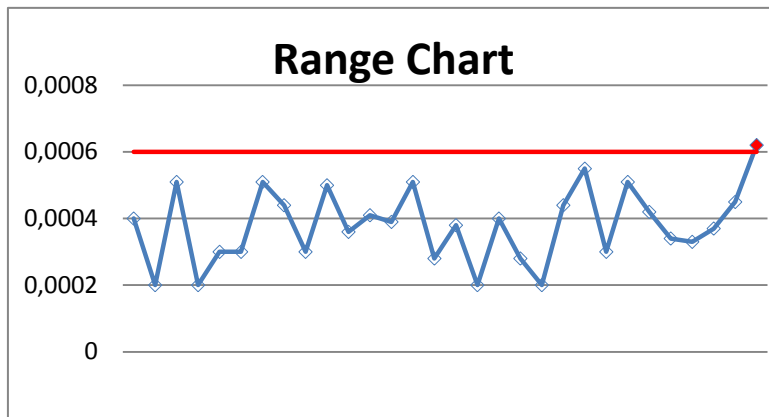


Figure3: Daily Range chart control for multiple CDSEM tools

In observing Fig.1, Fig.2 and Fig.3, it indicated APCD10 had a k-shift from tools that cause the out of control limit event in EWMA control chart and range chart.

New design for QC Standard wafer :

Not only with above good statistic methodologies to simulate it but also using process methods to solve it and find a good QC standard wafer to monitor daily life and real life.

New process flow was used on the low charging wafer to reduce the e-beam carryover effect. The substrate with poly is no any dielectric interface and no dielectric on poly top either, then the heavy doping play the important role for the wafer preparation also.

Beside low charging wafer preparation as figure 4, wafer clean process is another key for daily QC monitor. The optimized wafer clean process can reduce wafer charging effect and prolong the wafer lifetime. Figure 5 shows the significant effect and improvement.

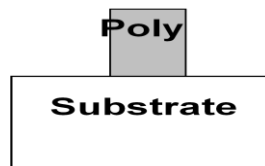


Figure 4: the pattern of CD SEM low charging wafer

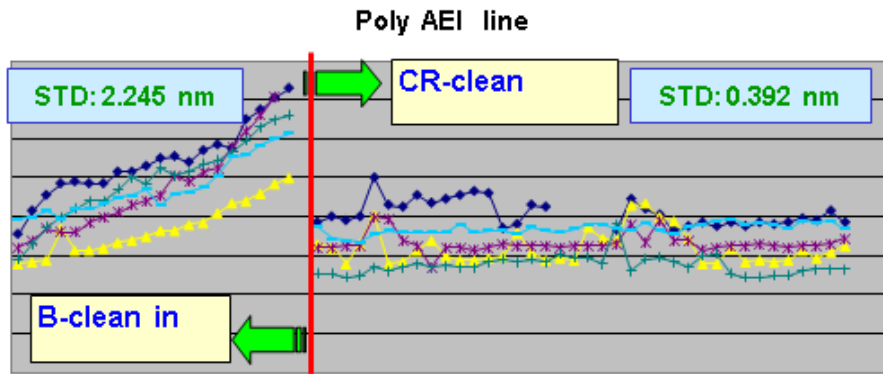


Figure 5: the Clean flow comparison to the low charging wafer

QC Monitor Methodology

After using a new design QC STD, we also need a good methodology for QC monitor, measurement location qualification and decision.

Application Systemic Sampling Method:

For CD line QC monitor of multiple CDSEM tools, the charging caused by the repeated measurements from multiple tools is a key problem in CD-SEM CD line metrology. The idea of these measurements is test to what a sample plan to be performed on all multiple tools. Investigate Systemic Sampling Method on a QC wafer is to split groupings for multiple CDSEM tools, and use statistic analysis to test the average CD line measurement per grouping and carryover risk estimation for each CDSEM tool.

Grouping A for CDSEM No.A
Grouping B for CDSEM No.B

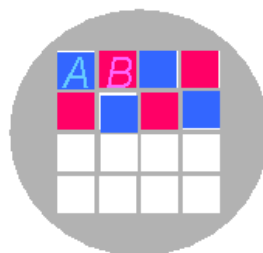


Figure 6: A grouping idea of Systemic Sampling Method for CDSEM tools

Therefore, the measurement per grouping is collected and tested as below:

Step1: Repeat to measure full map 5 times.

Step2: Calculate the average and standard variation each chip

$$\bar{s}_i < \bar{s}_i - 3 \times S_{s_i} \text{ or } \bar{s}_i > \bar{s}_i + 3 \times S_{s_i} \text{ and } \bar{x}_i < \bar{x}_i - 3 \times S_{x_i} \text{ or } \bar{x}_i > \bar{x}_i + 3 \times S_{x_i}$$

Step3: Delete outliers and ranking:

Step4: Select >10 chips be a grouping for a CDSEM tool

$$H_0 : \bar{x}_{group1} = \dots = \bar{x}_{group_i} \quad H_1 : \text{at least one } \bar{x}_{group1} \neq \bar{x}_{group_i}$$

Step5: Establish the following hypothesis:

Step6: Grouping resolution is the 10 to 1 rule is being interpreted to mean that the measuring equipment is able to discriminate to at least one-tenth of the process variation.

The application systemic sampling method can reduce carryover risk made and the tool performance is similar in day 1 in order to well CD line QC monitor.

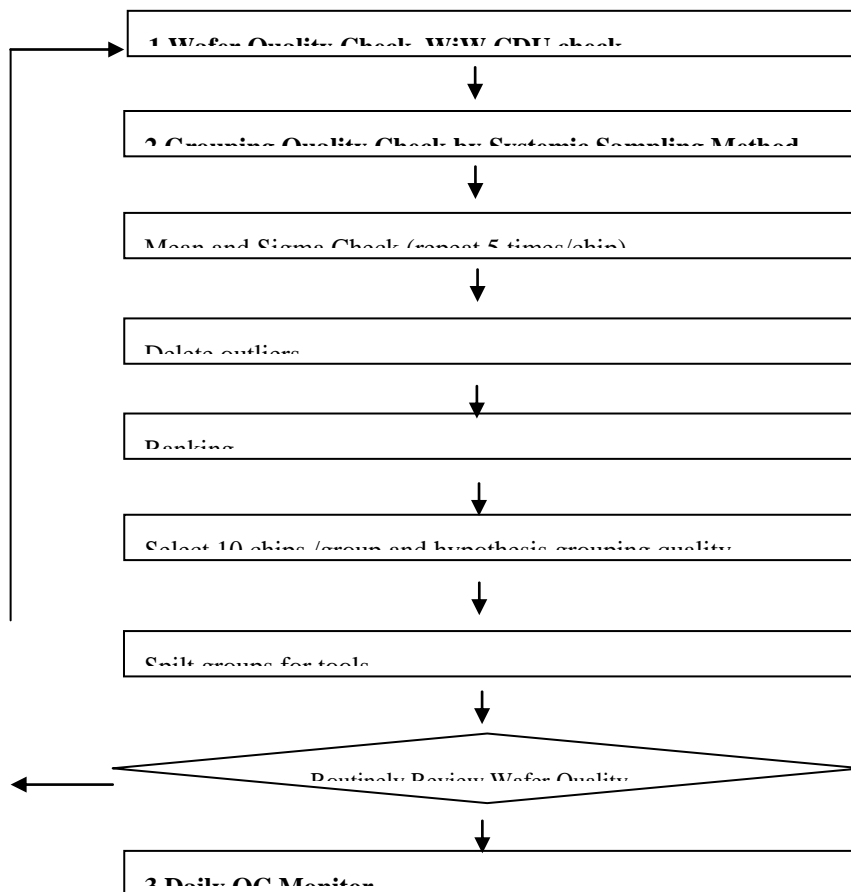
QC Wafer Quality Control

Of principal concern here is QC wafer quality, sufficient to capture the target for proper CD line measurement. According to simulation based on measurement error <5% to CDSEM CD line, getting wafer in wafer uniformity (WiW CDU) around 1nm causes systemic sampling method worse and approaches to the end of QC wafer lifetime. Both cannot capture the proper CD line measurement.

Wafer in	Wafer uniformity	Grouping Range	Measurement Error
	0.6	0.024	4.06%
	0.7	0.026	4.39%
	0.9	0.029	4.83%
	1	0.033	5.42%
	1.5	0.043	7.13%
	2	0.053	8.83%
	2.25	0.058	9.69%
	2.5	0.063	10.54%

Table 2: A Simulation for the measurement error of wafer in wafer uniformity

It is worth noting that, from 2-2-1 & 2-2-2 content, for each feature, a standard and completed procedure is below.



Based on the standard flow, we can improve a grouping bias from 0.793nm to 0.057nm, and the measurement error is less than 5%. It is important to have a good QC wafer quality control for QC monitor

3 CD-SEM Capability Improvement: Indeed, well CD line QC monitor can be extracted from useful carryover reduction and QC monitor methodology. We still face CD-SEM matching difficulties, different offset and capability questions.

The ultimate goal of the CD-SEM specification is to improve CDSEM capability, including accuracy, precision for tool performance matching to meet device tight requirements, and even triple capacity in CD monitor stages owing to free of restriction in some mis-matched CDSEM tools.

Accuracy means closeness to a reference value. Applying a bias is difference between the reference value and the observed average of measurements to meet tsmc request the bias performance matching from multiple tools

Precision is a multiple of reproducibility and is typically used for comparison to process tolerances, as in the commonly use Precision/Tolerance (P/T) ratio. A P/T ratio greater than 0.2 has an adverse effect on common production metrics such as Cpk. Applying a 20% P/T ratio to the 10% CD budget yields the necessary tool precision need from the CD metrology tool suppliers to meet these ITRS outline.

Moreover, there is a big challenge to CDSEM tool limitation. Then we surveyed and implement AAA (Auto-Axis-Alignment) and an offset evaluation to improve it.

Precision Improvement: (Auto-Axis-Alignment)

Image maintenance CIP, AAA(Auto Axis Alignment) fully auto instead of manual, frequency to 1 day from 4 days, fine tune time to 3 min from 25 min, the methodology including,

1. Alignment (beam perpendicular and current calibration) :
2. Stigma (beam X,Y direction sharpness calibration) :
3. SEM monitor mask: tsmc developed a mask as below for AAA function application.

We found the image is adjusted and clear as figure 7 obviously and sigma improve around 50% from table 3 and daily QC monitor chart as figure 8.

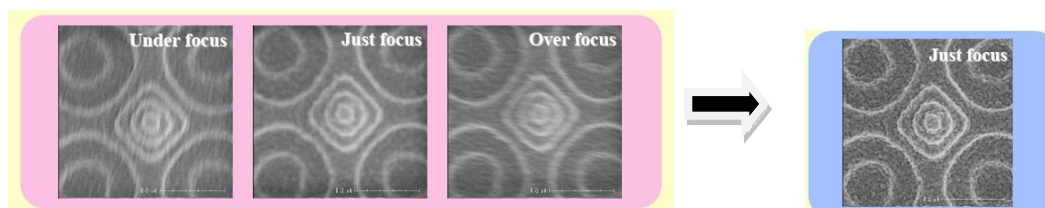


Figure 7: Image performance from AAA mode and Manual Model

800V CD-SEM tool	Tool 1	Tool 2
3 Sigma (Manual)	1.5	0.36
3 Sigma (AAA)	0.3	0.3

Table 3: Sigma performance between AAA mode and Manual Model

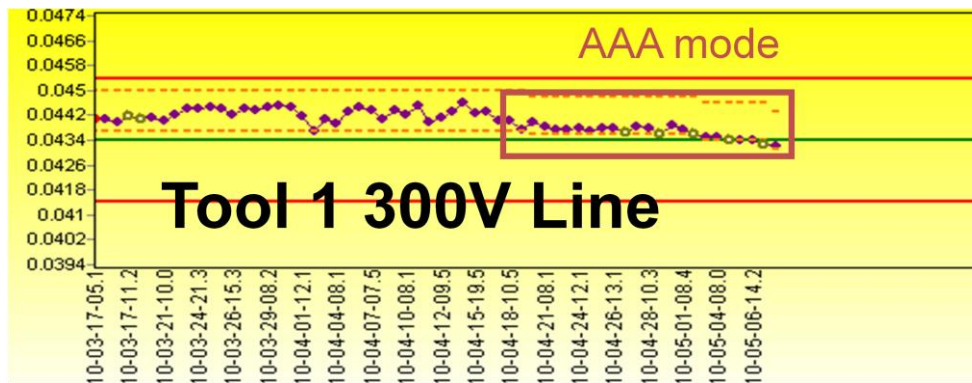


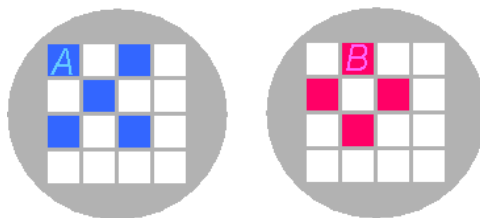
Figure 8: Tool 1 Daily QC Monitor Chart

Accuracy Improvement:

The paper implicates the most difficulties are the different tool type matching which would has a gap of image shape to cause CD measurement bias. The paper summarizes and innovates the steps for different tool type bias evaluation as follows:

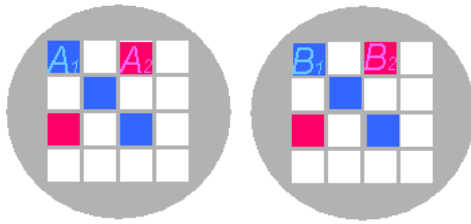
Step1: AB map matching or ABBA matching (short term)-Assume offset $AX+B$

- a. AB map matching for ADI: PR film has significant charge effect then choose AB map to get the CD line measurement



- b. ABBA matching for AEI: Measure $A1 \rightarrow B1 \rightarrow B2 \rightarrow A2$ to average be the CD line measurement.

ABBA Matching



$$\frac{A_1 + A_2}{2},$$

$$\frac{B_1 + B_2}{2}$$

Step2: Image Matching - Confirm to image bias

Step3: Numerical Method - Finalizes to hypothesize A value

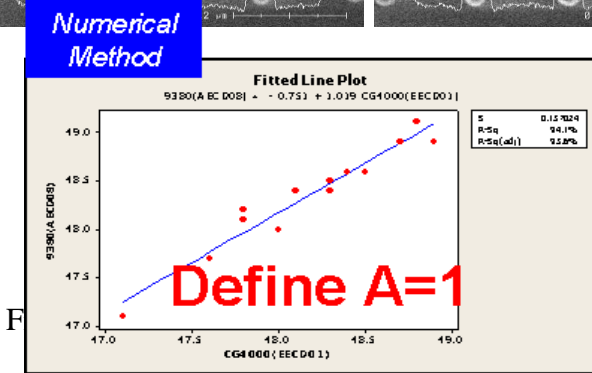
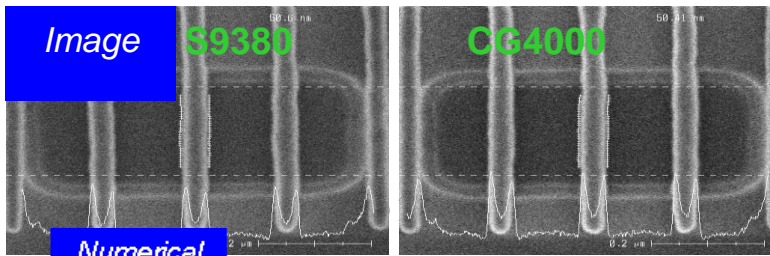
Step3: Inline production matching (long term) - Finalize to define B value.

In conclusion, the hypothesis testing, short-term and long-term data verification conducted in the paper demonstrates that A and B value across generations in the empirical case presented here.

A case study about N40 ADI CD line shows the result of the innovation such as below
AX+B evaluation is offset assumes CG4000 poly line measurement =0.8nm+S9380
poly line measurement based on table 4, table 5, figure 9 and figure 10.

ABBA	S9380	CG4000
Part I	48.8	48.2
Part II	49.6	49
Part III	50.8	50.4

Table 4: AB Map Matching Data (short-term)



Method to define A=1

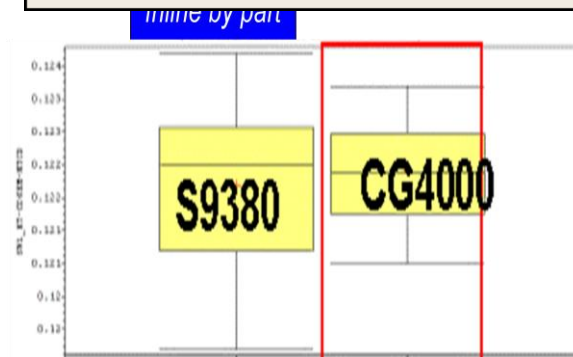


Table 5: Inline Production Data (long-term) to define B=0.8nm

Conclusion

We found statistic methodologies including regression model GRR and EWMA to be a potential standard and evidence that wafer design, clean method which reduced the carry over effect in order to monitor long-term and short-term precision of line CD for multiple CD SEM.

We also have presented a data and strategy that was successfully implement at tsmc to monitor and match multiple CD-SEM. Then, those innovations and accomplishments

bring great benefits and values to tsmc. That is not only to minimize CD measurement error from 1nm to 0.3nm (70% improvement), and fulfill tight device requirements shift <1% (69% improvement) and 20% P/T ratio based on ITSR outline, but also triple capacity in CD monitor stages owing to free of restriction in some mis-matched tools.

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Health Care Improvement and Learning – A Study of Emerging Islands and System-Wide Approaches

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Key words: Organizational Learning, Quality Improvement, Process Facilitators, Implementation, Hospital Care,
Diffusion of Innovations

Introduction

Learning and change in health care

Traditional views on the spread and diffusion of knowledge and learning in health care have been criticized as being overly linear, simplified and rational, leading to an often plodding progress of clinical praxis (Ferlie, Fitzgerald, Wood & Hawkins, 2005, and Bhattacharyya, Reeves & Zwarenstein, 2009). Rationalistic perspectives on implementation interventions seem unable to adequately portray the complexity of changing the behaviour of a professionalized organization. There is a great deal of confusion regarding the essential components of practice change and also to what extent health care providers can borrow new practices developed in contexts different to their own.

The scope of implementation science is broad and related questions can therefore be formulated from various perspectives. Based on a systematic literature review Greenhalgh et al. (2004) summarize empirical research studies from across several traditions on different aspects of diffusion of innovations in service organizations. Their results include a conceptual model for considering the determinants of diffusion, dissemination and implementation of innovations in health care organizations. Among the findings are significant aspects of the innovation, the adopter, assimilation, diffusion and dissemination, system antecedents and readiness for innovation, inter organizational networks and collaboration, and the process of implementation. Greenhalgh et al. (2004) state that “a striking finding of this extensive review was the tiny proportion of empirical studies that acknowledged, let alone explicitly set out to study, the complexities of spreading and sustaining innovation in service organizations”.

In a review of literature on organizational learning and knowledge with relevance to public service organizations, Rashman, Withers & Hartley (2009) found that public organizations which operate in a complex policy and political environment constitute an important, distinctive context for the study of learning and knowledge. The primary drivers for learning and innovation in public service organizations are not financially related but derive from demands and expectations by a wide range of stakeholders. Haynes (2005) states that in order for inter-organizational learning to occur in the public sector, a partnership approach is needed between managers, professionals and users. Increasing competition among public service providers might hamper this approach. Rashman et al. (2009) conclude that there continues to be an over-reliance on the private sector as the principal source of understanding and research, and that the concepts of organizational learning and knowledge are under-researched in relation to the public sector.

Change strategies vary and change agents can design their approach taking the context more or less into account. In a very simplistic way change initiatives may be seen as a) top-down, i.e. emerging from a high hierarchical level or central position of the system or organization and from there spreading towards its bottom or periphery, or b) bottom-up, i.e. emerging from some peripheral or lower hierarchy position of the system or organization and from there spreading horizontally and/or upwards in the hierarchy. Initiatives could also use combinations of a) and b), leading to a mixed strategy, which might as well vary over time. The chosen change strategy for a project is assumed to have a high impact on how successful the change initiative will be.

The present study will address some of the challenges discussed above, focusing on how to implement large changes in a dynamic and complex health care environment where several change attempts, initiators and strategies for change coincide. The aim of the study is to describe initial strategies and results when concurrently commencing a regionally initiated but system-wide organizational learning intervention program called the Dynamic and Viable Organization (DVO) in a Swedish county's specialised hospital care with a coinciding national initiative on stopping health care-associated infections (SHAI). The initiatives main focus and goals differed but they shared the aim of achieving organizational learning by increasing staff competence regarding systematic work procedures for improvement, see Figure 1. The questions addressed were if DVO used SHAI to achieve its goals and vice versa and how change agents of DVO and the SHAI improvement teams viewed the situation.

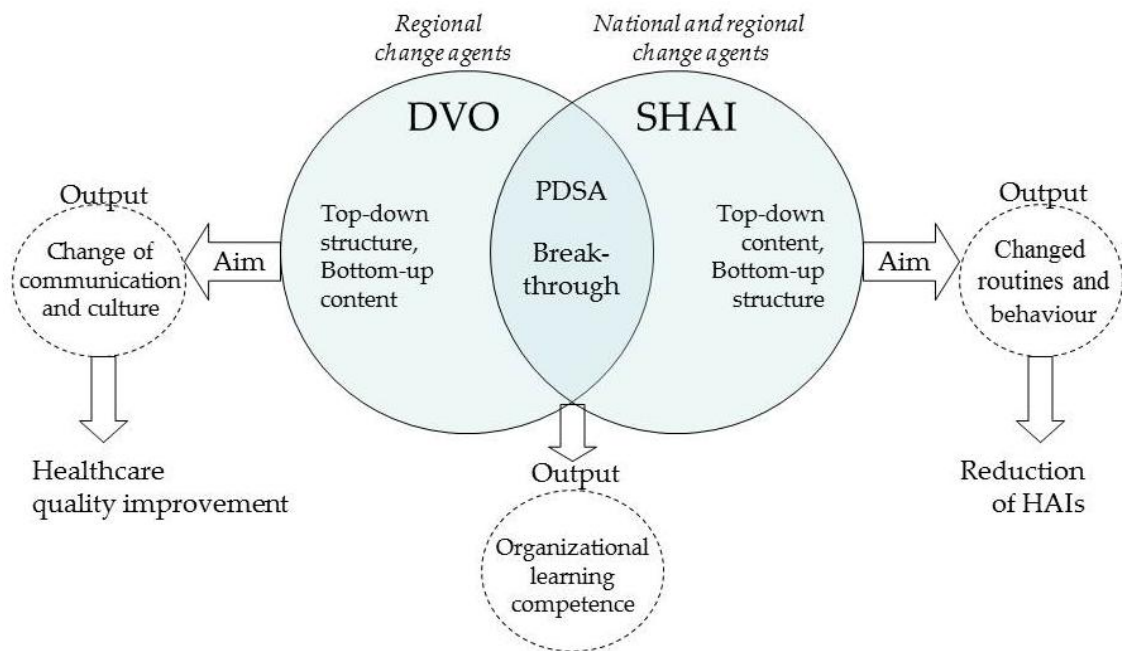


Figure 1 A basic model of the dominant initial strategy, aims, outputs and outcomes of the two studied interventions.

The study is interdisciplinary and forms a part of a Vinnvård financed research program aimed at examining organizational learning and development processes in health care. The research program's intention is to broaden our understanding of when, how and why interventions get implemented, spread and sustained, including the relations between content, context, process and outcome of the change effort.

Method

The present case study of two complex and large interventions implemented in a heterogenic context used triangulation of mainly qualitative data from interviews, questionnaires and documents. Our ambition has been to enable theoretical rather than empirical generalization (Walshe, 2007).

Empirical Setting

The studied Swedish county council serves about 250 000 citizens and has about 10 000 employees. The county council has since 1998 a development unit as a support organization, the process facilitating agency, with coordinators, trainers and mentors focusing on quality related knowledge management and process facilitation for departments and clinics within the county council. At the time of the study PFA had 10

employees and had developed into an improvement resource for the whole county council, focusing on several organisational levels.

The Dynamic and Viable Organisation (DVO)

In 2004 a developmental venture was initiated by top managers and the development unit of the county council. This initiative was named Dynamic and Viable Organization (DVO), a new meso structure intended to be rooted on a middle management level with development groups and with procedural assistance by assigned facilitators from the council's internal support organization and a strategic group of higher management and strategic actors. The new communication and work process structure was launched in 2008, including groupings on different levels (strategic development group, unit development group and improvement teams) as well as communication arenas (Figure 2). It was also decided to make use of a PDSA-based improvement approach with the aim to increase the organisation's ability to transfer knowledge into practice and transform limited subsystems views to a holistic system view by a change process based on learning. The goals included building a learning culture, increasing competence in systematic ways to work with improvement (PDSA), competence for several management levels in motivating, setting goals, coordinating, supporting, and following-up improvement work of teams.

The design of the change process for implementing DVO had been inspired by models and theories developed at the Institute for Healthcare Improvement (IHI) and by Idealized Design of Clinical Practice (Moen, 2002) with the aim to enhance system wide change.

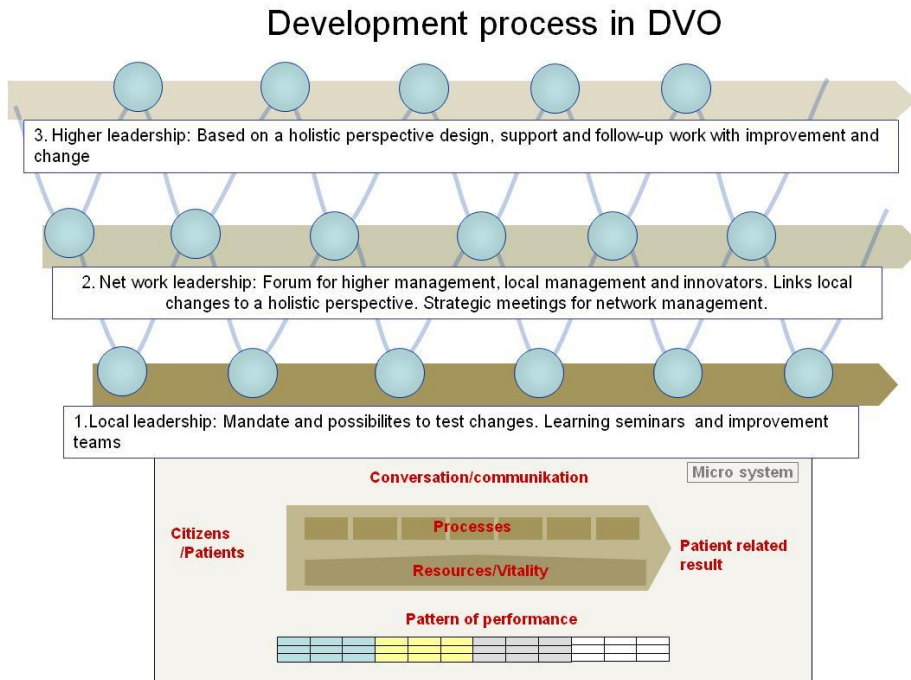


Figure 2 The structure and process of the Dynamic and Viable Organization

Thus, the original approach of PFA, which focused on local initiatives based on willingness to participate in development, was enlarged to incorporate additional managerial levels and a strategic group which included actors responsible for medical care, economy and staff. Forums dedicated to dialogue and the spread of good experiences were planned at micro, meso and macro system levels. The intention was to facilitate a two way communication between the parts and the whole of the system and thereby increase understanding and learning.

DVO and the IHI Breakthrough model

The Breakthrough model implies that ideas and new approaches are tested on a small scale and then evaluated and either abandoned or made permanent and disseminated, depending on the results. By doing so, theory and knowledge are put into practice. The goals should be clear, challenging and possible to measure. Coaches and support should be available, but the work is supposed to add a great deal of responsibility on the participating teams and organizations to learn by doing things themselves.

The model of improvement used by the teams and supported by the process facilitators consists of three central questions and the PDSA-circle for small-step testing of changes, see Figure 3. The innovation process is intended to provoke new ideas,

stimulate participants of the improvement teams to test their ideas and then also share their experiences of the experimentation.

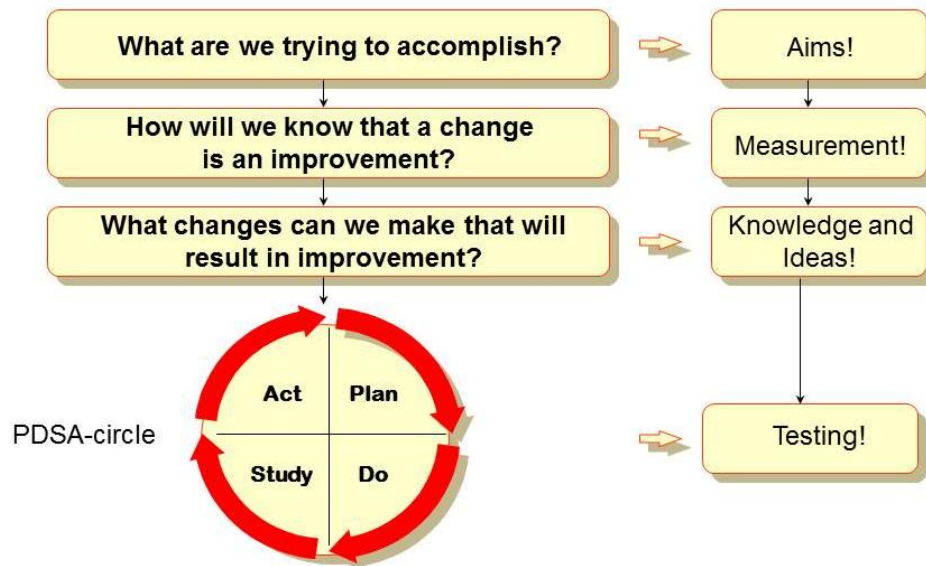


Figure 3 Model of improvement, derived by PFA from Deming (1986) and Langley GL, Nolan KM, Nolan TW, Norman CL, Provost LP. *The Improvement Guide: A Practical Approach to Enhancing Organizational Performance* (1996).

National initiatives to stop health care-associated infections (SHAI)

Health care-associated infections (HAIs) are a major problem worldwide, leading to increased mortality and morbidity for patients and higher cost of care (Centers for Disease Control and Prevention, 2002; Burke, 2003). Improving hygiene among health care workers is an essential intervention in preventing HAIs. However, despite the very well-known positive effect of good hygiene, compliance among healthcare professionals remains low (Larson, Albrecht, & O’Keefe, 2005; Whitby, McLaws, and Ross, 2006) and interventions to improve hygiene have only small or temporary effect on actual behaviour (Beggs et al., 2006; Sacar et al., 2006).

In 2004 the first SHAI-program was initiated in Sweden, which lasted for about one year. In total 21 multi professional improvement teams from different parts of the country participated, representing many specialities. Before the start an expert group was invited to describe state of the art in terms of HAIs reduction and to suggest the

best strategy to get there. In 2005 the second round of SHAI was launched, with the National Board of Health and Welfare as one of the arrangers (Wallin, 2007). Also this time 21 teams were involved. In order to participate the health care organizations were required to form a cross professional team including a physician, and to have active support from their unit managers. Unlike the first round municipalities were now represented among the participants.

SHAI and the IHI Breakthrough model

All SHAI programs were performed using a similar structure, in both cases consisting of three learning seminars for the improvement teams with work periods in between where changes were tested and spread, finishing with a conference. The teams had access to their own web based work places where they could also report and locally read about each other's results. During these projects the Swedish Association of Local Authorities and Regions (SALAR) offered help and support, for instance regarding guidance on the use of different methods.

The purpose of using the Breakthrough model in SHAI, was pointed out by SALAR as twofold: First, the participating teams and organizations should reach their HAI-related project goals by applying the method. Second, they should learn and internalize the method so that they – and the organization – after the project / learning period, may apply it to new and other areas.

SHAI – Local intervention and process of implementation

In the spring of 2008 all clinics in the studied County council were supposed to participate in a national wide measure of HAI prevalence. Those who wanted could also participate in a SHAI intervention, using the Breakthrough model. In the studied organisation twelve clinics chose to participate in the intervention using the Breakthrough model. The projects lasted for a year and were conducted in collaboration with SALAR, the County council's units for infection control and patient safety and PFA, i.e. the support organization. As in previous national SHAI initiatives, the primary focus was on eliminating incidence of healthcare associated infections. A specific goal identified was to halve the number of HAI. Each team had to write monthly reports and also a final report at the end of the project.

Data collection and analyses

Several different sources of data have been used as a basis for the analysis regarding progress and results, see Table 1.

Table 1 Data sources used in the analysis

		2007	2008	2009
Survey	Improvement teams		x	x
Observations	Learning seminars	x	x	
	Process facilitator meetings	x	x	x
	DVO forum	x	x	x
Archival data	Agendas, documents, presentations, team reports	x	x	x
Interviews	Process facilitators	x	x	x
Process diaries	Process facilitators	x	x	x

Data analyses of team reports

In the autumn of 2009 a review was made of all final reports and parts of the monthly reports from the studied SHAI projects. Preliminary categories for classification of material were created and a tentative summary of final reports from participating clinics was presented and thoroughly discussed within the research team. On the basis of this discussion the following categories of analysis were used:

Number of team members	Factors hindering the change of work procedures
Number of represented professions	Factors facilitating change of work procedures
Managers involved	Previous experience of Breakthrough models
Compliance to hygiene routines	Reflections
Compliance to clothing routines	Type of source
Patient related measurements	Goal fulfilment

Data was processed and analysed with the purpose of finding themes and patterns. Results were then compared and variation and deviation were noted. Finally, a report summary was made.

Data analyses of process diaries and interviews

To gain an overall conceptualization of process facilitators' main focus, strategic considerations, perceived challenges to manage etc. during the period (late 2007-mid

2009), interviews and process diaries from the process facilitators have been screened and main content areas has been identified.

Descriptions of essential/crucial elements, conditions, activities, events (i.e. determinants) and to these, linked strategic plans or actions, when launching DVO and simultaneously taking on the mission to support top-down initiated SHAI has been sorted out, analysed and interpreted as a whole – i.e. render in an overall description of the main reasoning of process facilitators during the period. Through this content screening and analysis, we also aimed to reveal the existence, or nonexistence, of indications on strategies being used to incorporate aspects of the SHAI initiative into the DVO-intervention, or vice versa.

Based on content, frequency of statements and comments on crucial elements, activities, events, conditions and strategic changes when launching DVO and/or managing SHAI where sorted as:

- *Strong indication:* frequently repeated, given by more than 75% of the respondents and originating from more than one data source
- *Medium indication:* often occurring statements/units mentioned by at least 50% of the respondents
- *Weak indication:* occasional, sporadic or implicit statements.

Data analyses of improvement team questionnaires

Based on a literature review of organizational change, learning and quality improvement together with a study of six successful organizational case studies Nyström (2009) has developed a model called CAOLD (Characteristics Associated with Organizational Learning and Development). This model formed the base for the closed questions posted in the questionnaires as well as the base for analyses.

The original CAOLD model covered 20 characteristics divided into three main areas: A) Organisational system, B) Key actors and C) Change management processes. In this study focus were on five of these characteristics, see Table 2. The total questionnaire consisted of 35 statements related to these areas and characteristics, to be judged on a scale from 0 (do not at all apply to the current situation) to 5 (fits the current situation very well). The five characteristics of primary interest in this study, where captured in 11 of the closed questions in the questionnaires.

Table 2 Studied characteristics of the CAOLD model

Staff motivation and commitment
Staff cooperation and team work
Encourage experimentation and quick pilot tests of ideas
Systematically use a Plan-Do-Check-Act (PDCA) cycle ^{12,33} or equivalent
Enhance sustainability by incorporating successful changes into organizational structures and processes

The two identical surveys were intended to explore changes over time in staff response to the selected aspects/characteristics of the CAOLD model.

Results

Structure, strategy and content

The regionally developed DVO had initially a clearly stated bottom-up and emergent design regarding what issues the different development groups and improvement teams were about to work with (Figure 1). On the other hand, the organizational structure and strategy of DVO was defined before the program was launched and thereafter described and disseminated during several so called strategic forums.

The nationally initiated SHAI had a clearly stated agenda regarding what issues the teams were intended to work with (Figure 1). These issues were introduced during learning seminars, where also the IHI Breakthrough approach was initiated and used, i.e. the strategy was very well defined from the start. The SHAI concept included guidelines and templates for minutes, data presentation and reports but was not as specific with regard to the organizational structure supposed to carry out the intervention.

Prior to the study the process facilitators had been primarily focusing on a micro system perspective when working with change teams at specific units and clinics.

The focus of process facilitators during the initial implementation of DVO

There were *strong indications* that the group of process facilitators focused on the core thoughts and strategies within DVO (the left side of figure 1). The most urgent achievement and central area of concern seemed to be:

- Helping clinics define their own areas of improvement, i.e. define clinic specific needs
 - Participants view themselves as owners of their improvement processes
- A structure for communication, policy deployment and reporting is established, centred around a design group, multi professional development groups and improvement teams at each clinic
- Participation in learning seminars and strategic forums for dissemination, spreading ideas, sharing information and providing motivation and inspiration
- Structuring the micro level improvement work according to the PDCA-cycle (with small scale testing etc.).

There were *medium indications* that the mission of process facilitators was perceived as un-clear. Expectations on what ought to be supported and done were not explicitly defined (neither from a management level nor within the group of process facilitators).

When top down SHAI arise, the process facilitators (to varying degrees) supported their clinics in creating the improvement team (for SHAI), getting the picture of present status at the clinic (regarding HAI), defining adequate goals and related measurements and in other ways help the clinics in gaining structure and systematic improvement work. They also supported the clinics in the process to systematically report on progress and results on the established website, that all clinics had access to and were supposed to retrieve information and inspiration from. Participation in learning seminars (SHAI) is spoken of as high as all teams were represented in all learning seminars.

Potential strategies on how to handle and combine DVO and SHAI did receive far less attention. Even though the issue with staff perceiving DVO as a project “owned” by others but themselves how to design the mission accordingly to each clinics’ specific needs were discussed, a strategic plan for these aspects were not discussed, and thus seemed to be missing. The issue of how to use the DVO-approach when working with “top-down” initiatives in general did arise and was briefly discussed.

However, there were *medium to strong indications* that the group of process facilitators used the SHAI initiative to help clinics structure their improvement work according to the thoughts in DVO (structuring the micro level improvement work according to the PDCA-cycle). The gap between the initial idea with DVO, that areas for improvement and development should be identified by the involved staff themselves, and the top-down initiated SHAI initiative was not discussed strategically or explicitly managed.

Nor were there any indications that a strategic discussion on how to make use of the SHAI initiative to achieve goal effectiveness in DVO (or vice versa) took place.

There were some indications that the group of process facilitators noted a potential setback for the DVO-progress when taking on the SHAI initiative. There were weak indications that members of the group even saw the SHAI initiative as a reason to “put DVO on hold”.

Effects on improvements teams’ competence in working with systematic improvement procedures based on questionnaires

The effects on the improvement teams’ competence in working with systematic improvement procedures were captured by use of eleven of the closed questions of the repeated CAOLD model questionnaire regarding the five model factors outlined above.

Results from the questionnaire indicated that the clinics’ capacity to work systematically with improvements had increased during the period regarding small scale testing and working according to the PDSA-cycle. The questionnaires also indicated positive changes in how well the clinics managed to enhance sustainability by incorporating successful changes into organizational structures and processes and that staff motivation and learning style had changed. There seemed to be no changes when it came to the clinics capacities to work in teams.

Effects related to knowledge and learning based on team reports

Many respondents stated explicitly that the measurements conducted as a result of their involvement in SHAI projects had been contributing significantly to a reduction of so called hidden statistics. Previous tacit knowledge had become explicit, aided by graphs and tables providing clear descriptions of the situation within the clinic. Respondents claimed that the systematic measurements performed centred attention to problematic areas and areas with high improvement potential, lead to increased awareness, development of new knowledge and a greater focus on problem solving at staff level.

When it came to the studied teams’ reflections regarding the Breakthrough-approach as a method, there were also recurring themes. The Breakthrough approach was described as contributing to an increased degree of reflection and discussion. It was also thought to encourage networking, both when it came to collaboration across professional

boundaries and in the sense that it included knowledge sharing and the exchange of experiences with colleagues in other clinics.

The learning seminars that had been arranged were found to provide new energy and also incentives to keep on working within the project. Many teams reported that they were surprised by the results of the measurements performed, for instance by discovering that HAI occurred more frequently than they had thought previously.

Effects related to behaviour and HAI based on team reports

In many teams, compliance to routines regarding clothing and hygiene had increased slightly over time. However, in some of the teams initial gains had started to deteriorate at the end of the measuring period. Physicians were clearly overrepresented in the group of professionals that are described as having difficulties following health regulations.

In many cases the patient related results presented in the teams' final reports did not show clear trends of improvement. The improvements that may be discerned in some of the graphs in the reports were in many cases over-stated by the teams.

Problems and hindrances identified based on team reports and questionnaires

A large majority of the respondents stated that too little time was provided for the completion of the SHAI projects. The projects had been more time consuming than the respondents had imagined and expected from the start. Working with preventing HAI was reported as having a low priority and in some cases the respondents stated that it had been difficult to get their managers support for the implementation of the SHAI initiative.

There were several similar and parallel activities going on at the same time as SHAI within the county and the respondents reported that it had been difficult to find energy and engagement in relation to all the on-going activities. A common reflection among the respondents was that it had been unfortunate and ill-timed to launch the SHAI projects just before vacations had started, when the level of inspiration and motivation might be lower than usual.

Several respondents expressed a feeling of having been forced to engage in the SHAI projects, and with short notice. It was argued that too few did participate from each clinic, making it more difficult to disseminate the results and make an impact among all

employees. Some had experienced problems due to the fact that some measurements and goals had not been developed or agreed upon within the clinic.

Lack of computer experience was stated as a big problem in many clinics. The approach involved extensive documentation, which was also perceived as problematic. Lack of writing skills was mentioned by several teams as a problem. Negative or ignorant attitudes among physicians were pointed out as a concern in some cases.

In terms of the common organizational learning processes described by Rashman et al. (2009) the SHAI projects were characterized by shared understandings and perspectives at a group level through communication and interaction. Diffusion via organizational routines was also present but the individual perspective and embedding of learning was much less apparent.

Discussion

During the first year of the DVO implementation, there were no clear indications that the two initiatives of DVO and SHAI were strategically combined in order to let any of them benefit from each other. The core idea of DVO – the bottom-up approach regarding the selection of areas for improvement – was being put on hold, or was being breached, when the top-down SHAI initiative arise. The process facilitator group was obligated, and tried to support the work of the clinics within the SHAI initiative, but DVO and SHAI continued to be viewed upon as two separate and somewhat incompatible efforts. Working strategically with the progress of DVO, in terms of changing the culture and individual and unit based learning styles was temporarily put on hold, since its essential elements were based on a bottom-up approach. Some progress was reached during the period when it came to the goal shared by both initiatives; improving staff competence in working systematically according to the Breakthrough model including the PDSA cycle.

Thus, our in-depth analysis of the data indicates that in the early stage comprehensive management strategies to utilize the national SHAI initiative and its resources were partially lacking. Instead the initiative was regarded by many of the respondents as a strictly top-down project with little room for contextual adaptation regarding its content or strategy. The newly developed structure of DVO was used when implementing SHAI.

In terms of organizational learning the SHAI projects were characterized by shared understandings at a group level and dissemination of innovations via organizational routines. In hindsight it was argued that the national initiative could have benefited from a stronger incorporation with DVO, especially for reducing content focus and overriding of process knowledge building, thereby increasing adopter motivation and managerial support for solutions and insights. Process facilitators played a key role in enabling this organizational learning, and at the following stages the building of improvement competence on different organizational levels, the sense-making activities provided and the national support structures available for measurement and feedback were used to pursue DVO related goals of reducing fragmentation and enhancing capability to handle complexity.

It is important to realize that the data collection was performed during the early stages of the DVO implementation (the main part gathered during 2008 and 2009) and SHAI was the first national initiative for the DVO approach to handle. Since then the DVO initiative in the county has been enlarged and also incorporated and used several national Break through initiatives in order to enhance the DVO approach. The organization has also scored high or medium high on many of the factors related to a learning organization in the CAOLD model.

Taking initiatives to change the way organisations work are well known to be difficult endeavours. A general conclusion of our study is the need to recognize intermediate phases when moving from knowledge to practice and when designing studies evaluating effects of change initiatives in health care. Our contention is that if treating these processes as “black boxes” then potentially important information might be lost. Instead it is important to acknowledge the relations between evidence based knowledge, innovative/creative processes of producing and selecting interventions, interventions design, the choice of implementation process and its effects on sustainability, the learning-in-context by professionals and its connection to sustainability, the cognitive processes involved in learning and behavioural change and effects on health.

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New methods in university entrepreneurship education: An approach to multidisciplinary teams

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Category: Research paper

Introduction

Since Myles Mace taught the first entrepreneurship course at Harvard Business School in 1947 (Katz, 2003) the number of education programs designed to instill entrepreneurial spirit and ultimately boost new firm creation has continued to grow, leading one author to claim that “the younger generation of the 21st century is becoming the most entrepreneurial generation since the Industrial Revolution” (Kuratko, 2005, p. 578).

This proliferation of entrepreneurship education programs is a consequence of the positive effects that entrepreneurship has in terms of economic growth and job creation (Audretsch, 2002) as well as the recognition that entrepreneurship education has now reached full maturity (Katz, 2008) and is close to gaining full legitimacy (Kuratko, 2005) as a scientific and academic discipline.

On the other hand, the profound changes affecting the economy, the technological revolution, and the social and environmental crisis, among other aspects, are generating greater levels of uncertainty and even ‘unknowability’. Thus educators need to profoundly rethink the methods and approaches they use in the University (Neck & Greene, 2011; Bechard & Gregorie, 2005; Fiet, 2001). In the same line, “entrepreneurship within a formal education structure requires a new approach based on action and practice” (Neck & Greene, 2011, p. 68).

But despite this huge growth in entrepreneurship education, particularly in the universities, researchers have shown relatively little interest in identifying the benefits that students gain from participating in these programs (Peterman & Kennedy, 2003; Athayde, 2009).

In this context, a group of professors at the University of La Laguna (Spain) conducted a project to test an innovative methodology for teaching entrepreneurship. The project involved the drawing up of business plans by multidisciplinary teams of students studying for degrees in chemical engineering, industrial engineering, computer engineering and business management. In the current work, the authors present the methodology they followed and the main results from the evaluation of the impact of participating in the project among the students. They offer their main conclusions from the experiment and suggest possible improvements for the future. The authors first contextualize the initiative by offering a diagnosis of the current state of entrepreneurship education and the role universities play in it.

Entrepreneurship education and the university’s role

The importance of the entrepreneur and entrepreneurship in the real world are increasingly difficult to ignore (Wennekers & Thurik, 1999), which can be explained on the basis of an “emerging economic environment created by the confluence of changes in the corporate world, new technology, and emerging world markets” (Fiet, 2001, p. 102).

Nevertheless, entrepreneurship is more than the mere creation of a business, and although that is certainly an important facet it is not the whole picture. The characteristics of seeking opportunities, taking risks beyond security, and having the tenacity to push an idea through to reality combine into a special perspective that permeates entrepreneurs (Kuratko, 2005). Entrepreneurship can be defined as “the

pursuit of opportunity beyond the resources you currently control (Stevenson, 1983, 1985; Stevenson & Jarillo, 1990; World Economic Forum, 2009).

According to this perspective, entrepreneurs are shaped by their experiences, during which they try to make the right choices. Thus entrepreneurship can be understood as a process of learning, and a theory of entrepreneurship requires a theory of learning (Minniti & Bygrave, 2001). Clearly, what is learned may be false: entrepreneurs may fail. But entrepreneurs, like all individuals, also learn from their failures and the key question about entrepreneurship is not who the entrepreneur is, but what he/she does (DeTienne & Chandler, 2004; Gartner, 1988). Entrepreneurship can even be understood as “a method of human action, comparable to social forces such democracy and the scientific method” (Wiklund et al. 2011; Sarasvathy & Venkataraman, 2011).

Just as entrepreneurship can be learned, “most of the empirical studies surveyed indicated that entrepreneurship can be taught, or at least encouraged, by entrepreneurship education” (Gorman, Hanlon, & King, 1997, p. 63). The possibility of learning entrepreneurship is clear not only in the later, more technical, stages of the entrepreneurial process—such as the elaboration of the business plan—but even in the initial stages when the innovative ideas are generated (DeTienne & Chandler, 2004). Considerable debate exists about the most appropriate pedagogical models for teaching entrepreneurship (Neck & Greene, 2011; Honig, 2004).

The conviction that entrepreneurship can be taught has driven the growth in the number of colleges and universities offering courses teaching some aspects of entrepreneurship from a handful in the 1970s to 1,600 at the dawn of the new millennium (Katz, 2003). A fierce competition has grown up among these institutions, and a number of researchers have compared the content and quality of their courses (Vesper & Gartner, 1997; Gartner & Vesper, 1994). More importantly, the academic legitimacy of the field of entrepreneurship has now almost been consolidated (Kuratko, 2005). In parallel, the conviction exists that “entrepreneurship education is essential for developing the human capital necessary for the society of the future. It is not enough to add entrepreneurship on the perimeter – it needs to be central to the way education operates” (World Economic Forum, 2009, p. 15).

According to Kuratko (2005), the question is not whether entrepreneurship can be taught, but what should be taught and how it should be taught (Honig, 2004; Fiet, 2001). Thus educational institutions at all levels (primary, secondary and higher education) should adopt 21st century methods and tools to develop the appropriate learning

environment for encouraging creativity, innovation and the ability to “think out of the box” to solve problems (World Economic Forum, 2009).

Thus educational systems need a fundamental rethinking to bring their contents closer to real life. Theory should always be applicable, and “[i]f we fail to teach our students how to apply it in surprising ways, it is we who are at fault, not the theory” (Fiet, 2001, p. 101). Thus in recent decades, with experiments in entrepreneurship education accumulating, came the realization that one of the basic lines of development needs to be research into the teaching methods commonly used in entrepreneurship programs (Kuratko, 2005; Zeithaml & Rice, 1987).

Researchers have observed the benefits of participating in programs to promote entrepreneurial spirit among university students in terms of their level of entrepreneurial vocation (Athayde, 2009; Harris & Gibson, 2008; Peterman & Kennedy, 2003). According to Rodrigues et al. (2010), entrepreneurship education is the most important factor explaining propensity for business creation, over and above aspects such as personal, family and demographic attributes.

The above is particularly important in the context of higher education in Europe, given the conclusions of a study from The Commission of The European Communities (2008) among 664 higher-education institutions:

- Less than half of university students have access to some type of initiative related to the development of entrepreneurial spirit.
- European universities are trailing far behind US and Canadian universities in this area.
- Very little cooperation takes place between institutions to exchange good practices.
- Most institutions allocate less than €50 per student per year to promoting entrepreneurial spirit.
- It is necessary to agree on a more inclusive definition of what is understood by entrepreneurial education.

In this context, it is essential to promote entrepreneurship education. Educational institutions in general, and universities in particular, have to play a key role in this as fundamental elements in the configuration of the “entrepreneurial ecosystem”, since they contribute to “shaping young people’s attitudes, skills and behaviors” (World Economic Forum, 2009, p. 15). The aim should therefore be to consolidate the tendency to include entrepreneurship in the curriculum in higher education that started at the end

of the last century (Katz, 2003), and to evaluate and learn from the many initiatives that have taken place (see e.g., Dévora, 2010).

A Practical initiative: multidisciplinary teams of university students

A group of professors at the University of La Laguna (Spain) who teach four courses from four different degree programs in business management and the engineering sciences carried out a project to test an innovative methodology for teaching entrepreneurship and inculcating entrepreneurial spirit among the students. The project involved setting up multidisciplinary teams of students to draw up business projects on the basis of an idea. The starting point for the project was the following ideas about the role and potential of entrepreneurship education in the University:

- Entrepreneurship education could offer a broad, integrative, pragmatic, and rational approach to business, avoiding the problem of the continued increasing fragmentation of business education into narrow specializations (Kuratko, 2005; Zeithaml & Rice, 1987).
- On the other hand, teaching entrepreneurship requires a multidimensional and cross-disciplinary approach with an emphasis on dynamic processes (Fayolle, 2007). In this respect, Kuratko (2005, p. 584) notes the trend in “new interdisciplinary programs that use faculty teams to develop programs for the nonbusiness students”. For this, universities need to change their structures with regard to their entrepreneurship classes, because they only offer these classes to students from one or sometimes two disciplines (Fayolle, 2007).

Description and objectives of project

The project consisted of the drawing up and subsequent presentation and defense of business plans by interdisciplinary groups of final-year students on various degree courses at the University of La Laguna. The business plans were based on business opportunities detected in the environment. The objectives of this project were as follows:

- To teach entrepreneurship and promote entrepreneurial spirit among the university students.
- To show the students the utility of the knowledge they had gained during their courses and help provide them with an eminently practical focus adapted to solving real needs.

- To promote initiatives and attitudes among the students focused on problem solving, providing them a channel through which to develop their knowledge and ideas in a business environment.
- To promote cooperative team-work and the exchange of ideas and experiences among students studying different degrees, encouraging an interdisciplinary approach to problem solving.
- To facilitate interrelation between professors and the creation of interdisciplinary teams of professors, as well as the exchange of perspectives on teaching methodologies.

The professors formed multidisciplinary teams consisting of two distinct sets of students: first, students studying one, and not more than one, of either computer, chemical or industrial engineering; and second, business management students. The idea was that they work together to develop a business idea and draw up a business plan. The students coming from the scientific-technical areas would conceivably contribute a more technical and operational perspective to the project, while the business management students would offer the vision and conceptualization of the business, support in the market research, and above all the economic-financial analysis. The business management students would be acting as “business consultants”, advising the scientific-technical students in the development of the business plan.

The four professors teaching the courses participated in the project. Of the 217 students registered on the four courses, a little over half (109) were studying one of the engineering degrees and the rest were studying business management. A total of 12 interdisciplinary teams of students were established. The teams ranged in size from 11 to 20 members, with a mean of 16.

After four months the results of the project were evaluated. For this, the professors drew up a questionnaire to measure participating students’ satisfaction with and evaluation of the project. The next section describes this evaluation process and the main results obtained.

Methodology of evaluation

For the evaluation process a questionnaire was drawn up. The questionnaire had its basis, on the one hand, on the dimensions for assessing the quality of a project for testing an innovative teaching methodology for entrepreneurship, and on the other, on

the attributes defining entrepreneurial activity according to the Annual Report of the GEM Spain project (De la Vega et al, 2009).

With regard to the quality of the project, and following Mauri, Coll and Onrubia (2007), the questionnaire considered four dimensions: implementation of the project; results of learning; fundamental elements of the innovative methodology; and degree of satisfaction. The next step involved establishing a set of indicators to define each dimension of the construct. These variables made up the questionnaire sent to the students participating in the project. Table I presents the items grouped into the four main dimensions.

Table I. Quality of project to test innovative teaching methodology

Implementation of project
I1 The professor informed us at the beginning of the course how the project was going to proceed (objectives, content, methodology, evaluation, duration...)
I2 The initially established deadlines for the project were met
I3 The professor resolved any doubts we had during the project clearly and quickly
Results of learning
I4 Participating in the project has helped improve my understanding of the contents of this course
I5 After participating in this project I now understand the business environment better
I6 Participating in this project has allowed me to apply what I have learnt in this course to the business reality, orienting my knowledge to the solution of real problems
I7 After participating in this project I am more likely to start a business at some time in the future
I8 This project has enabled cooperation with students from other degrees, which has given me a new perspective in the solving of real problems
Fundamental elements of innovative methodology
I9 The structure of the project was clear, logical and organized
I10 The professor gave a clear explanation of the concepts involved in the implementation of the project
I11 Working on the project has provided us with motivation and interest in the course
I12 The teamwork with classmates from my degree was fruitful and stimulating
I13 The teamwork with classmates from other degrees was fruitful and stimulating
I14 The material recommended (bibliography, documentation, transparencies, etc.) helped us carry out the work and was easily accessible
I15 The virtual classroom and the information and communication technologies were adequate and useful in doing the work
I16 I think the evaluation criteria and the weight of the project in the total grade for the course are about right
Degree of satisfaction
I17 In general, I am satisfied with how the practical work went

I18 In general, I am satisfied with the professor's support of the practical work
I19 I think I learnt a lot from doing this work and it will be useful for my education
I20 Doing this work meant that this course required more effort than the other courses

The population object of study consisted of all students officially registered, in January 2011, on one of the following courses as part of their degrees: Management Accounting (MA); Computer Systems Management (CSM); Business Administration and Organization of Production (BAOP); or Economics and Industrial Organization (EIO). According to data from the Office for Analysis and Planning at the University of La Laguna the total number of students officially registered on these courses at that time was 217.

For the data collection the professors of these courses uploaded the questionnaire onto the corresponding Virtual Classroom at the end of the first four-month term of the academic year 2010-2011, after the students took their exams but before they learned their grades in order to encourage greater homogeneity and objectivity in the responses. The professors received 126 validly completed questionnaires, which represents a response rate of 63%. Table II shows the response rate in each course.

Table II. Composition of population and sample size

COURSE	Degree	No. students registered	No. questionnaires	Response rate
Management Accounting (MA)	Business Management	104	48	46%
Computer Systems Management (CSM)	Computer Engineering	30	15	50%
Business Administration and Organization of Production (BAOP)	Industrial Engineering	62	46	74%
Economics and Industrial Organization (EIO)	Chemical Engineering	21	17	81%
Total		217	126	63%

The information collected was codified and stored in a database for subsequent treatment (preliminary analysis of data quality and replacement of absent data by the mean of the series using the statistics program SPSS 19.0). The statistical analysis of the data followed, and the following subsections look at the results.

The SPSS 19.0 program was used to analyze the validity and reliability of the measurement scale used to measure the quality of the project to test the innovative methodology in entrepreneurship education. After confirming the normality and linearity, the Cronbach alpha coefficient was calculated to evaluate the internal

consistency of the indicators of each latent variable. The results show that each set of observed variables is representative of its corresponding factor, since values close to or exceeding 0.6 are considered acceptable in exploratory analyses (Hair et al., 1999). Thus for Implementation of project and Degree of satisfaction this statistic is lower than 0.6 but remains acceptable because it exceeds the minimum of 0.5 (0.504 and 0.545, respectively). For the other two dimensions—Results of learning and Fundamental elements of innovative methodology—the statistic gives higher values (0.654 and 0.756, respectively). The Cronbach alpha for the whole scale is 0.858, which means that the questionnaire is reliable as a whole. Finally, with regard to the discriminant validity, for a 95% confidence interval the correlation between each pair of latent variables does not contain the value 1. The variables are not perfectly correlated, so they each represent a distinct concept.

Results

The authors now look at the main results. They first analyze the four dimensions defining the quality of the teaching innovation in entrepreneurship, using the questionnaire described and validated previously. They then evaluate the predisposition to engage in entrepreneurship among the students participating in the project in comparison to the population in general according to data from GEM.

Implementation of project

The results in Table III show that the students thought highly about the aspects relating to the implementation of the project. More than 90% select the most favorable responses (agree or strongly agree) in the case of items I1 (The professor informed us at the beginning of the course how the project was going to proceed) and I3 (The professor resolved any doubts we had during the project clearly and quickly). The students are less positive about item I2 (The initially established deadlines for the project were met): 27% opt for the least favorable responses (strongly disagree or disagree). Looking at the results by degree, these students are studying the courses MA and BAOP, their work teams have the most members and they provide the most questionnaires (see Table II).

With regard to this latter item, the authors should note that the limitations due to the time available and the number of participating students were an enormous obstacle to the organization of the work groups, so that in some cases (MA and BAOP) the professors had to establish big groups (average of 16 students per group). This led to

some loss of control on the part of the professors and a reduced capacity of interaction or feedback between professors and students and between students.

Table III. Evaluation of Implementation of project (%)

Implementation of project	Strongly disagree	Disagree	Neither disagree/nor agree	Agree	Strongly agree
I1. The professor informed us at the beginning of the course how the project was going to proceed (objectives, content, methodology, evaluation, duration...)	-	2.4	2.4	50.4	44.8
I2. The initially established deadlines for the project were met	5.6	21.8	12.1	41.9	18.5
I3. The professor resolved any doubts we had during the project clearly and quickly	-	3.2	6.4	40.8	49.6

Results of learning

Table IV shows the proportion of students selecting each of the five options in the questionnaire from strongly disagree to strongly agree. In general, the students participating in the project have a very positive opinion about the results of their learning. This is particularly the case in the aspects to do with understanding of contents (I4), knowledge of the business environment (I5), and application of learning to solving real business problems (I6). At the same time, with regard to the promotion of entrepreneurial spirit (I7), 44% of the students manifest a clear predisposition toward entrepreneurship in the future, with 28.8% and 15.2% responding agree and strongly agree, respectively.

In contrast, it is striking to see that 23.8% of the students have a very unfavorable opinion about the interdisciplinary nature of the project (item I8: This project has enabled cooperation with students from other degrees, which has given me a new perspective in the solving of real problems). The large group sizes and the separation between education centers (the students participating in the project came from two different university campuses) put enormous difficulties in the way of the normal development of the work. The authors consider that they are the main reasons for this result.

Table IV. Evaluation of Results of learning (%)

Results of learning	Strongly disagree	Disagree	Neither disagree/ nor agree	Agree	Strongly agree
I4. Participating in the project has helped improve my understanding of the contents of this course	0.8	3.2	9.6	55.2	31.2
I5. After participating in this project I now understand the business environment better	0.8	3.2	12.0	56.0	28.0
I6. Participating in this project has allowed me to apply what I have learnt in this course to the business reality, orienting my knowledge to the solution of real problems	-	4.8	20.0	51.2	24.0
I7. After participating in this project I am more likely to start a business at some time in the future	5.6	12.8	37.6	28.8	15.2
I8. This project has enabled cooperation with students from other degrees, which has given me a new perspective in the solving of real problems	23.8	12.7	24.6	30.2	8.7

Fundamental elements of innovative methodology

This dimension consists of aspects to do with: the organization and methodology of the work; the team work; the teaching materials; the use of ICT; and the evaluation of the learning. In general, the respondents have a very favorable opinion about the elements of the innovative methodology. Table V shows that nearly 80% respond agree or strongly agree in all but two cases. The respondents have a slightly less favorable opinion about item I14 (The material recommended helped us carry out the work and was easily accessible).

Table V. Evaluation of Fundamental elements of innovative methodology (%)

Fundamental elements of innovative methodology	Strongly disagree	Disagree	Neither disagree/ nor agree	Agree	Strongly agree
I9. The structure of the project was clear, logical and organized	0.8	6.4	14.4	61.6	16.8
I10. The professor gave a clear explanation of the concepts involved in the development of	-	6.5	13	56.9	23.6

the project					
I11. Working on the project has provided us with motivation and interest in the course	1.6	2.5	13.1	64.8	18
I12. The teamwork with classmates from my degree was fruitful and stimulating	1.6	5.6	12.9	44.4	35.5
I13. The teamwork with classmates from other degrees was fruitful and stimulating	32.8	19.7	30.3	13.9	3.3
I14. The material recommended (bibliography, documentation, transparencies, etc.) helped us carry out the work and was easily accessible	1.6	8.0	24.0	52.0	14.4
I15. The virtual classroom and the information and communication technologies were adequate and useful in doing the work	0.8	2.4	9.6	52.8	34.4
I16. I think the evaluation criteria and the weight of the project in the total grade for the course are about right	1.6	8.9	12.2	53.7	23.6

In addition, 32.8% of the students have a very unfavorable opinion about item I13 (The teamwork with classmates from other degrees was fruitful and stimulating). Looking at this result, a connection exists with that of item I8 (This project has enabled cooperation with students from other degrees, which has given me a new perspective in the solving of real problems). These two results point to potential improvements to the project in future years.

Degree of satisfaction

The students participating in the project are very satisfied with the development of the business plan (I17), the support of the professor (I18), and the utility of the knowledge acquired (I19). This in spite of the fact that the majority consider that carrying out the project meant that the course demanded more effort than the rest of the courses (I20). Table VI shows the main results for the degree of satisfaction.

Table VI. Evaluation of Degree of satisfaction (%)

Degree of satisfaction	Strongly disagree	Disagree	Neither disagree/nor agree	Agree	Strongly agree
I17. In general, I am satisfied with how the practical work went	-	3.2	11.2	61.6	24
I18. In general, I am satisfied with the professor's support of the practical work	0.8	2.4	4	56.5	36.3
I19. I think I learnt a lot from doing this work and it will be useful for my education	1.7	1.7	14.9	62.0	19.8
I20. Doing this work meant that this course required more effort than the other courses	2.4	4.8	30.4	33.6	28.8

Aspect to improve

The questionnaire included an open question asking the participants for their opinion about how the project had gone and for their suggestions for improvement. A large majority express a very positive opinion about their participation in this project, mainly because it has provided them with a new perspective on the course, and brought the academic content closer to the professional reality. But at the same time they mention a number of difficulties and offer some suggestions for improvement:

- a) Interaction between group members. The students stress that the excessive group size made the teamwork more difficult; some students did not get particularly involved because they did not consider the course to be fundamental; different learning rhythms in the four courses involved; incompatibility of class times between group members based in centers on different university campuses.
- b) Duration of project. The students argue that they had barely enough time to do the work considering the objectives.
- c) Weight of project. Students stress the need to increase the weight of the project in the total grade for the course, given its importance.

Participants' attitudes toward entrepreneurship after finishing project

The authors evaluated the students' attitude and pre-disposition toward entrepreneurship and compared the results with data from the Annual Report of the GEM on entrepreneurial activity in Spain in 2009 (De la Vega et al., 2009). They considered two fundamental dimensions: the entrepreneurial activity and dynamic; and the motivation and capacity to engage in entrepreneurial activity.

According to De la Vega et al. (2009), 5.7% of the Spanish adult population is considering starting a new business in the next three years, compared to 24% of the university students participating in this project. In addition, 5.1% of the Spanish active population have started or tried to start a new business in the past 3.5 years, compared to 9% of the students in this study. Consequently, the intention and the attitude toward entrepreneurship is significantly superior among the university students participating in this study than in the active Spanish population in general.

On the other hand, 51% of the Spanish adult population say that they have the knowledge, skills and experience necessary to start a new business venture, compared to 50% of the students. But almost 17% of the general population perceive opportunities to start a business, compared to only 6% of the students.

Conclusions

The current work has described the methodology and the main results of a project to test an innovative methodology for teaching entrepreneurship. The methodology involves the elaboration of business plans by multidisciplinary teams of students studying for scientific-technical or business management degrees at the University of La Laguna (Spain).

The authors can conclude from the results that the interdisciplinary elaboration of business plans is an excellent pedagogical tool in economics/business and scientific-technical degrees in response to some of the challenges higher education is currently facing in the international context in general and in Europe in particular. The authors would stress the potential of such projects to promote entrepreneurial spirit among students—a key element in the University's progress toward fulfilling its “third mission” on top of its traditional teaching and research roles. In this respect, after participating in the project the students manifest a greater long-term intention to start a business than the general Spanish population.

At the same time, the methodology described seems to be offering the students learning closer to the real world, a closer contact with the business reality, and a greater involvement in the solution of real problems.

To exploit the potential of this interdisciplinary approach it is essential to give the students the most individualized attention possible. The size of each group and the

number of groups that the professors must coordinate are key variables. The process of forming the interdisciplinary work teams must be done carefully, and the students of the different degrees must be offered efficient tools, spaces and methods of contact, coordination and communication. Otherwise much of the potential of the interdisciplinary work process may be lost.

It would be very interesting to deepen the analysis of the impacts among the students of entrepreneurship teaching methodologies via the creation of interdisciplinary teams, like the one described in the current work, and compare them with more classical teaching methodologies.

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The study of the relation between Total quality management and service quality improvement leading to an optimal model presentation

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Introduction

Quality is one of the most expected by customer's aspect of almost all service products. High and unique quality is a way to win customers and make them loyal for a long time. Management literature proposes many concepts and approaches concerning how to deal with service quality. There are also many different concepts how the notion “service quality” should be understood (Urban, 2009). The perception of service quality has been extensively studied during the past three decades. Owing to the intangible, heterogeneous and inseparable nature of services, service quality has been defined as “the consumer’s judgment about a product’s overall excellence or superiority, or “the consumer’s overall impression of the relative inferiority/superiority of the organization and its services’. Many models have been developed to measure customer perceptions of service quality (Martinez & Martinez, 2010).

The general philosophy and attitude which is based on marketing principles in insurance industry are "since no one buys the products, rather they should be sold". Therefore insurance organizations by using appropriate measures such as ideal service, quality and policies of encouragement should motivate the public to buy the products. But today this problem in order to put forward the private sector contribution in Iran's insurance industry is serious and is becoming increasingly more serious. So it is easy to understand that one of the successful factors in insurance companies is the use of management theories especially total quality management because the main centre of total quality management is attending to customers needs and continual improvement of all products, services and processes. The great problem, however, in performing total

quality management is that this kind of attitude in every organization according to its goals and conditions would face with its difficulties and it wouldn't be performed as a framework in any organization. Hence, the present study will investigate TQM approach with emphasis on these five principles in insurance industry so that it recognizes how the performance of TQM principles can affect on service quality improvement and what is an optimal model of service quality improvement in Iran's Insurance Industry?

Literature review

The Emergence & Concept TQM

Global competition and economic liberalization are creating opportunities for organizations. They use “quality” to compete with other organizations to improve their market share. TQM is one of the important quality improvement techniques, which many firms are using to achieve success. TQM has been widely implemented throughout the world across different industries and sectors. The implementation of TQM has given them positive results (Bhat and Rajashekhar, 2009). TQM has been described as a new way of thinking about the management of organizations, a comprehensive way to improve total organizational performance and quality, an alternative to “management by control” and ultimately, as a paradigm shift. (Fotopoulos and Psomas, 2010). Although originally applied to manufacturing operations, but In the late 1980s, corporations such as American Express finally began abstracting and applying TQM to the service sector. (Kumar et al, 2011)

The purpose of TQM is to provide a quality product or service to customers, which will, in turn increase productivity as well as customer satisfaction and decrease the cost With a higher quality product/service and lower price, competitive position and customer satisfaction in the marketplace will be enhanced. TQM is a way of managing the industries to improve product as well as service quality and the overall efficiency of production and other operations (Kumar et al, 2011). TQM is a management philosophy that is based on a set of theoretical principles that seek to mobilize organizational resources to increase stakeholders’ satisfaction. (Das et al, 2011) and that is a compilation of various processes, systems, committed people, transparent communication and culture for customer satisfaction. (Kumar et al, 2011)

Service quality concept

The emergence of quality as a top priority in many corporate entities is primarily due to the globalization of world trade and the competitive pressure brought about by the escalating demands of consumers, who want better products and services. According to Feigenbaum (1999), the key is transforming quality from the past emphasis upon the reduction of things gone wrong for the customer, to emphasize upon the increase in things gone right for the customer, with the consequent improvement in sales and revenue growth. Creating better planning, better external and internal focus, better design, strengthening weak processes and protecting strong areas, which give organizations an edge over their competitors, is being achieved through total quality management (TQM). It ensures that the voice of the customer is always matched by the voice of the processes (Fotopoulos and Psomas, 2010). Since the service quality is very important in surviving and profit making of an organization, it affects in customer's satisfaction and motivation after shopping positively and customer's satisfaction also affects in tendency toward shopping positively. (kuo et al. 2009). Quality has been generally defined as “fitness for use” and “those product features which meet customer needs and thereby provide customer satisfaction” These basic definitions are commonly accepted and can also be applied in service management.(Juga et al, 2010). Service quality can have many different meanings in different contexts. For example, Bitner and Hubbert (1994) defined service quality as “the consumer’s overall impression of the relative inferiority or superiority of the organization and its services”. Parasuraman, Zeithaml, and Berry (1985) defined perceived service quality as “a global judgment, or attitude relating to the superiority of a service” and noted that the judgment on service quality is a reflection of the degree and direction of discrepancy between consumers’ perceptions and expectations.(Rajasekhar et al, 2009)

Service quality has been conceptualized as an overall assessment of service by the customers. It is a key decision criterion in service evaluation by the customers. Perceived service quality is believed to be resulting from comparison between customers’ prior expectations about the service and their perceptions after actual experience. Besides service outcomes, service quality perceptions also involve evaluation of the service delivery process. Hence, conceptualization of service quality ought to include both the process as well as the service outcomes. A firm’s ability to serve the customer needs as well as to maintain its competitive advantage also affects the customer perception of service quality (Ganguli and Roy, 2010).

SERVQUAL Model

The conceptualization and measurement of service quality has been dominated by the use of the expectancy-disconfirmation paradigm and the related service quality model and SERVQUAL instrument. According to this model, service quality is based on a comparison of customer's expectations with perceptions of the service actually received. (Juga et al, 2010). The authors developed SERVQUAL, a five-dimension scale which represent Tangibles, Reliability, Responsiveness, Assurance, and Empathy (see Table I). This framework and scale have been widely used in various industry segments (Zeithaml et al., 2006).

Zeithaml, Parasuraman, and Berry (1990) emphasized four basic characteristics of services: intangibility, perishability, heterogeneity, and simultaneity. More specifically, intangibility suggests that services are performances only experienced by the customer. Perishability indicates that a service cannot be produced and stored for future use. Heterogeneity reflects that the performance of the producer and customer's perception are often different from producer to producer, customer to customer, and from day to day. Thus, services are inherently variable and lack consistency. Lastly, simultaneity means the production of the services occur at the same time as consumption. Thus, a customer cannot judge the quality of the product Prior to using it. (Lee et al,2010)

Table I. Five dimensions of service quality

Dimension	Explanation
Tangibles personnel	Physical facilities, equipment, and appearance of
Reliability	Ability to perform the promised service dependably and accurately
Responsiveness	Willingness to help customers and provide prompt service.
Assurance ability to inspire	Knowledge and courtesy of employees and their trust and confidence
Empathy customers	Caring, individualized attention the firm provides its

Note. From Parasuraman et al. (1988): p. 23.

However, Cronin and Taylor (1992) criticized SERVQUAL and proposed an alternative scale called SERVPERF. It includes all the SERVQUAL scale dimensions, but uses

only service performance (perception) as a measure of customer perceived service quality instead of the gap (between expectation and perception) approach of SERVQUAL(Wong et al, 2010).

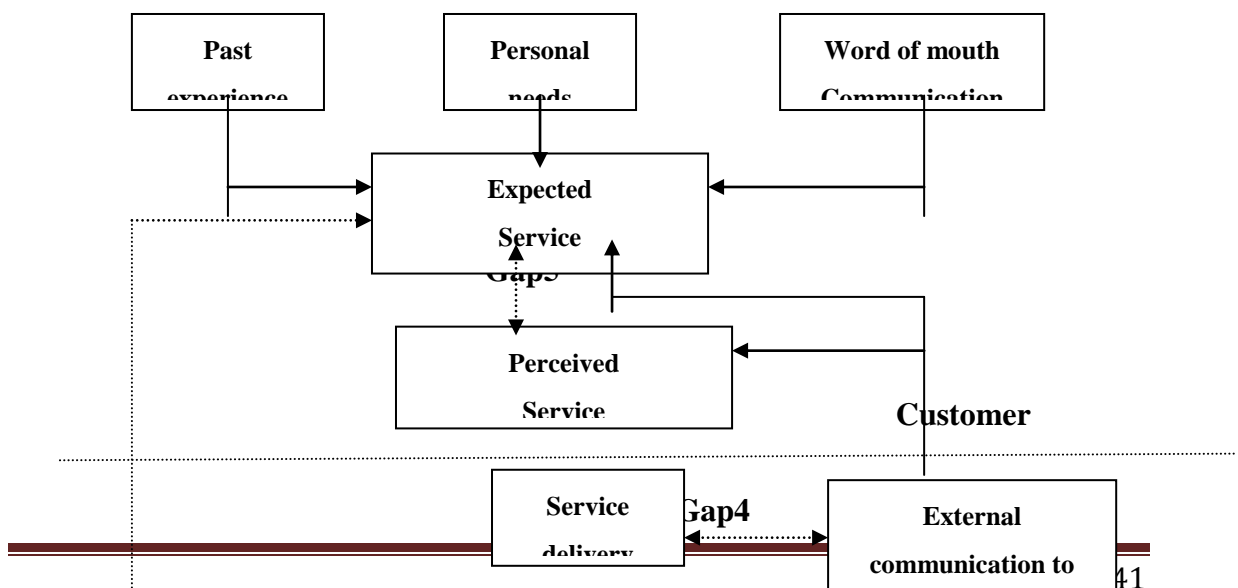
Service Quality Gap Model

Among many concepts of service quality, the service quality gaps model plays an unquestionably significant role in the service management literature. Gaps approach proposes precious propositions on how the notion “service quality” might be understood and how the service quality emerges across a service organization. (Urban, 2009)

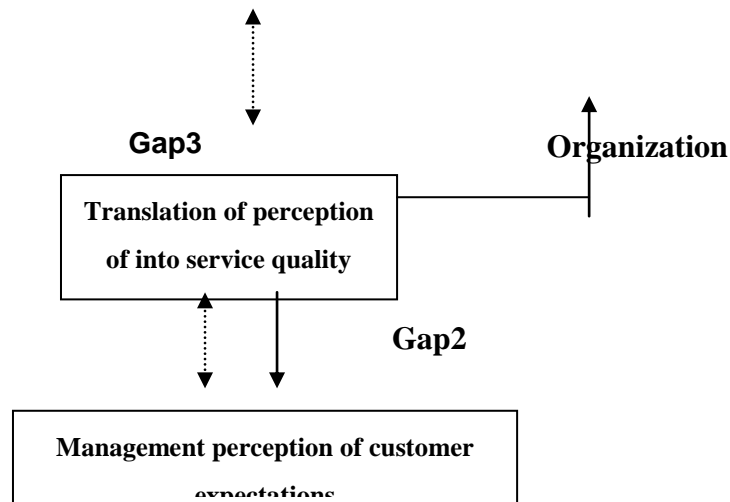
Parasuraman et al. (1985) thinks that the cognition level of service quality is evaluated by The difference between pre-sell service expectation and after-sell service perceptions. Therefore, the bank, credit card, security agent and product maintenance, etc industries were processed using exploration study to further establish service quality model. The model is mainly to explain the reason that the service quality of the service industry cannot meet the customer demands, and considers that in order to meet the customer demands, it is necessary to break through the five service quality gaps in the model. These five gaps respectively are:(Figure 1).

- (1) The difference between customer expectation and manager cognition.
- (2) The difference between manager cognition and service quality standard.
- (3) The difference between service quality standard and provided service.
- (4) The difference between provided service and external communication.
- (5) The difference between customer cognition service and expected service.

Figure1: Model of service quality gaps



Gap1



Parasuraman et al. (1985) thinks that Gap 5 is the function of Gap 1 to Gap 4, which is $Gap\ 5 = f(Gap\ 1, Gap\ 2, Gap\ 3, Gap\ 4)$, among which Gap 1, Gap 2, Gap 3, and Gap 4 are from the service provider, which originated from the internal organization, and Gap 5 is decided by the customer, which originated from the difference between customer expectation and actual perceptions. In order to satisfy the customer, the difference of Gap 5 needs to be shortened, therefore, directly considering the customer expected service standard and actual perceptions service standard will be allow the evaluation of the overall service quality result, which is the value of Gap 5.(YuanHu et al ,2010).

Parasuraman et al (1988) used ten service dimensions as the foundation to develop 97 questions and adopted the concept of service quality is originated from the difference between customer expected service and cognition service, which is $Q(\text{service quality}) = P(\text{Perceptions}) - E(\text{Expectations})$, to process questionnaire investigation and analysis, using the factor analysis method to find the service quality scale with good reliability and validity. This scale is formed using five dimensions and 22 service quality questions. The scale is called "SERVQUAL", and the five dimensions of the scale respectively are Tangibles, Reliability, Responsiveness, Assurance and Empathy.(YuanHu et al, 2010).

Research hypothesis and aims

The aim of the present study is to determine the status quo of service quality and a survey of total quality management's implementation focusing on five main principles such as customer's satisfaction, sustainable improvement, staff cooperation, attention to task processes and systematic viewpoint in insurance companies. That is to present an ideal model finally and determine the effective way of TQM principles on service

quality improvement. Therefore in this regard there are two main research hypotheses. In the first hypothesis there is significant relation between the principles of total quality management and the components of service quality gaps. In the second hypothesis there is a significant relation between the principles of total quality management and the components of Servqual model.

Research Methodology

The research method was applied and Survey –Correlation and The statistic population includes the all managers, staff and customers of Iran's three insurance companies of Alborz, Iran and Dana. By using Morgan table the sample volume for managers is 203, employees 312 and customers 385 people that has been selected by simple random and clustering sampling. The data collected tools are six questionnaires related with the five fold gaps of service quality and TQM principles whose validity by content method and reliability by Cronbach method have been confirmed and for the first through fifth gaps are respectively 0.877, 0.758, 0.944, 0.878 and (two questionnaires 0.916 and 0.959) also TQM principles questionnaire 0.988. In order to analyze the data, there have been used Spearman correlation, Wilcoxon tests, Mann-Whitney assessment and ANOVA methods.

Research Findings

The condition of service quality determines on the basis of service gap model by considering the fifth gap that is the difference between customers' expectations and believes from received services. This gap is the result of the first four fold gaps. The fifth gaps' measurement is done on the basis of Servqual model. The results of Servqual model show that the range of customers' satisfaction from the presented service quality is %52.2. By considering the range of customers satisfaction %90.44 and the range of their understanding from service quality %52.2, there is a gap of %38.24. Furthermore in order to measure the service quality condition, there is a survey the service five fold gaps in which the received results are shown in Table II.

Table II. The rate of service quality gaps

Gap5	Gap4	Gap3	Gap2	Gap1
-1.6	-0.2	-2.5	2.7	-2.5

As you see in Table II, there are gaps in all five status so that the rate of the gaps is all negative and the rate of the second gap is only positive because insurance industry managers have misconception about customers' expectations. The service quality characteristics in second gap have been based on such a misconception. Therefore although the gap extent is a positive number, it accounts for misconception of customers' expectations by insurance companies' managers and this leads to the practical standards selection to offer services. This subject approves the effect of the rate in second gap in low service quality.

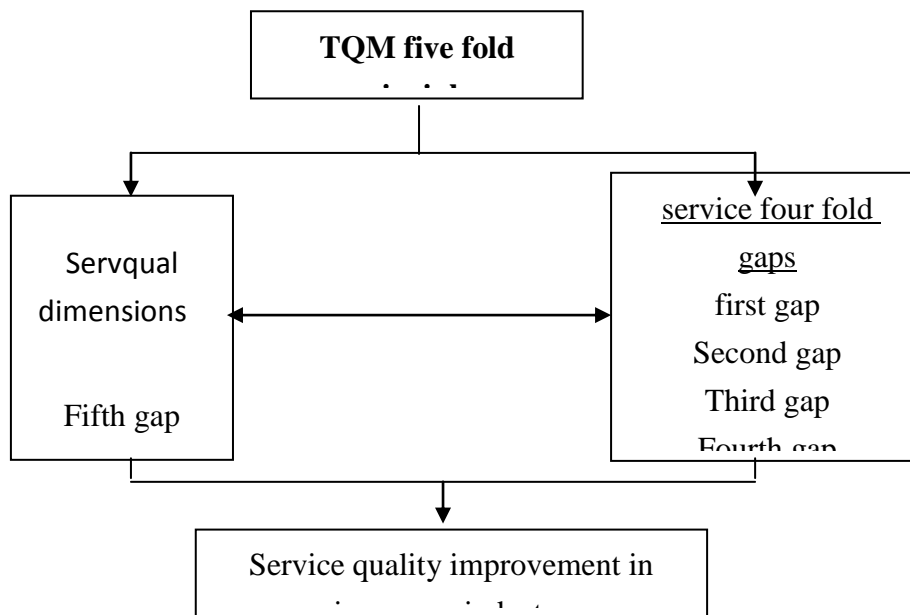
In order to survey the first hypothesis, first of all by considering the method components of service quality gap and TQM principles, the relation between the components of each principles of total quality management has been surveyed in order to separate and make fit the components with each five fold principles of total quality management. Hence through content and conceptual study and survey of theoretical discussion about TQM principles and service gaps components, the results shown in Table III .

Table III. The relation between TQM principles & service quality gaps components

TQM Principles	Service Quality Gaps Criteria
1- customers' satisfaction	1-scientific research and studies 2-fitness of occupation & employee 3-fidelity
2- continual improvement	1-control system of management 2-role ambiguity 3-performing control system 4-role contradiction
3- Involvement of people	1-group work 2-horizontal communication 3-bilateral communication
4- process approach	1- duties standardize 2-management levels 3-fitness of occupation & technology
5-systematic approach	1-outstanding management commitment 2-attention to aims 3-understanding feasibility

Now by considering Table II the research theoretical framework about the first hypothesis is that since the service quality gaps exist in insurance industry, TQM five fold principles should be used to leave out these gaps and improve the service quality at the end. That is if five fold principles of total quality management perform in Iran's insurance industry, it leads to leave out the service gaps which are shown in Figure 2.

Figure 2. How TQM five fold principles affect on service quality improvement



Therefore, there is a reverse relation between total quality management and service quality four fold gaps consequently. The gap of service quality lower by using and performing total quality management principles and that is the reason of reverse meaningful relation between TQM principles and service quality gaps. The results of Spearman assessment show that there are reverse relation between customers' satisfaction, sustainable improvement, staff cooperation, attention to task processes systematic viewpoint principles and related components of service gaps with quotients of -0.745, -0.833, -0.747, -0.790, -0.895 respectively. And Wilcoxon assessment results also approve the research first hypothesis. That is there is a meaningful reverse relation between TQM principles and service quality gaps which the service quality gaps decrease by performing TQM principle.

But, the theoretical framework in representing the second hypothesis is that since the condition of service quality according to Servqual model in insurance industry is low in order to improve it there should be a struggle in leaving out the fifth gap. Hence there is a belief that by applying total quality management principles and Servqual components by improvement in Servqual components this gap leaves out and a direct relation between TQM principles and Servqual components takes place. In order to survey this hypothesis, there is a survey of the rate and kind of correlation between TQM principles and Servqual components by using Spearman and Pearson correlation test. The results were 0.825, 0.875, respectively. It means that by performing TQM principles, there is

an improvement in physical dimension, reliability, responsibility, assurance and empathy which leads to lowering the fifth gap.

Table III. Mann-Whitney test results between TQM principles and Servqual scales

	TQM
Mann-Whitney U	9275.500
Wilcoxon W	72821.500
Z	-18.687
Asymp. Sig. (2-tailed)	.000

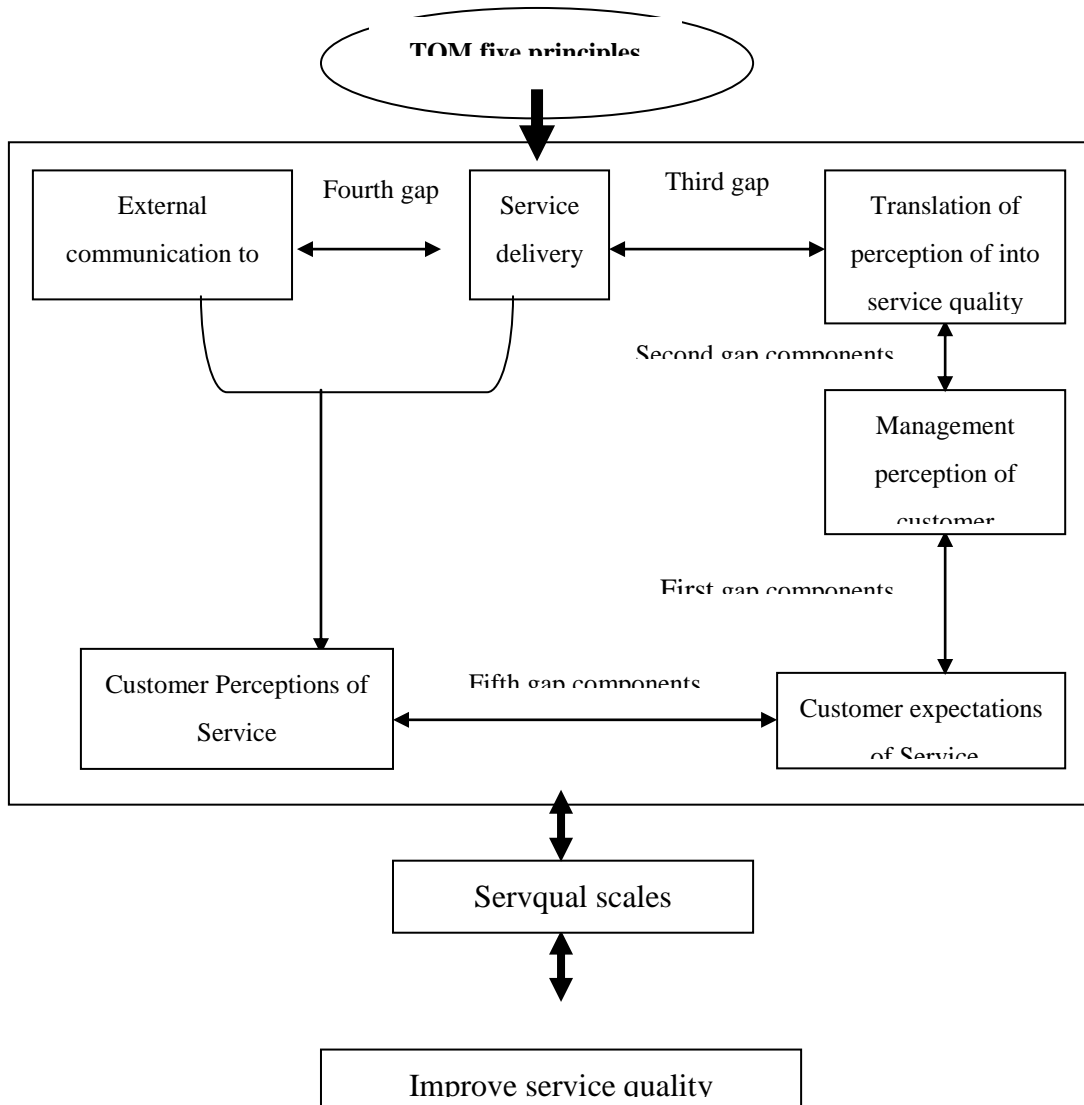
Table V. ANOVA test results between TQM principles and Servqual scales

	Sum of Squares	df	Mean Square	F	Sig.
Between Groups	203984.300	1	203984.300	587.808	.000
Within Groups	231118.970	666	347.025		
Total	435103.269	667			

Also, according to the results derived (Tables III & V) of the Mann-Whitney and ANOVA tests we can conclude that approve the research second hypothesis. Totality by approving the research hypothesis the conclusion is reached that if the service quality according to Servqual model components in an organization decreases, the fifth gap happens, so we should leave out the fifth gap to improve service quality and it is possible by leaving out the quality's four fold gaps. It can be done by applying and performing the five principles of total quality management. It means that by applying TQM principles we can affect on service gaps components in insurance industry and leave out them which affects on Servqual model components indirectly and leads to leaving out the fifth gap and improve the service quality in insurance industry finally. In order to determine the effective rate of total quality management principles, we surveyed the correlation rate of TQM principles and the related components of service quality gaps. The results are in the followings respectively: % 86 systematic approaches, %85 continual improvement, %80 processes approaches, %78 customers' satisfaction, %76 Involvement of people. It shows that systematic and staff cooperation have the most and the least effect on service quality respectively.

lastly considering what we went before we illustrate the proposed model in figure3, According to the proposed model, in order to improve the service quality we can affect the components of quality four fold gaps by implementation TQM five principles and emphasis on characteristics and tools which apply in total quality management separately and leave out the service quality gaps. Therefore by leaving out four fold gaps, five fold gaps also leaves out and lastly an improvement in service quality.

Figure 3. The suggested mode



Conclusions

The purpose of the current paper is to determine the status quo service quality condition and survey the implementation of total quality management in insurance companies, So that we will have an optimal model and determine the effective way of TQM principles in service quality improvement. The results on the basis of Servqual model shown to determine service quality condition. The rate of customers' satisfaction by receiving services are %52.2, and according to the rate of customers expectations (%90.44) and the rate of their perceptions of service quality (%52.2), it shows the gap of %38.24. Also the five fold were recognized according to service gap method. The results derived

from hypothesis tests by using Spearman test show that there is a reverse relation between customers' satisfaction, continual improvement, Involvement of people, processes approach, systematic approach principles and components related to service gaps with quotients -0.748, -0.833, -0.747, -0.790, -0.895 respectively. The results of Wilcoxon test also approved research first hypothesis. It means that there is a meaningful reverse relation between service quality gaps and TQM principles. It represents that the service quality gaps decrease by performing TQM principles and there is an improvement in service quality finally. Furthermore these principles of systematic approach, continual improvement, processes approach, customers' satisfaction and Involvement of people with quotients of %86, %85, %80, %78 and %76 respectively affect in lowering the quality's five fold gaps. The research second hypothesis was approved by using Spearman, Pearson correlation test and with quotients %825 and %878 respectively. It means that the implementation principles of total quality management in insurance industry will strengthen and improve Servqual model scales as well as service quality improvement. Therefore, we can conclude that by applying five principles of total quality management, the components based on service gap method make four and finally five gaps and then were left out. They improve service quality under positive and direct effects on Servqual scales. And according to the findings at the end the proposed model was planned.

By considering the research results and suggested model there are recommended in the followings:

1-Insurance companies' managers should collect and process defined criteria and components of service quality firstly as indices of organization performance quality management. Secondly they should run advanced learning levels for introduction, importance and effects of total quality management approach to improve the service quality. Because performing a successful TQM, calls for an outstanding management commitment.

2-Managers in performing these principles simultaneously and the rate of TQM principles on service quality emphasize their order and effectiveness priority.

3-It could be possible to prepare healthy and constructive competition ground in insurance industry by using various promotion ways such as introducing a top service quality company after selecting service quality standards in order to apply total quality management in insurance companies.

4-It should be noticed when performing total quality management is effective that it leads to a change in an organization's culture. Since it makes time and there is also staff stability against changes, therefore building it up take patience and immediate result is not reasonable.

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Coping with service development in a forced relationship context

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Introduction

The complex needs of today's markets and societies frequently require service solutions that reach far beyond a single organizations' inherent capacity, and sometimes even beyond its control. The nature of value-creation, as defined and perceived by the customer in-context, does not necessarily follow organizational boundaries (Vargo and Lusch, 2004; 2008a; 2008). Working together within organizational networks provides one popular way of facing the challenge of providing these boundary-spanning services. Working together with external actors has according to last decade's research become an important part of a company's success and possibilities to compete and create growth (e.g. Kogut, 1991; Ahuja, 2000; Rothaermel and Boeker, 2008). In a traditional business-to-business setting, the development of a network could be seen as an investment process in which the parties freely select their counterpart and gradually develop trust and commit resources to each other, in order to receive benefits in the future (Ford *et al.*, 1996; Turnbull *et al.*, 1996). The relationships and the cooperation between the actors in the network will continue to exist only if the parties involved yield returns that exceed the costs of the relationship. If not, the relationship is dissolved or at least transformed in the long-term (Dwyer *et al.*, 1987). In order to create value for the parties involved and create a foundation for long-term business success, developing and/or improving the offering under deliverance is one important ingredients in virtually all organisations (deBrentani, 1989; Cooper, 1996; Johne and Storey, 1998; Cooper and Edgett, 1999; Menor *et al.*, 2002; Smith *et al.*, 2007). The willingness to develop the customer offering is in most cases driven by commercial incentives, since it is important to satisfy the customers' needs and wants in order to increase the organizations earnings in the long run.

In other contexts the partners does sometimes not have commercial incentive or by other means feels obligated to show commitment by engaging in different forms of development tasks or projects. This is for example the case in the public sector where the selection of partners often is accomplished through various forms of public tendering or complete procurement (Swedish Code of Statutes 2007:1091 and 2007:1092). The relationships that are developed under these contextual circumstances could be described as forced or elementary relationships (Laing and Lian, 2005). An elementary relationship is characterized by being a relationship at arm's length, with low trust, a short time-orientation, and with a low degree of socialization, formal communication and substantial unilateral dictation of the content of the relationship. In this elementary relationship context, resulting from public tendering described above,

the operators does sometimes not have these kinds of commercial incentive to develop the offerings agreed on in the contract between the parties, since the contract regulating the roles and obligations between the parties is written in fixed terms without higher earnings for increased sales or improved service offerings. Since the commercial operators often have several comparable contracts with other organizations within their portfolio of contractual relationships, they must prioritize and adjust the resources committed to each relationship in order to optimize the return on their entire portfolio. One consequence of these commercial realities is that the operator seldom appears to be doing anything outside the negotiated contract, leaving the other party with the responsibility for developing and improving the service.

The discussion above describes a situation that is somewhat different from a more traditional commercial setting, since the development of new service offering with a view to increasing the earnings for the involved actors are not necessarily the primary imperative of the organisation in the contractual dyad. This situation creates somewhat specific conditions for why and how the long-term development of the offering under deliverance in the contractual dyad is created and handled. In the recent year there has also been a shift in focus of public tendering or procurements role from to a large extent being a tool to reduce costs and streamline operations, to a situation where the focus of the procurement process besides the cost reduction part also is about how to create basis for long-term business development and how to create value for the parties involved. This shift in focus from cost reduction to value creation has made the procurements a highly strategic question in the involved organizations.

Based on the discussion above, the aim of this paper is to increase the understanding of how the long-term development of the service offering can be reconciled within the context of more competitive based and priced oriented logic induced by a public tendering process or competitive bidding, where you initially do not have a close and co-operative partnering relationship with the one you provide the service offering together with. To do so we have chosen to make use of case studies to exemplify and discuss how long-term service developments are maintained within the frames of a public procurement setting. The three selected cases from the public transport sector shows three different way to handle the restraint resulting from the procurement setting, where you not can anticipate or rely on a partner to develop the service offering together with. The examples will each show three different ways; the market way by regulating with contracts, the hierarchical way by doing it in house and the intermediary form by using a network approach.

Theory – markets, hierarchies and intermediary forms

Market and hierarchy are two of the classical ways to organize coordinated action (Coase 1937; Williamson 1975). The basic idea of procuring parts of the own operation is based on the idea that competition spurs efficiency and development in a way that is difficult to achieve within a traditional organization. The model that the market looks at has an inherent dynamic that organizations through procurement hope to take a part of. An important part of the market concept is the classic so-called "invisible hand" that tends to match the supply with demand so that the right activities are carried out by using the right resources at the right price. What is "right" in the actual case is stated in the formal contract where the object of the transaction and the commitment of each party are stated (Coase, 1937; Callon, 1998).

While the invisible hand in theory is a very efficient way to organize activities, does the market solution in many cases not work as good in practice as it does in theory. Proof of this is the existence of businesses and public organizations where coordination efforts are done within the company with the help of an organizational hierarchy that arose as a result of a market not always functioning optimally. The reasons for this can often be traced to various forms of misinformation that sometimes makes it hard to predefine what is to be achieved and to verify that the actual transaction has been completed as agreed upon (Coase 1937; Williamson 1975). It is difficult to establish a sufficient comprehensive contract, and a problem increases the more complex the actual activity in question is. Expressed in economic terms this proposes that the cost to implement the market transaction will rise as the contract becomes more complicated to design and follow up.

Organizations can simply be seen as a way to solve problems by replacing the invisible hand and the regulations of the contracts with "visible" administration. Within the organization there are set rules on how various activities are to be implemented, who should decide and do what and when it should be done and what benefits should be eliminated. There are set procedures for what happens if someone violates the mutual agreements. All together the activities can be coordinated without having every little detail needed to be clarified and agreed upon in advance. The organization also develops a more fundamental approach and informal rules and procedures on how to act in different situations. Such culture related coordination mechanisms are particularly important when dealing with complex, non-routine situations, situations which are unsuitable for the market or the strategies that the formal organization is based on. According to Williamson, the market and the hierarchy are two separate alternatives for

how to organize coordinated action. Each form is supported by clear contractual agreements (fundamental agreements). Transactions carried out in the market are underpinned by the classic formal formation of contracts, where transactions take place within an arm-length distance and any eventual conflicts are resolved in a formal way. Companies with hierarchical structures are based on consensus and collaboration in which the hierarchy itself manages and resolves conflicts within the organization. These different forms of organizations mean different incentive and control opportunities (Williamson, 1991). Williamson argues “.....*not only do the alternative modes of governance differ in kind, but each generic mode of governance is defined by an internally consistent syndrome of attributes- which is to say that each mode of governance possesses distinctive strengths and weaknesses*” (Williamson, 2002:6)

The reasoning is a variant of the so-called Coase theorem (Coase, 1937) under which it is always possible to find contractual solutions to market exchanges, given the preconditions for a functioning market is satisfied (especially with respect to full information, clear property rights and independent operators). Callon (1998) extends the argument to the cases where these conditions are not met (which they, as also Coase points out, in practice rarely are), and highlights the work and investment that is needed for a contract to be established and a market exchange to come about. Further, the existence of various intermediate forms of transaction solutions have made Williamson describe the market-hierarchy as a continuum, rather than a dichotomy where many transactions are made through various collaborations in a so-called hybrid- or network organizations. Contract management can be seen as one such intermediate form, to control the market and the governance contained in a business (Bryntse, 2000). Contract management is characterized as an interaction between elements of opposite nature. Among other things, combining formal communication with informal cooperation, short term contracts can be combined with long term relationships. The benefits drawn from this can have connecting resource use, changes in norms and technological development. Disadvantages may be related to coordination and specific quality aspects to name a few.

According to representatives of the so-called school of networks, that has its roots partially in the industrial market research (and which is of particular interest to the discussion on how procurement works) are saying that important factors that influence the organizational operations are lost in the simplified classic theory. In a similar manner Adler (2001), criticizes the classic division between market and hierarchy to be ineffective in dealing with transactions of different types and resources, especially the knowledge- intensive ones. According to Zenger and Hesterly (1997, in Adler 2001),

we have an increasing number of transactions that has neither been organized according to the market nor in hierarchies (organizations), instead there is an increase of alternate shapes of organizational structures where we find a mix of market structures in the tools that are available on the markets in hierarchies, and in various control- and monitoring mechanisms within the market. Adler (2001) argues that the focus on the different intermediate forms does not fully resolve or explain the difficulties in completing effective operations. He argues that besides the two forms of market and hierarchy (who build on the price mechanism or authority) and the intermediate of hybrid forms there is also a form that he calls 'community', which is based on the existence of 'trust' between the involved actors (Adler, 2001).

Method

This study uses a case study approach (Yin, 1994) with the aim of increase the understanding of how the ideal of long-term development of a service offering can be reconciled within the context of more competitive based and priced oriented logic induced by a public tendering process or competitive bidding which is the case in the public transport sector. A case study approach was adopted since service development is a fairly new area, in which rich qualitative data from case studies are considered more appropriate for theory building than theory testing (Eisenhardt, 1989; Merriam, 1994; Daymon and Holloway, 2002) The present study is empirically based on three cases from the Swedish public transport sector which each are working very actively to provide transport solutions in accordance with contractual requirements and to develop the public transport services. However, the transport solutions required by each cases were different, because of differences in populations, geography and traffic types. Selection of the three cases was made by means of intentional sampling of information-rich cases (Patton, 1990).

The public transport in Sweden – a short background

The responsibility for regional public transport in Sweden is assumed by the Public Transport Authority (hereafter labelled PTA), which are commissioned by Cities and County Councils to manage the delivery of public transport within their geographical area (SLTF 2002). The PTAs are responsible for developing and delivering public transport and meeting the demands of different groups. The PTAs do not operate services themselves. The actual services are instead produced within a network of interacting actors, each responsible for different parts of what the customer perceives to be "public transport". Operators are selected by means of a public tendering process

pursuant to the Public Procurement Act (Swedish Code of Statutes 2007:1091 and 2007:1092).

Data collection and analysis

To build up the cases we have used two sources of data (i) interviews and (ii) internal and external documents. Interviews were done with executives/managers from each of the three public transport authorities and their operators in Sweden, who had personal experience in and/or knowledge about the development and delivery of public-transport services including the business relationship and the contracting processes. Each of the interviews, which took place at the offices of the respondents, lasted between 30 minutes and 150 minutes. The interviews were all recorded and transcribed verbatim. In some instances, the data recorded in these interviews were supplemented by data from follow-up interviews or clarifying questions by e-mail correspondence. A semi-structured interview guide was used to provide some degree of uniformity to the interviews, while allowing the interviewees to speak as freely as possible. The interviews focused on: (i) service development process (ii) working relationships between PTAs and their operators; and (iii) contractual issues (including the content of the contracts and the contracting process, and evaluation of the content of the contract).

We have also gathered data from three types documents (i) laws and regulations governing the public transport sector in Sweden; (ii) government reports and statements regarding the guidelines and regulations for the sector; and (iii) internal and external documents from the PTAs and the operators as well as information from the Swedish Public Transport Association, which is the trade organisation of the local and regional public transport in Sweden.

Empirical descriptions and findings

In this section the three cases and the findings from the cases are presented. The analysis of the cases indicates that there are three different ways to handle the development of the delivered offering under the restraints of public tendering contractual relationship settings.

Case A – Contract Development

Case A represents a traditional contextual solution in the Public Transport area focusing on a relationship between the Public Transport Authority and operator formed by a public tendering. In this traditional dyad the partners sees themselves as the central actors that should in between them should create the long-term development of the public transport service they are responsible for. In order to create this long term perspective both parties are aware of the need for having a trustful and committed relationship, since they will work together for a long period of time during which they should deliver a service of high quality. Although both the PTA and the operator wished to develop a trusting and cooperative relationship, it was apparent that representatives of the operator were placing more emphasis on the written requirements in the contract. The fact that the operator had adopted this attitude toward the relationship made the PTA play safe and write as much into the contract as possible in order to safeguard a certain level of quality and development. Because of this, it has become important to have a detailed specification of the services being purchased and how these should be provided in order to guarantee the quality of service. A consequence of this is that the relationship is managed to a greater degree through the contract.

Discussion – Case A

The first case above showed a traditional relation based on a public tendering setting, resulting in a market based approach to handling the activities in the relationship. In Case A the contract was used to a high extend to control the counterparty and guaranteeing a certain level of contribution to the exchange in general. The contract used in this relationship could be labeled a transactional contract (Macneil, 1978) in which formal rules and measurability are prioritized issues (see also Sjöstrand 1985; Lindvall, 2001). These kinds of contracts are often written, impersonal in nature, and have a preventive purpose since the sanctions applicable when not fulfilling the contract are clearly stated in them. A transactional contract is also characterized by having a clear start and finish, and by the content of the contract being measurable and quantifiable. By using a regulative style of writing, the contract could be used to control the counterparty to a greater extent and thus the need to trust the other party decreases. Laing and Lian (2005) labels this types of relationships resulting from formal public tendering processes as forced or elementary relationships with arm's length interactions, low trust, a short time-orientation, and a low degree of socialization, high degree of formal communication and unilateral dictation of the content of the relationship. One problem of using formal contracts as the dominant management tool is that they cannot

address all the issues existing or developing during a long-term relationship, since formal contracts, especially explicit ones (Hart and Holmström, 1987), mainly focus on governing the short-term and foreseeable aspects of an exchange. This creates some restrictions concerning the long-term development of the relationship and what is created during this since a strict formal contract that to a high degree governs the interplay between the parties and gives very little room for creative business solutions. In our case described above, these problems were fairly obvious since the operator showed no willingness to contribute to developing the service besides the parts agreed upon in the contract, or if they receive extra payment. In many cases the operators have a number of similar contractual dyads and have to distribute their resources in a way that makes them earn the most money in respect to the resources they invest in the relationship. This resulted in a formalized contractual situation where the tendering organization made sharp demands in the contract to make certain that they receive actions within the area, which only enhance the situation by making the operator even more following the writings in the contracts when they make the bid.

Case B – In-house Development

Instead of working together with operators some of the larger PTA's choose to handle all long-term development within their own organization since they believe this gives a higher degree of control of the long-term process and they also have the control (Owner-right) of what has been developed, which makes it possible to apply on other contractual dyads, i.e. what has been developed in one area could be transferred and used in the relationship with another operator.

One such example is case B that is about the long-term (5–8 years) development and implementation of a new ticketing and information system by a single public transport authority in one large Swedish city. The development process was conducted jointly with a technical consultancy firm that was responsible for developing the hardware and software for the project. At the beginning, the project was run by a project group, but it subsequently involved 8–10 subgroups that became responsible for developing and integrating various aspects of the system. A major challenge was ensuring that the system suited the needs of different groups of operating staff.

Discussion – Case B

One way to handle the coordination problems is to solve these difficulties is to single-handedly take care of the development task. This is done in the second case where the

tendering organization, instead of relying on a market solution, they decided to take care of the development process themselves and use a more hierarchical solution by doing most of the work in-house. Doing the work inside the own organization facilitates the process as the organization controls what is happening. Within the organization there are established rules for how various activities are to be implemented, who should decide and do what and when it should be done. All together the activities can be coordinated without having every little detail clarified and agreed upon in advance. The organization also develops informal rules and procedures on how to act in different situations. Such culture related coordination mechanisms are particularly important when dealing with complex, non-routine situations, like for example service development projects. Organizations can simply be seen as a way to solve problems by replacing the regulations of the contracts with “visible” administration. One problem with in-house solutions is that in today’s society organizations have though difficulties to have sufficient technical competence as well as other resources that are needed within the organizations.

Case C- Networked Development

Instead of doing the development work at one PTA, sometimes a number of PTAs work together to create solutions for the long-term perspective that could be applied to their own business as well as the other actors. Case C illustrates such an example describing a study of the long-term (6–8 years) development of a new ticketing and information system involving collaboration between six Swedish Public Transport Authorities. The collaboration involved: (i) a formal project group of four members with the overall responsibility for the project; (ii) an advisory and board of managers of public transport authorities; (iii) large project groups of approximately 25–30 participants representing different areas of expertise within the Swedish public transport sector; and (iv) smaller workgroups tasked with working on technical solutions to specific problems. In addition, an external technical consultancy firm was also hired to build the actual ticketing system. The ticketing and information system was based on a joint standard created by an industrial organisation for the Swedish public transport sector.

The main reason for working together was, according to the interviewees, mostly practical. The PTAs in themselves are rather small, and they lack the manpower to have expertises for all different parts of an integrated ticket and information system. By working together, the participating actors could combine the existing knowledge that was dispersed between the different PTAs and jointly create the knowledge base required to develop the system. As it was 10-15 years ago since the last time a new

system had been developed, the level of experience was very low among the PTAs. This lack of knowledge is very obvious due to the fact that a new ticketing and information system is nowadays a high-tech-product, requiring specific knowledge vis-à-vis both practical requirements and technological ones. Another reason facilitating the decision to work together was the fact that a number of PTAs had experienced previous cooperation positively.

Discussion – Case C

Working together within organizational networks like in Case C provides one popular way of facing the challenge of providing boundary-spanning services and to help out the problem that the companies have difficulties to have sufficient technical competence as well as other resources that are needed within the organizations to do in-house (hierarchical solutions). The interactive and networked nature of value-creation (Vargo and Lusch, 2004; 2008, 2008a), as defined and perceived by the customer in-context, does not necessarily abide by organizational boundaries. Instead, service is often provided via complex combinations of physical goods, information, and institutions. Service is co-created and value is experienced contextually by various customer groups interacting with these combinations, rather than with individual organizations (cf. Vargo and Lusch, 2008).

Within the framework of these relationship networks there are a set of activities and exchanges done to access the resources needed to create value in an efficient manner. Companies interact and develop relationships with each other in order to exploit and develop their resources for the mutual benefit of each other (Turnbull and Wilson, 1989). This is the kind of value creation, or rather expected value creation that drives the interaction and development of relationships and networks. Different resources such as physical, human, scientific, financial, are combined and transformed through activities into goods and services. Networks of relationships are developed whereby the parties continuously exchange resources and activities (Morgan and Hunt 1994); or, as some recent thinkers would have it, whereby ‘service’ is exchanged for ‘service’ (Vargo and Lusch 2004). The result is a long-term form of governance which transcends the classical market-hierarchy dichotomy (Williamsson, 1975; 1981) and which relies on mutual understanding, commitment, and trust (Morgan and Hunt, 1994).

The Business-to-Business research highlights that a company’s operations cannot be understood in isolation from a context, but the company is in one way or another dependent on various internal and external stakeholders. Business is done in a complex

interaction process between stakeholders, both internal and external (see e.g. Turnbull *et al.*, 1996; Ford *et al.*, 1996) The businesses often have close, complex and long term relationships who are created during intense, changing and complex contract patterns that involve and engage the stakeholders at different levels within each organization (Håkansson and Snethota, 1995; Turnbull *et al.*, 1996).

Conclusions and managerial implications

In this paper we have provided three examples of how long-term service offering could be handled by using different way to organize coordinated action;

The first of the three examples shows the classical market solution, where the contract is used to state by using sharp demands, detailed terms and conditioned in the contract terms and conditions about what and how the offerings should be developed. This puts a lot pressure on the formulating of the contract, and the forming of the contract becomes a vital part of the service development process, done in beforehand of the relationship. Based on this, the formal contract established between the parties play a key role, since it specify, to a great extent, the short-term as well as the long-term obligations and duties of the parties including what types of development that should be undertaken during the contract period. Moreover, all requirements regarding the service have to be stated before the bidding process is initiated, which results in restricted creative and spontaneous service development. These findings suggest that the formulation of the terms of the contract represents an especially important aspect of the service-development process. Indeed, the formulation of the contract could actually be seen as service development in itself, given that the contract provides the guidelines for how the service is to be developed during the coming years. Based on this it is important for managers to recognize that a large proportion of service-development planning is actually undertaken before the contract period begins; indeed, this is often done unilaterally by the purchaser, who decides (without consultation) what service output it wishes to achieve during the contractual period. One conclusion to drawn from this is that it is difficult to establish a sufficient comprehensive contract, and a problem increases the more complex the actual activity in question is. Expressed in economic terms this proposes that the cost to implement the market transaction will rise as the contract becomes more complicated to design and follow up.

The second example shows the hierarchical way by taking care of the development in the own organization. In this case the tendering organization disregards the tendered partner and take care of the long-term development within the own organization. In this

one of the main problems is that in today's society organizations have difficulties to have sufficient technical competence as well as other resources that are needed within the organizations.

The third case shows an example of a mix of market and hierarchical structures - by using network actors outside the dyad delivering the offering to create the long-term aspects and then implement it in the offering. The notions of exchanges, interactions, and relationships provide a rich source for understanding various aspects of inter-organizational cooperation. However, the concepts do not offer much analytical guidance when it comes to what actually happens in the network, i.e. what should actually be done, and by whom. The question of how coordination is achieved between the actors thus remains. One way of remedying this is to elaborate on the systemic nature of inter-organizational networks and to consider what holds them together on a more fundamental level.

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Customer satisfaction to implement benchmarking in the public sector

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Type of paper: Research paper

Introduction

CS ProMod is a standard measure model of the Customer Satisfaction (CS) regarding to public services provided online, offline and in multichannel way. CS ProMod model has the aim to give the administrations, information about the service quality provided to citizens. The model proposes a new conceptual measuring method of the CS based on the connection between the citizen perception and the providing service process also considering the providing service channel (Cappelli et al., 2011). Specifically, the CS ProMod model reflects the recent use - in the public sector – of new methods of proving multichannel service.

Multi-channel service is a way to simplify the service use and to make public administrations more flexible and reachable from the citizen. However, increasing multichannel service can lead to collect fragmented data: this suggests the use of CS collecting and analyzing methods which permit to maintain an overall vision. This is possible only throughout the use of standard measuring tools which allow collecting homogeneous and integrated information (Eipa, 2008). CS ProMod model bases on the connection between the client satisfaction and the providing service process, which integrates the quality of a provided service throughout different channels; this connection is inserted in the submitted survey. The survey contains standard aspects and a personalized dimension, “Capacity of Response”, coming from the determination of satisfaction items directly connected to the back office service process. A part of the survey is dedicated to the dimensions, coherently with the idea that it's not only important to determine the citizen satisfaction but also his consideration about a specific or more aspects, this in order to direct the improving actions in the right way, focusing on those elements which can impact the satisfaction (Cappelli et al., 2010). The logic is that the importance of the citizens perception represents the driver for the priorities

fixation (Martilla, 1977). The model fosters improving actions and an internal benchmarking process, starting from the CS results, first step for developing a less referential action of external benchmarking (Camp, 1989; Zairi, 1995).

Any organization that pursues a continuous improvement has the aim to search in a systematic way, within the company, the performance and its own organization optimization. The risk and the limit of this approach is the self-referentiality that can cause the missing of new improvement opportunities formation. Benchmarking, throughout managerial solution research and methodology coming from external environment, allows to revitalize the continuous improvement process. Companies that implement/adopt benchmarking have consciousness of the applicable improvements at their contest learning by the best practices. Benchmarking can be defined as a improvement systematic process fit for/suitable for determining standard performance, compare themselves with the standard performance and identify the procedures that allow to get/reach the new standard reference. Its definitions and classifications vary according to the time and criteria they focus on. For example, Kulmala (1999) suggests that benchmarking refers basically to the process of evaluating and applying best practices that provides possibilities to improve the quality. According to Bhutta and Huq (1999) benchmarking is first and foremost a tool for improvement, achieved through comparison with other organisations recognised as the best within the area. On the other hand, Ahmed and Rafiq (1998) argue that the central essence of benchmarking is the learning how to improve activities, processes and management. It means “challenge themselves” analyzing their managerial procedures and their relative performance in order to identify strong and weak points. Determining the performance gaps they can also define new target and action plans in order to improve all the organization’s levels.

Recently, it has also extended its scope from large firms to small businesses and public as well as semi-public sectors (Kulmala, 1999). Benchmarking developed in a typical private setting and it is a management tool with the aim to improve the performance and competitive positioning compared to the competitors. Can benchmarking be applied to the public field/sector? The answer is positive though the different purposes respect the private sector; in fact they must be led to the supplied services’ quality and to the performance efficiency in order to improve the society/company. Benchmarking can be adopted/applied both in those companies that are going to introduce for the first time in their organization TQM logic and tools and in those “advanced” administrations that have already introduced them and want improve. This comparison can be made between “advanced” and “less advanced” administrations basing on remarkable performance

indicators, so that the “less advanced” administrations have external reference points as strategic objectives in order to improve their efficacy and efficiency. In the public sector benchmarking can be led through a realization of a network based on a sharing and improvement of the common practices. It’s easier to start a comparison process if there are measurement standard methodologies both in the organization and in the others. It’s really fundamental opening up to those organizations that have the same activity so that the involved companies/organizations could use the same measurement methodologies. The first step to launch an organized benchmarking process is to evaluate if in the internal organization there are some opportunities to learn effective methodologies from their own excellence cases (best practice). The consciousness of their internal strong and weak points allows to the organization to start up a continuous improvement, getting over the self-referentiality and analyzing the external organizations’ behavior that have better performance.

Methodological approach

The aim of this paper is to verify the following research questions:

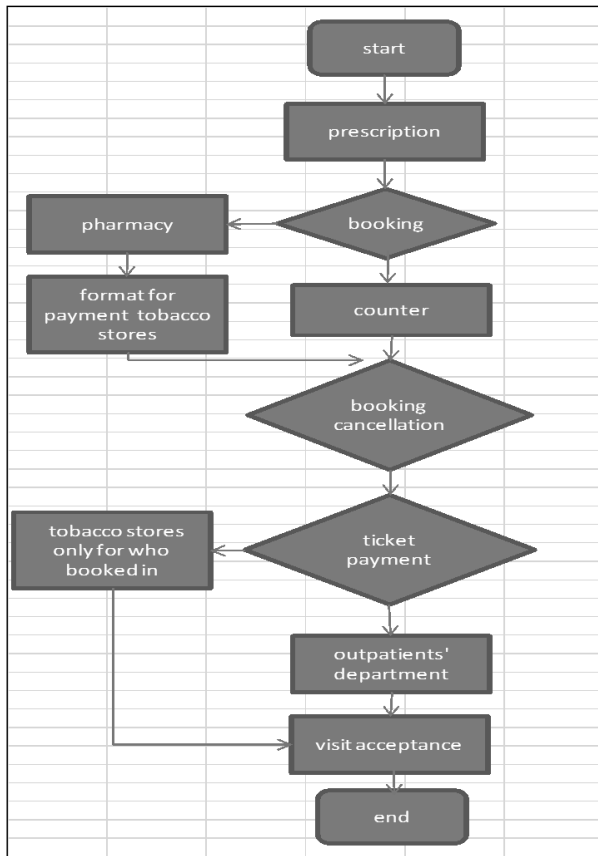
1. Can the CS ProMod model provide cues in order to improve the quality service throughout the determination of characteristics which have a significant impact on the citizen satisfaction?
2. Has the CS ProMod Model the capacity to provide integrated information and to start (up) a benchmarking process?

The research hypotheses are verified throughout the model experimentation in an Health Agency concerning the “Booking health centre” provides by the counter and by pharmacy channels. We highlight that this kind of service is provided in all the Health Agency and that the survey results could be analyzed in the entire nation; however, this research is limited to the study case here mentioned and it doesn’t regard other realities. The survey research verifies the research hypothesis highlighting specificities and common aspects related to multichannel service (Cappelli et al. 2010).

“Booking health benefits centre” is a centralized and computerized system to reserve and to cancel health service and it is usually provided over the counter or by phone. The well-known problem of this service is the rising demand respect the health service supply, with limited available resources, factors which convince the citizen that the long waiting list a great inefficiency.

The Health Agency here analyzed, coherently with the Ministry of Health Guidelines (2009), has started up a new way to book/cancel a health service in order to simplify its access: it enabled the city pharmacies to accept the health service reservations and cancellations and the tobacco stores of the area to receive their payments. This innovative channel guarantees a best territorial expansion of the system and reservation quality, less hardships caused by the distance and drastic reduction of the queue counter and/or by phone. It's important to underline that this survey doesn't analyze the telephone channel but it focuses on counter and pharmacies channels. The aim of the survey is to measure the satisfaction of those citizens who made use of the booking health centre service over the traditional counter and throughout the pharmacies in order to evaluate the users' satisfaction level between the two channels. Specifically, we want to test the impact of the new and innovative service delivery channel (Kano, 1984) on the citizens and to realize if there are significant differences in the satisfaction between the two channels. Within the guidelines for a specific delivery offline service (Cappelli et al. 2010) we have realized two specific questionnaires, one for the counter and the other for the pharmacies, whose structure considers all the transversal and common aspects of the two channels in the service delivery. The questionnaire, within the standard structure of the CS ProMod model, is structured in four sections: one dedicated to the "profiling", a six dimensions set and 20 satisfaction items, a section dedicated to the importance and another to the suggestions. Moreover there were two questions overall, the first one at the beginning of the questionnaire in order to test the citizen instinctive opinion and the other at the end in order to have a reasonable opinion. As indicated in the model, the Likert scale was used with anchor 1-6 (1= totally disagree; 6=totally agree). The stream analyze of the back-office process has allowed to define the customized items to insert in the Response capacity.

Figure 1. Flow chart to determine the items to insert in the Response Capacity



The analyze of the citizen steps to benefit of the service together with the opportunities offered by the Health Agency, has permitted to determine the customized items: particularly, we have determined one common item “Rightness of time to get a medical examination” (CR.3) and two specific items for the pharmacy channel “Advantage of reservation throughout pharmacies” and “Information clarity about the payment at the tobacco’s stores”.

Questionnaires were distributed, throughout a face-to-face interview, at the “Booking health benefits centre” counters (counters 1, 2 and 3) and in 25 pharmacies operating within the health national service. According to the data provided by the Agency and considering a 15 days period, the operation number effected over the counter num. 1 was 97, over the counter num. 2 was 610 and over the counter num. 3 was 1095, total 1802 operation. Regarding to the 25 pharmacies involved in the survey, in the same 15 days period, the operation number was 734 (just one datum). The sampling plan was elaborated considering the specific target of the delivery channels.

In order to determine an appropriate number of interviewees, it must be calculated the sample number basing on some strategic considerations. Generally, do not knowing the value of the proportion in the population, we assume $p = 0.5$. Moreover we suppose that

political-management valuations could lead to fix the maximum acceptable error limit value in the sample calculation equal to 5%. It's moreover necessary to fix the probability that the error doesn't exceed the 5% limit and therefore considering this probability equal to 95% (therefore $1 - \alpha = 0,95$).

The value of the Normal standard distribution in point 2 = 0,025. For this value, the

Normal standard distribution, $\frac{z_{\alpha}}{2}$ takes the value 1,96.

In the "Booking health benefits centre" Pharmacy survey case, it was effected a casual sample on limited population, getting the following sample number:

$$n = \frac{1,96^2 \cdot 734 \cdot 0,5(1-0,5)}{0,05^2(734-1) + 1,96^2 \cdot 0,5(1-0,5)} = 252$$

Regarding to the counter it was instead effected a proportional sample on "not limited population", getting the following sample number:

$$n = \frac{1,96^2 \cdot 0,5(1-0,5)}{0,05^2} = 385$$

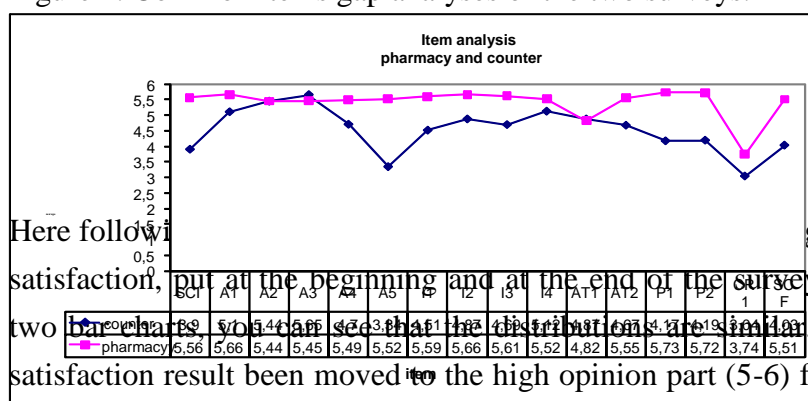
In the "Booking medical visit centre" counter case the suggested sample number limit was exceeded and 484 questionnaires were collected: 26 from counter num. 1, 162 from counter num. 2 and 292 from counter num. 3, in line with the turnout proportion at the three different counters. Concerning the pharmacy, instead, 252 questionnaires were collected. The data collection had place in 2010.

Survey results

The data analysis was effected on three different statistical techniques of different complexity: the descriptive analysis, the multiple regression and the hypothesis test, which permitted to verify the research hypothesis (Cappelli et al. 2010). The sample is distributed in the following way: 35% at the counter are males, 40% are females, 2% didn't answer. The most presented age range in both surveys was between 45-60 years old. It's interesting to notice how the citizen is not sensitized of the reservation cancellation, aspect inserted in the profiling questions: in fact, 97% of the subjects went to the pharmacy to reserve a medical examination and only 3% to cancel it; in the same way, 99% of the interviewees went to the counter to reserve a medical examination and only 1% to cancel it. In order to analyze the data, the opinion scale was unified in three classes: 1-2 negative opinion; 3-4 sufficient opinion; 5-6 positive opinion (Cappelli et al. 2010). Here following the analyses of the medium opinion of the common items presented in both questionnaires, comparing the medium satisfaction for the two

channels (Fig. 2). As shown in the graphic, the pharmacy channel presents a medium opinion quite high (5-6) and homogeneous respect the counter channel which has a not homogeneous course and it sets himself in the intermediate range (3-4). Specifically, the items which present a greatest variance are: the overall beginning satisfaction opinion (SCI) and the last one (SCF); the item “Waiting time rapidity to get to the service” (A.5); the two items related to the “courtesy” (P.1) and staff “professionalism” (P.2). We notice that the item “Rightness of time to get a medical examination” (CR.3) doesn’t present a significant gap, but it will be deeply analyzed because it presents a low peak caused by the satisfaction opinion for both channels.

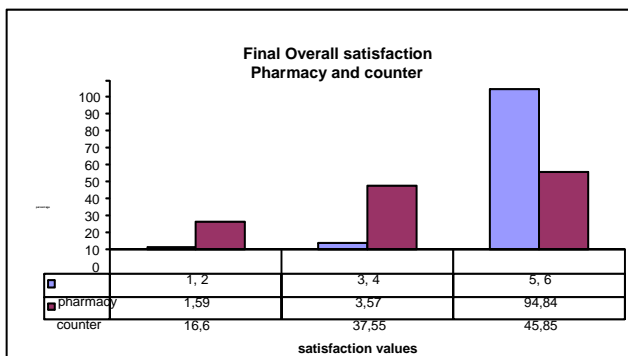
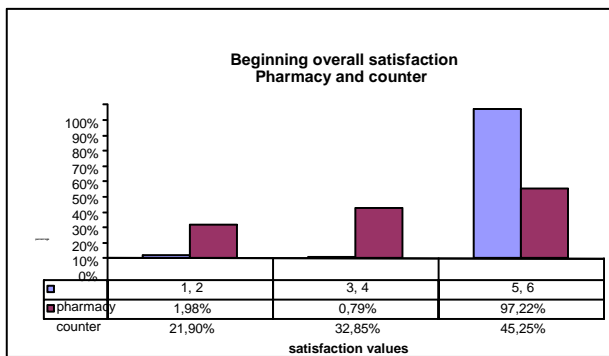
Figure 2. Common items gap analyses of the two surveys.



Here follows the percentage distribution on the total satisfaction, put at the beginning and at the end of the survey (Fig. 3). Comparing the two channels, we can see that the distributions are similar. The values of the initial satisfaction result been moved to the high opinion part (5-6) for the pharmacy, whereas for the counter there is an homogeneous percentage distribution on all the vote ranges, that shows that the citizens, who benefit of the counter service, have a different opinion about the service quality.

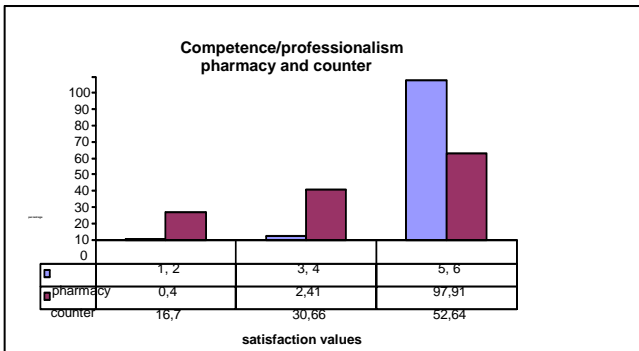
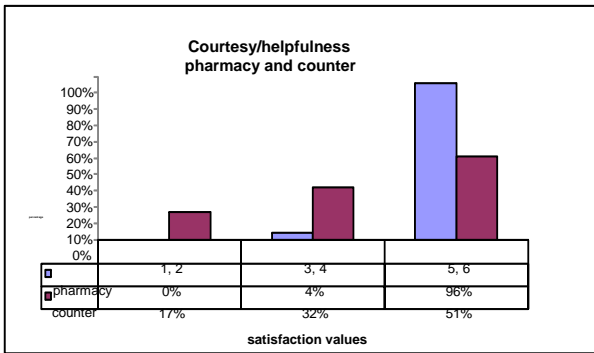
The percentage distribution confirms that the pharmacy users are more satisfied respect the counter’s users. Both regarding the pharmacies and the counter the opinion is essentially unchanged considering the beginning and the final satisfaction.

Figure 3. Beginning and final overall satisfaction analyses on between pharmacy and counter.



Here following the comparison between counter and pharmacies concerning the items regarding to the employees, P.1 and P.2 (Fig. 4). You can point out that in this case there is a quite big difference for both the items in the two surveys. The satisfaction of the employees is greatest for those users who benefit the service in the pharmacy. It can depend to the chemists' approach, that is the most similar to the private one, and therefore they distinguish themselves from the public employees because they are more trained and oriented to the client respect the counter employees.

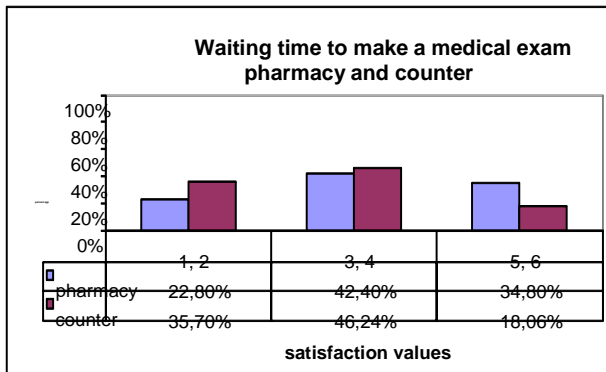
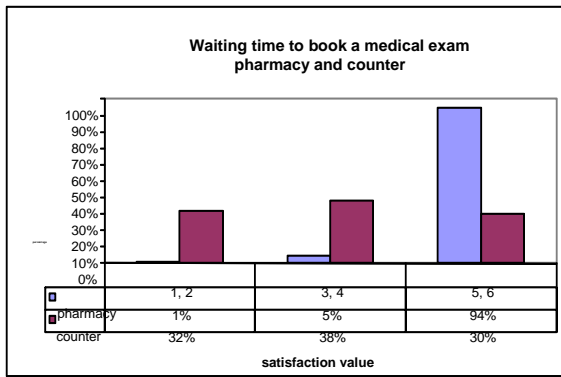
Figure 4. Analysis of the courtesy/helpfulness and competence/professionalism of pharmacy and counter employees



It's also interesting to analyze the items regarding the waiting time: specifically, concerning the time to get to the reservation, it's possible to assert that to reserve throughout the pharmacy is faster than over the counter. Regarding to the CR.3 item "Rightness of time before to get a medical examination", common element to both surveys, you can see a dissatisfaction for both channels with a homogeneous opinion (Fig.5). However, if you pay attention to the highest opinion, it's possible to notice the twice the interviewees for the pharmacy is on 5-6 range.

You can therefore suppose that the citizen, more satisfied by the new pharmacy service of booking, has a less negative perception of the waiting time that elapses between reservation and medical service, even if the time is the same one.

Figure 5. Waiting time analyses to book (a) and make (b) a medical exam for pharmacy and counter



(a)

(b)

Throughout the descriptive analyses is possible to highlight that the CS ProMod model allows noticing the users' satisfaction level and giving comparing information which can support the benchmarking process. This hypothesis can be also analyzed throughout statistical analyses as a hypothesis test on independent sample (Fig. 6), which allows verifying the quality of a hypothesis, watching a specific phenomenon. The hypothesis test was calculated using the *Minitab* software. The *p value* analyses results 0 and therefore less respect the α level, fixed equal to 0,05; therefore, we can refuse the null hypothesis and therefore to assume that the medium of CR.3 is indeed less in the counter survey case. The same result is verified also for the hypothesis regarding the beginning and final overall satisfaction (Fig. 7 and Fig. 8) and also if we consider the courtesy and competence of the employees (Fig. 9 and Fig. 10).

Figure 6. Independent sample hypothesis test on common item to pharmacy and counter "Rightness of waiting time to get a medical examination" (item CR. 3).

H_0 : μ satisfaction "Rightness of time to make a medical examination" counter
= μ satisfaction "Rightness of time to make a medical examination" pharmacy

H_1 : μ satisfaction "Rightness of time to make a medical examination" counter
< μ satisfaction "Rightness of time to make a medical examination" pharmacy

	N	Mean	StDev	SE Mean
CR.3_S	465	3,04	1,53	0,071
CR.3_F	250	3,74	1,56	0,099

Difference = mu (CR.3_S) - mu (CR.3_F)
Estimate for difference: -0,697
95% upper bound for difference: -0,497
T-Test of difference = 0 (vs <): T-Value = -5,75 P-Value = 0,000 DF = 500

Figure 7. Independent sample hypothesis test on common item to pharmacy and counter "Beginning overall satisfaction" (item SCI).

H_0 : μ beginning overall satisfaction counter = μ beginning overall satisfaction pharmacy

H_1 : μ beginning overall satisfaction counter < μ beginning overall satisfaction pharmacy

	N	Mean	StDev	SE Mean
SCI.0_S	484	3,90	1,67	0,076
SCI.0	252	5,560	0,773	0,049

Difference = mu (SCI.0_S) - mu (SCI.0)
Estimate for difference: -1,6566
95% upper bound for difference: -1,5079
T-Test of difference = 0 (vs <): T-Value = -18,34 P-Value = 0,000 DF = 725

Figure 8. Independent sample hypothesis test on common item to pharmacy and counter "Final overall satisfaction" (item SCF).

H_0 : μ final overall satisfaction counter = μ final overall satisfaction pharmacy

H_1 : μ final overall satisfaction counter < μ final overall satisfaction pharmacy

	N	Mean	StDev	SE Mean
SCF.0_S	484	4,03	1,47	0,067
SCF.0	252	5,512	0,728	0,046

Difference = mu (SCF.0_S) - mu (SCF.0)
Estimate for difference: -1,4850
95% upper bound for difference: -1,3517
T-Test of difference = 0 (vs <): T-Value = -18,34 P-Value = 0,000 DF = 732

Figure 9. Independent sample hypothesis test on common item to pharmacy and counter "Courtesy and harmfulness of the employees" (item P.1).

$H_0: \mu$ satisfaction “Courtesy and harmfulness of the employees” counter = satisfaction “Courtesy and harmfulness of the employees” pharmacy

$H_1: \mu$ satisfaction “Courtesy and harmfulness of the employees” counter < satisfaction “Courtesy and harmfulness of the employees” pharmacy

	N	Mean	StDev	SE Mean
P.1_S	482	4,17	1,55	0,070
P.1_F	252	5,734	0,589	0,037

Difference = μ (P.1_S) - μ (P.1_F)
 Estimate for difference: -1,5640
 95% upper bound for difference: -1,4328
 T-Test of difference = 0 (vs <): T-Value = -19,63 P-Value = 0,000 DF = 684

Figure 10. Independent sample hypothesis test on common item to pharmacy and counter “Competence and professionalism of the employees” (item P.2).

$H_0: \mu$ satisfaction “Competence and professionalism of the employees” counter = satisfaction “Competence and professionalism of the employees” pharmacy

$H_1: \mu$ satisfaction “Competence and professionalism of the employees” counter < satisfaction “Competence and professionalism of the employees” pharmacy

	N	Mean	StDev	SE	Mean
P.2_S	473	4,19	1,55	0,071	
P.2_F	249	5,723	0,588	0,037	

Difference = μ (P.2_S) - μ (P.2_F)
 Estimate for difference: -1,5284
 95% upper bound for difference: -1,3961
 T-Test of difference = 0 (vs <): T-Value = -19,03 P-Value = 0,000 DF = 670

Therefore, it is possible to consider satisfied the second research hypothesis concerning the CS ProMod model capacity to provide integrated information and to start up a benchmarking process. Another element to add and which supports the obtained results is the classification of the open questions, which underlines the main criticality of the item CR.3. It’s interesting underline that 398 observations have been collected respect the 484 interviewees (80% ca.) for the counter and a total of 30 observations respect the 252 interviewees (12% ca.) for the pharmacy. In both cases, the most common category is the decrease of the waiting time to get a medical examination, then the second category, for the counter, is “the operators’ number” (it means a decrease of the reservation waiting time) and, for the pharmacy category, is the information clarity to reserve in the tobacco’s stores, item quite critical studying the same percentage distribution. You can assume that the open questions analyses let emerge aspects not considered among the survey’s questions (f.e. counter operators’ number or development of the telephone service).

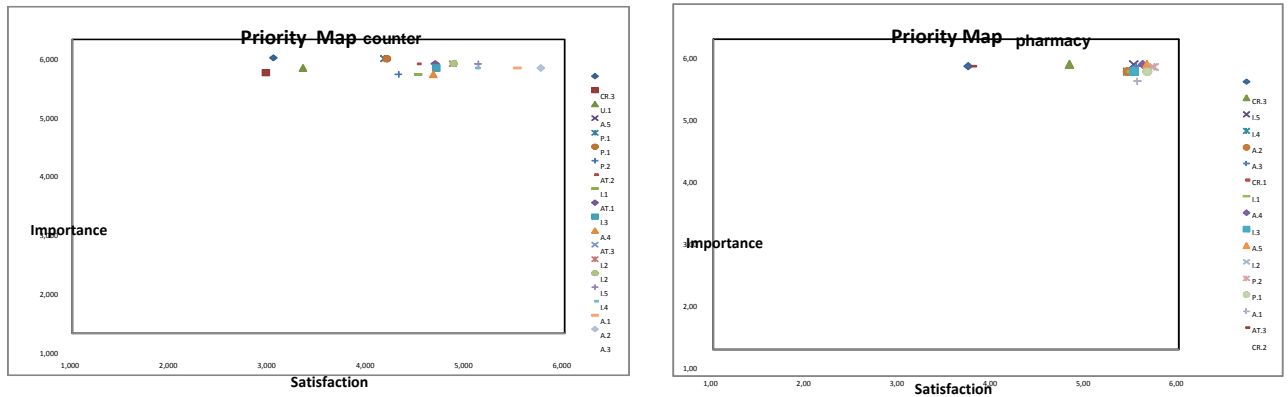
The CS ProMod model provides the elaboration of the connection between the average of the dimension Importance and the average of the Satisfaction item (average I/average S), so as to rank in order of priority the items from a quantitative point of view. A priority item is an item which has a high importance level even having a low satisfaction level. Determining this kind of item allows to the manager to find out the main improving areas, directing the possible actions to the most important - and at the same time the most critical - dimensions (Cappelli et al. 2010). Therefore, also in this case, throughout the calculation of the index I/S (Tab.1) is possible to estimate the priority action for both channels. This analysis confirms that item CR.3 “Rightness of time to get a medical examination” is the most critical item for both the providing channels. Another critical item for the pharmacies is that related to the “Information clarity about the payment at the tobacco’s stores” (CR.2), whereas for the counter is priority the “Facility to make a complaint” (U.1) and to fast the counter reservation time.

Table I. Determination of the priority actions throughout I/S rate.

PHARMACY				COUNTER					
COD	ITEM	Average S	Average I	I/S	COD	ITEM	Average S	Average I	I/S
CR.3	Response capacity– Rightness of time to get a medical examination	3,74	5,57	1,49	CR.3	Response capacity– Rightness of time to get a medical examination	3,04	5,69	1,87
CR.2	Response capacity– Information clarity about the payment at the tobacco's stores	3,78	5,57	1,47	U.1	User contact – It's easy to make a complaint/suggestion	2,96	5,43	1,83
I.5	Tangible aspects- It is easy to identify a pharmacy in which I can book a medical visit	4,82	5,60	1,16	A.5	Accessibility - Rapidity in the waiting time for the booking at the counter	3,34	5,51	1,65
I.4	Adequacy of information- The steps that I must do to book a medical visit in pharmacy is clear	5,52	5,60	1,01	P.1	Personnel- Courtesy/helpfulness of the employees	4,17	5,67	1,36
A.2	Accessibility- It is simple to reach this pharmacy	5,44	5,48	1,01	P.2	Personnel - Competence/professionalism of the employees	4,20	5,67	1,35
A.3	Accessibilit�- This pharmacy has not architectural barrier	5,45	5,48	1,01	AT.2	Tangible aspects- There are sufficient seats to wait	4,32	5,40	1,25
CR.1	Response capacity - To book a visit in pharmacy is more convenient	5,54	5,57	1	I.1	Adequacy of information- It is easy to find the information I am looking for	4,51	5,58	1,24
I.1	Adequacy of information- It is easy to find the information I am looking for	5,59	5,60	1	AT.1	Tangible aspects- The environment is comfortable	4,51	5,40	1,20
A.4	Accessibility- It is easy to identify the employees the provide the service	5,49	5,48	1	I.3	Adequacy of information- The provided information are complete	4,69	5,58	1,19
I.3	Adequacy of information- The provided information are complete	5,61	5,60	1	A.4	Accessibility- It is easy to identify the employees the provide the service	4,70	5,51	1,17
A.5	Accessibility - Rapidity in the waiting time for the booking at the pharmacy	5,52	5,48	0,99	AT.3	Tangible aspects- The environment is functional	4,67	5,40	1,16
I.2	Adequacy of information- The information are provided with a simple language	5,66	5,60	0,99	I.2	Adequacy of information- The information are provided with a simple language	4,87	5,58	1,15
P.2	Personnel- Courtesy/helpfulness of the employees	5,72	5,56	0,97	I.5	Tangible aspects- It is easy to identify the counters	4,88	5,58	1,15
P.1	Personnel - Competence/professionalism of the employees	5,73	5,56	0,97	I.4	Adequacy of information- The steps that I must do to book a medical visit in the counter is clear	5,12	5,58	1,09
A.1	Accessibility - The open time of the pharmacy is appropriate	5,66	5,48	0,97	A.1	Accessibility - The open time of the office is appropriate	5,10	5,51	1,08
AT.3	Tangible aspects- The environment is functional	5,55	5,33	0,96	A.2	Accessibility- It is simple to reach this office	5,52	5,51	1,00
					A.3	Accessibilit�- This pharmacy has not architectural barrier	5,76	5,51	0,96

The collected data have been represented throughout the priority map, where every point has coordinates equal to the medium of satisfaction (X coordinate) and to the medium of importance (Y coordinate). This tool is really effective because it allows to understand how the items are set on a Cartesian axis (Martilla, 1977). The priority map (Fig. 11) represents at once the priority items and allows to individuate them: particularly, for pharmacies are CR.3, because even if they have an high importance opinion they also have a low satisfaction level and CR.2, that has an higher importance level but at the same time a lower satisfaction level; also in the counter case, CR.3 is the most critical item, because even if it has an high importance level it presents a low satisfaction level, as item U.1 (user contact – It’s easy to make a complaint/suggestion) that has a lower satisfaction level but at the same time an higher importance level.

Figure 11. Priority map for counter and pharmacy



From the data analyses comes out that the model, throughout the priority map and the I/S index, allows to managers to determine the action priorities in order to take effective and efficient actions, basing on the citizens opinions, concerning not only the dissatisfaction but also the importance of every aspect. In order to answer to the research question about the informative capacity of the CS ProMod model to generate an improvement in the service quality, it's necessary to investigate the characteristics that have a positive impact on the citizen total satisfaction. In this specific case it's possible to analyze this impact on two different opinions about the satisfaction overall, the first one at the survey beginning and the second one at the end (where the answer must be judicious).

In Fig. 12 – here following - it's also possible to compare the multiple regressions occurred for both surveys considering the initial and final satisfaction (De Luca, 2002). The regression factors analyses allows to determine the most impact variables on the satisfaction. Specifically, for the counter, the variables which can clear the initial satisfaction are: “Rapidity in the waiting time for the booking” (A.5); “Comfort in the waiting halls” (AT.1) and “Rightness of the waiting time to get a medical examination” (CR.3). In the case of final satisfaction the item with more impact on the satisfaction is the CR.3. In the case of pharmacy the factors which can explain the initial satisfaction are connected to aspects regarding the employees and they are “Language simplicity used by the employees” (I.2) and “Employees professionalism and experience” (P.2). In the case of the final satisfaction the items with more impact on the satisfaction are “Employees courtesy and helpfulness” (P.1), “Language simplicity used by the employees” (I.2) and “Rightness of the waiting time for the booking” (A.5).

Figure 12. Multiple regression for counter and pharmacy survey

Pharmacy											
Beginning overall satisfaction						Final overall satisfaction					
The regression equation is $SCI.0 = -0,549 + 0,113 A.2 + 0,192 A.5 + 0,349 I.2 - 0,174 I.3 + 0,195 I.4 + 0,285 P.2 + 0,133 CR.1$						The regression equation is $SCF.0 = 0,438 + 0,193 A.5 + 0,201 I.2 + 0,135 I.4 + 0,255 P.1 + 0,0876 CR.1 + 0,0508 CR.3$					
248 cases used, 4 cases contain missing values						249 cases used, 3 cases contain missing values					
Predictor	Coef	SE Coef	T	P	VIF	Predictor	Coef	SE Coef	T	P	VIF
Constant	-0,5493	0,4633	-1,19	0,237		Constant	0,4379	0,4234	1,03	0,302	
A.2	0,11257	0,04868	2,31	0,022	1,356	A.5	0,19303	0,05809	3,32	0,001	1,322
A.5	0,19165	0,06181	3,10	0,002	1,313	I.2	0,20107	0,06662	3,02	0,003	1,452
I.2	0,34896	0,08865	3,94	0,000	2,380	I.4	0,13519	0,05310	2,55	0,012	1,253
I.3	-0,17367	0,08461	-2,05	0,041	2,081	P.1	0,25506	0,07194	3,55	0,000	1,419
I.4	0,19518	0,05810	3,36	0,001	1,388	CR.1	0,08764	0,03739	2,34	0,020	1,139
P.2	0,28473	0,07647	3,72	0,000	1,387	CR.3	0,05082	0,02304	2,21	0,028	1,046
CR.1	0,13265	0,03867	3,43	0,001	1,128						
S = 0,575066 R-Sq = 46,7% R-Sq(adj) = 45,2%						S = 0,553650 R-Sq = 38,2% R-Sq(adj) = 36,7%					

Counter											
Beginning overall satisfaction						Final overall satisfaction					
The regression equation is $SCI.0 = 0,030 + 0,357 A.5 + 0,169 I.1 + 0,114 I.3 + 0,161 I.4 - 0,180 AT.1 + 0,157 AT.3 + 0,0857 P.1 + 0,139 CR.3$						The regression equation is $SCF.0 = -0,209 + 0,112 A.1 - 0,0359 A.2 + 0,0605 A.4 + 0,163 A.5 + 0,165 I.1 + 0,131 I.3 + 0,0980 AT.3 + 0,132 P.1 + 0,230 CR.3$					
437 cases used, 47 cases contain missing values						444 cases used, 40 cases contain missing values					
Predictor	Coef	SE Coef	T	P	VIF	Predictor	Coef	SE Coef	T	P	VIF
Constant	0,0299	0,3353	0,09	0,929		Constant	-0,2091	0,2878	-0,73	0,468	
A.5	0,35707	0,04350	8,21	0,000	1,476	A.1	0,11185	0,04027	2,78	0,006	1,141
I.1	0,16900	0,06518	2,59	0,010	2,376	A.2	-0,03591	0,02300	-1,56	0,119	1,021
I.3	0,11448	0,06703	1,71	0,088	2,239	A.4	0,06049	0,04398	1,38	0,170	1,517
I.4	0,16064	0,06629	2,42	0,016	1,543	A.5	0,16279	0,03646	4,46	0,000	1,484
AT.1	-0,17998	0,05762	-3,12	0,002		I.1	0,16541	0,05589	2,96	0,003	2,488
I.537						I.3	0,13068	0,05593	2,34	0,020	2,227
AT.3	0,15655	0,04677	3,35	0,001	1,266	AT.3	0,09802	0,03894	2,52	0,012	1,244
P.1	0,08570	0,04976	1,72	0,086	1,630	P.1	0,13236	0,04171	3,17	0,002	1,645
CR.3	0,13878	0,04175	3,32	0,001	1,154	CR.3	0,22984	0,03514	6,54	0,000	1,169
S = 1,23922 R-Sq = 44,6% R-Sq(adj) = 43,6%						S = 1,04397 R-Sq = 49,8% R-Sq(adj) = 48,8%					

In both the factor $R-Sq(adj)$ explains the 45% of the variance, whereas acceptable values for a good regression model are around the 70% (De Luca 2002): this shows that the survey must be considered as a still optimize and improving tool. It's interesting to see as the main factors - which present the greatest impact on the satisfaction - are the same in the final satisfaction case, but different in the case of the pharmacy and counter. This information is useful to decide the improving actions on which to invest in order to increase the citizen total satisfaction. Specifically, in the pharmacy case the items have impact on the employees and on the used language simplicity, that have high satisfaction values and this simply suggests to maintain the satisfaction level on these aspects whereas, to improve the counter users perception, is necessary acting on the waiting time. The results have allowed determining the priorities' actions for the Agency in order to improve their service. Among these items, in order to decrease the waiting time to get a medical examination, a free toll number to cancel the reservation

has been activated and a sensitive campaign regarding the cancellation has been started up, whereas to implement the pharmacy channel a communication campaign has been effected.

Conclusions

The results of the survey made in the Health Agency on the “Booking health benefits centre” service allow giving a positive answer respect the research questions put on the CS ProMod model that, throughout the use of statistic techniques of different complexity, can give useful information on the strength, critically and priority points of intervention regarding both channels and the providing process. It’s interesting to see that throughout simply descriptive statistics and more complex techniques, the model allows to study the citizen perception, giving the possibility to have a comparison among common measures and those intervention priorities on which the manager should act in order to improve the satisfaction level. It has been possible to verify that the CS ProMod CS provides useful information for the improvement and can be the starting of an internal benchmarking process, dedicated to increase the value of the good procedure. Specifically, the model allowed to evaluate the satisfaction impact introducing a new providing service tool and to classify it as internal best practice. However, this can be the first step to implement the process to other administrations that provide the same service. However, it is possible to presume that the model presents anyway optimization margins in effectiveness and it’s necessary to proceed with other efforts to validate it and make it more rigorous and trustworthy.

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Identification of customer needs in healthcare – translating patient needs into critical-to-quality characteristics

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Category: Case study

Introduction

According to patients, there has been a recent increase in interest in how the customer concept could be used in healthcare (Lengnick-Hall, 1995, 2000; Mazur, 2003). Previously, patients were thankful if they could visit a doctor or a nurse. Healthcare was given on sufferance and the patient's natural role was one of servility. However, modern patients have a completely different position in society and expect to be treated differently. Nevertheless, the old strict hierarchical mentality still prevails within some hospital walls (Kettunen, Poskiparta and Gerlander, 2002). Healthcare staff use their knowledge and resources in a way that they assume is best for the patient. Consequently, the patient is seen as an object and is handed from one specialist function to another; this way of working builds barriers in the processes of care (Bohmer, 2009). According to Mazur (2003), organisations obtain better results if there is a focus on improving the experiences of the customer process from the customer's point of view, rather than simply improving work processes. However, it seems somewhat far-fetched to expect the patient to be seen as a subject and where the care processes flow smoothly, thus creating value for the customers (that is, the patients).

There is reason to believe that knowledge about the customer concept and how to visualise the needs of the customer could be translated from operations management knowledge into healthcare knowledge domains (Batalden and Stolz, 1993; Bergman and Klefsjö, 2001; Berwick, 2008).

Although the healthcare system trying to satisfy the needs of its customers could be seen as a complex situation, healthcare staff must find strategies to cope with this

situation (Glouberman and Mintzberg, 2001). Lengnick-Hall (1995) suggested four dimensions of the patient as a customer that could support the customer concept in healthcare. According to Lengnick-Hall (ibid), healthcare providers adapt a number of tools and techniques that are used in other settings to systematically incorporate patient information into their planning and service delivery activities. It is necessary to develop a systematic approach in order to find out the real requirement of patients, as this requirement leads to greater customer satisfaction and ultimately makes the hospitals more successful (Yeh, 2010).

This paper describes how the management team at a Swedish hospital applied the customer concept from a patient perspective, using the Kano model in the identification of patient needs to support the translation of needs to critical-to-quality characteristics when designing the care process.

The paper will first provide a background to the patient concept and the patient as a customer, and then continue with a description of the Kano model. This is followed by a description of the methods used in the study. Finally, the case study is described, followed by a discussion and concluding thoughts.

Background

The patient as a customer

As early as 1988, Grönroos and Montheleie used the word “customer” to describe a consumer of public services, including healthcare (Grönroos and Montheleie, 1988). The introduction of market- and service-management discourses in healthcare has paved the way for a situation in which the patient has become a customer. The word “patient” comes from the Latin word *patior*, which means “the suffering” or “those who patiently endure suffering” (Eriksson, 2001). According to Nordgren (2008), the word “patient” could be emotionally charged; on the other hand, the word may have no importance and it may be the meaning of the concept that determines the consequences of actions and behaviours.

The relationship between healthcare professionals and patients is built on the fact that the healthcare professionals have medical knowledge that the patient needs. This relationship creates an unequal power balance and means that one of the parts is more dependent on the other (Eriksson, 2001). The relation between healthcare providers and receivers is in focus for development and change. The customer concept involves

overturning the medical hierarchy and shifting the power to the patient (Nordgren, 2008; Eriksson, 2001).

According to Lengnick-Hall (1995), the relationship between healthcare systems and their patients is complex, and a traditional perspective on quality development and familiar views of customer satisfaction is inadequate for managing this relationship. Lengnick-Hall proposed four different roles for the patient in a healthcare system: a supplier, a product, a participant, and a recipient (Lengnick-Hall, 1995). The key differences between healthcare processes and other service delivery firms are that “the product” that healthcare produces is human change. Healthcare deals with experiences, rather than with objects. The production and delivery are inseparable (Zeithaml, Parasuraman, and Berry, 1990). Moreover, the product is assumed to be improved over time, rather than worn out. The in-house service production processes are often as important to the patient as the final result.

Visualise the needs of the customer

The 1980s saw the presentation of Kano’s model of attractive quality (see Figure 1) (Kano, 1984; Mikulic and Prebezac, 2011). According to Walden (1993), use of the Kano model requires a deep understanding of customer requirements. Customer ideas about quality are often confused and difficult to see clearly, but they must be made clear. Expected requirements are essential to the customer but, in most cases, are not mentioned. However, if these requirements are not met, the customer will be very disappointed. Hence, Gremyr et al. (2009) argued that the explicit voice of the customer is sometimes not enough as a main input. Instead, the voice of the process and the voice of compliance may take centre stage in particular settings. The focused voice of the customer is difficult to handle in a healthcare application because patients have limited insights into the medical aspects of the healthcare process. According to the Kano model, these medical characteristics are *must-be quality* criteria in the process (Figure 1). Other requirements are indifferent and provide the customer with a neutral feeling. One-dimensional requirements are the spoken needs of the customer and affect satisfaction to the extent that they are present or absent. Exciting requirements are difficult to find and are connected to the attractive perspective of quality. The customer will not notice if they are absent but will be very pleased if they are present. The horizontal axis of the Kano diagram indicates how some aspects of the service are fully functional. The vertical axis indicates the customer’s degree of satisfaction (Walden, 1993). However, Kano’s theory also includes a third class of requirements, which

behaves as if the positive and negative axes were continuous and one-dimensional factors.



Figure 1. *The Kano model of customer satisfaction (based on Walden et al. 1993).*

According to Yeh (2010), a patient’s consciousness regarding health will increase, which is why hospitals need to pay more attention to satisfying patient demands. Examples of must-be quality presented include: hospital washrooms being properly cleaned, skilful techniques of nursing staff, and convenient hospital parking. When it comes to attractive quality, the patients mentioned the doctors’ ability to explain the disease and its treatment in detail. One-dimensional qualities include empathy from doctors and the degree to which the hospital guarantees the confidentiality of the patient’s personal information (Yeh, 2011).

Analysis of complaints and compliments may be one reason for applying the Kano technique (Friman and Edvardsson, 2003; Mikulic and Prebazac, 2011). The quality attributes may be categorised by comparing how frequently customers mention an attribute in a positive context or a negative context. Kano’s analysis aids in an understanding of the relationship between the fulfillment of a requirement and the satisfaction experienced by the customer. According to Walden (1993), the Kano analysis seems to increase the credibility and confidence of the team with respect to the care process design, perhaps due to increased traceability. The model verifies that the team has accurately understood the voice of the customer and translated it into an appropriate requirement statement. A graphical representation may often convey more information simultaneous information than a non-graphical approach (Walden, 1993). Mikulic and Prebazac (2011) argued that the Kano model provides managers with valuable information that can be used to design new products/services or to improve existing processes. The Kano model is particularly useful in the design stage because it

helps categorize existing and non-existing attributes according to their potential to elicit satisfaction/delight and dissatisfaction/frustration from a customer perspective.

Care for mothers and their newborns

Care for newborns and their mothers is one aspect of healthcare that can be improved to better satisfy patients' needs (Ellberg, 2008; Erlandsson, 2007; Sandin-Bojö, Kvist, Berg and Wilde-Larsson, 2009). The most important need for these patients is that the family is able to stay together. Being together is important for achieving a positive family relationship, which leads to better breastfeeding initiation, better bonding between mothers and their children and earlier discharge from the hospital (Aagaard and Hall, 2008). However, these requirements not only create demands pertaining to the design of the facilities, but also demands pertaining to the organisation of the actual care process. Children in need of neonatal care must have their mothers and fathers at their side as much as possible (Aagaard and Hall, 2008). This requires new forms of cooperation between women's healthcare and paediatrics.

The hospital under study, Skaraborg Hospital (SkaS), is situated in the Western region of Sweden and handles approximately 2500 births each year, about 10 percent of whom need neonatal care. The delivery ward, the maternity ward and the neonatal care unit are located far from each other in the hospital building. This means that large distances must be covered when transporting patients between the wards. The "patient process" is defined as the patients' journey from prenatal diagnosis through antenatal care, the birth and on to maternity care and, perhaps, neonatal care for the baby (Figure 2).

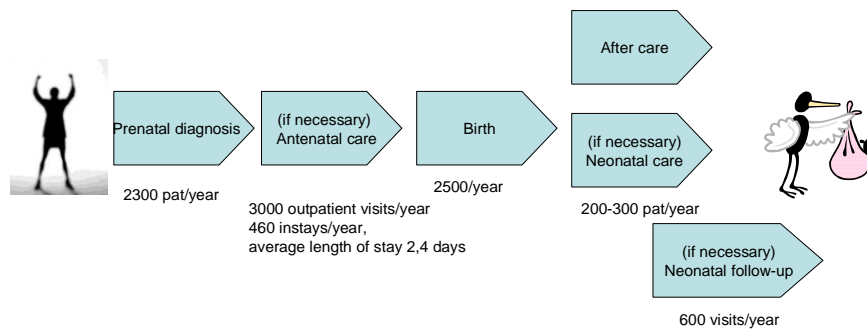


Figure 2. The patient process.

Method

The research is empirical and focuses primarily on contextually rich data from real-world settings to explore the application of customer orientation in healthcare. This is in line with Barratt, Choi and Li's (2011) definition of qualitative case studies. This case was chosen because it was included in a longitudinal action research study at this division, with the researcher as an insider. This meant that the method could be regarded as action scientists conducting research within their own organisation, which Coghlan and Brannick (2008) described as "insiders". The advantage of being an insider is that the researcher may have access to the local practices but also the credibility of the organisation, knowing the people and the culture. The disadvantage is that the researcher's pre-understanding of the problem and context can make it difficult to take a step back to analyse, reflect, and sometimes criticise the research role. Coghlan and Brannick (2008) argued that if the researcher is aware of this disadvantage, it can be turned to his or her advantage and pre-understanding will be of great use in the research.

The empirical material was collected over a two-month period and consisted of observations (attendance at meetings by the insider researcher), documents (meeting notes and reflexive diary), and reflecting dialogues with the management team. Subsequently, seven interviews were conducted with staff members (doctors, nurses and a secretary). The collection of empirical material was carried out in a systematic manner

(Benzabat et al., 1987; Mintzberg, 1979). The insider researcher collected the data, which was then analysed qualitatively and inductively and reflected on with the management team. In a single-case study, the depth of the observations enables the researcher to capture more details of the context about the phenomenon under study (Barratt, Choi and Li, 2011).

The use of multiple data sources and multiple investigators could be considered triangulation of data from different sources to strengthen the analysis and the results of the study. There was an overlap between data collection and data analysis, which, according to Meredith (1993) and Coghlan and Brannick (2008), allows the researcher to capture the reality from which the data was collected. The purpose of the analysis was to gain a deeper understanding of the case related to the broader body of knowledge expressed in the scientific literature. Action Research, with a focus on innovations in a healthcare environment, requires each situation to be regarded as unique. The research will not create knowledge on a predictable “truth”. Instead, the result should be seen as descriptive insights of using the customer concept in a healthcare context, which could therefore be regarded as a tentative framework for other practical implications. Generalisability is analytical rather than statistical and the result is presented as a narrative supported by quotations from key informants (Yin, 1994).

The Case

In the spring of 2009, a major project begun in the area of Children’s and Women’s Healthcare. The aim of the project was to plan for a new building that could harbour, support and enhance the efficiency of some of the division’s critical care processes. The present study has focused particularly on the “perinatal centre” part of the project. The main purpose of the project was to create a patient process that was attractive, accessible, effective and safe for patients. The new centre was to be designed according to the patient process, without taking into account existing organisational structures or existing buildings. The care for the patient was planned to be more patient-oriented and patients were not supposed to be able to notice any differences between the functions of care.

Patients as customers

The management team consisted of the divisional manager, the manager of the obstetrics clinic and the manager of the pediatric clinic (including neonatal care). An accountant and an improvement facilitator were also represented in the team (the latter

being the internal researcher in this project). The managers were educated in improvement knowledge and became familiar with the customer concept as a guiding principle for intensive quality improvements at the hospital, according to the “corner stones” described by Bergman and Klefsjö (2001). At the start of the project, the most important issue was to create and organise a common picture of the management team’s responsibilities. The team had representatives from two organisations, in the form of managers from the obstetric and neonatal care departments. The two managers had to develop a common picture of the project that they could convey to their own staff. The team dialogue contained several reflections about difficulties getting the other staff in the clinics to share the vision. Comments included: “We must give those new ideas time”, and “The staff may feel threatened when the old organisation is changed”. A thorough plan for communication was seen to be essential. The managers decided to go and tell the rest of the staff together. Initially, there was an unstructured brainstorming session regarding what the project should elaborate on. There were several discussions about processes and patient flows, and even more discussions about “manageable parts” and “concepts”. Questions included, “What do we actually mean by antenatal care?” and “What do we actually mean by neonatal care?”

The team conducted a stakeholder analysis and identified the patient and his or her family as key stakeholders. The managers clearly stated and agreed that the project should primarily focus on patients’ needs. As one of the managers mentioned, “It is important for the patients to keep their autonomy during their stay at hospital”. All individuals in the management team were enthusiastic and had many ideas, which they wanted to share. Two of the managers had written down their thoughts from a patient perspective, how it would look if everything was perfect. Notably, several of the things they had written coincided: “To feel seen and welcomed”, “Everything felt calm”, “I got all the information that I needed” and “It felt safe”.

The team was then introduced to the Kano model and the process of translating patient needs to requirements, requirements to functions, and functions to solutions. The team members found it interesting and wanted to use this process for their work. Later, they also wanted patients to be more involved in the work. Everyone in the management team agreed that the patient perspective could be translated to a customer perspective. During a brainstorming session, the team translated the customers and their main needs as corresponding primarily to the patient, his/her relatives and then the staff

The focus of the project was to improve the experience for patients, their relatives and the hospital staff. Thus, the first task was to find out about the patients’ experiences of

the existing care. All patients in the organisation had the opportunity to be involved in a survey of after-care services (called the “Quick Search” survey). The survey contained information on patient’s experiences that could be available to the team. Results from focus group interviews with parents from the neonatal care unit were used as an additional basis for understanding patient experiences. Drawing from this data, the management team decided that the new patient process should be based on patient needs and not on the current situation at the clinics. The team decided to come up with a shared vision in order to work towards stronger collaboration between the current functions.

The voice of the customer

The experiences of the patients were important to the management team. The team analysed the patient experiences found in the “Quick Search” survey result for the preceding year and the result of the focus groups. Some examples of quotations from the patients are provided below (translated from Swedish):

“Pure luck that the father had the chance for an overnight stay. He was thrown out during the second night. It should be obvious that the father wants to be with his new family as long as necessary. Where has all the nagging about equality gone regarding fathers’ rights? Construction of the single rooms *promptly* where the father may stay in an extra bed!”

“I was an inpatient for a very long time before the birth and it was boring to just watch television. Unfortunately, we were not allowed to bring a laptop with us to watch movies and listen to music.”

“Why don’t you try to cooperate better with the children’s department? Sometimes you had the feeling that it was ‘us against them’. I would feel better if after-care and the children’s department could work together better, but that’s a typical women’s characteristic to say that one is better than the other.”

“Having to change rooms due to lack of space was not so good.”

The team then analysed the experiences and translated them into customer needs. The team made a subjective judgement about the most important needs. These needs were then categorised using the Kano model (Figure 3) from both a subjective and qualitative perspective.

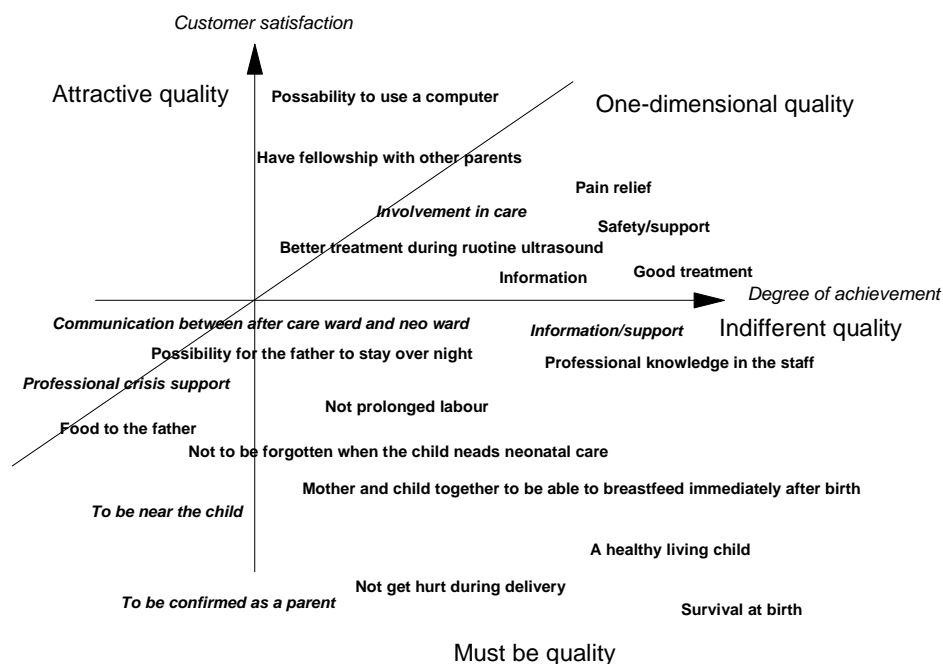


Figure 3. The Kano model

Some of the basic needs were not mentioned by the patients and the management team identified these needs based on their professional knowledge; for example, “not to be killed during childbirth”. The needs in italics (Figure 3) come from patient experiences that were mentioned in the focus groups at the neonatal unit. The rest of the needs were extracted from the survey results at the maternity ward. When the number of negative experiences exceeded the number of positive experiences, the attribute was categorised as a “one-dimensional” quality. When the number of positive experiences exceeded the negative experiences, the attribute was categorised as an “attractive quality”. Needs that were not mentioned by the patients but were experienced by the professional team were categorised as “must-be” quality. This model was presented to patients and their partners later on in the project, and they accepted the model created by the management team. According to the management team, placing patient needs into the Kano model provided a rich picture of the wholeness of the care that the patients needed. After the Kano model workshop, the management team thought about how to explain the results within a few sentences that could be included in the assignment for the project group.

Translating patient needs to critical-for-quality characteristics

The management team translated the patient needs into critical-to-quality characteristics using collaborative reflecting dialogues, with a focus on how patient needs are fulfilled

currently and how they could be better fulfilled in the future. The whiteboard was used frequently to share thoughts during the dialogues and the whiteboard pen was in constant demand. There were sometimes difficulties getting others to listen. Everyone wanted to talk, but all team members eventually had their voices heard and had the chance to share their thoughts. The process involved a great deal of enthusiasm. The team arrived at a shared vision about the new centre that could be conveyed to the project groups, to the architect, to the building company and, later, to all employees at the clinics. The premises in the “Perinatal centre” were intended to provide an opportunity for healthcare professionals to pursue treatment based on patient needs, while also offering a good working environment for employees. The critical-to-quality characteristics based on patient needs can be summarised into nine important requirements guiding the planning of the new centre. The premises should allow families to:

- Receive safe health care
- Feel supported and safe
- Obtain their autonomy
- Feel noticed and welcomed
- Experience a quiet and calm unit
- Have simple access to the centre
- Feel informed
- Feel that the premises are flexible
- Not experience unnecessary waiting

These requirements illustrate what the project should focus on in order to bring forward a patient-oriented design of the new care process. The requirements were delivered to the project group, which then had to translate them into functions and, later, to solutions. In the interviews, the project group members responded that the requirements felt very natural and provided a good framework for their future work. Comments included: “You have to be constantly reminded that the patient should be in focus”, “It is important to get a common picture”, and the requirements were described as a “light in the dark”.

Results – Comments to the case

The goal for the management team was to transform the care process from the present to the future, as shown in Figure 4 below.

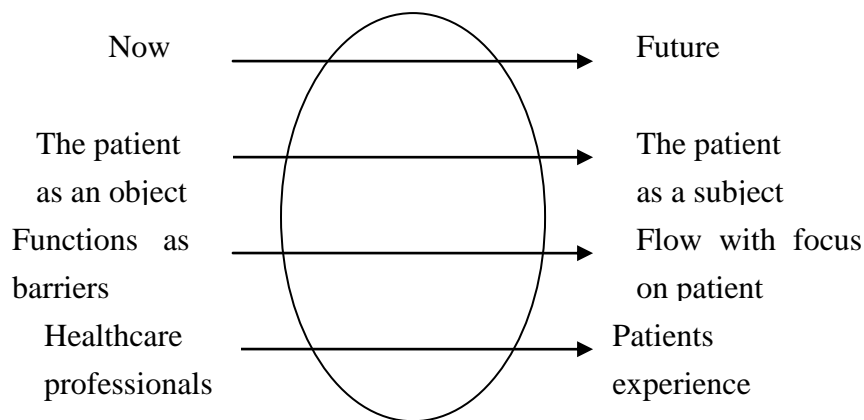


Figure. 4. Model of transformation from present to future.

In the presented case, the management team recognised the need for a difference from existing care to achieve higher quality in the future; the patient became an important central subject in the design of healthcare. The main steps the management team took were to *identify* the experiences of the patient and *translate* them to needs that were then *visualised* in a Kano model and *communicated* to the rest of the organisation. The management team *learned* through reflective dialogue and *defined* critical-to-quality characteristics in their design process to *achieve higher quality* in the patient process. Focusing on the experiences from a patient perspective instead of drawing from existing functions gave the team clear insights into the patient pathway. As one of the interviews with a member from the project group noted:

“It is obvious that, from the start, there is a vision to keep the patient in the centre, but in a while there will be other things in focus instead of the patient. I think that is what is happening in all healthcare situations. You have to be reminded of the patient focus. They are our customers. Now we have to think differently in the process, you could see beyond the situation today; that is what I learned”.

Patients’ experiences were important for the design of the new building, as well as for organising the care processes. Thus, the new patient process has been developed from a patient perspective, acknowledging critical-to-quality characteristics that are important to the patient. The graphical presentation (Kano model) of patient needs did verify that

healthcare staff understood and examined the voice of the customer and conveyed the purpose of the model to healthcare staff. One of the members of the management team said: “We have different pictures of how it could be in the future. It feels good to have a supporting picture with emphasis that shows the direction.” One of the members in the project group stated: “I have learned to focus on the assignment and it feels like we are developing a new way of thinking. It is exciting.” The Kano model and the list of requirements increased the credibility and confidence of the management team with respect to the patient process.

Discussion

From a healthcare perspective, it sometimes seems difficult to replace the patient concept with the customer concept. A reasonable approach would be to adapt the customer concept to a healthcare context. Nordgren (2008) argued that if a certain discourse is legitimised and comes into use in a society or a part of the society, it will, depending on its fulfilment, become powerful enough to influence the everyday speech, writing, thoughts and actions of that part of the society. This change implies that a gradual transformation in the view of the person seeking care has occurred, from someone waiting patiently to a customer who is obliged to be active when seeking care, asking questions and collaborating in the care process (Nordgren, 2008). In this case, there were no doubts when patients were identified as customers. The power of healthcare staff, vis à vis patients, was not discussed in a negative way; it was seen more as a positive move to translate the customer to the patient perspective. The patient’s role became more and more empowered and important throughout the project. According to Eriksson (2001), healthcare professionals have more knowledge, which gives them extra power towards the patient. Accordingly, the patient may be the one with more power than the staff because of the influence that the patient has on the process from the different dimensions mentioned by Lengnick-Hall (1995).

One possible reason why the patient perspective as a customer became obvious in this case could be that the knowledge of the management team was not only based on the domains of medicine, nursing and economic knowledge, but also on improvement knowledge. This meant that there were existing guiding principles in the hospital to put the patient in focus. These guiding principles were probably a success factor. The management team carried out an understanding of the importance of the patients as a customer in developing high-quality care. However, members of the project group mentioned that they had to be reminded of the patient as the central part when working with the design of the new patient process. It could be that the knowledge of quality improvement is strengthening the customer concept from a patient perspective.

The analysis of complaints and compliments in the “Quick Search” survey provided the management team with valuable information during the design phase. Consequently, the management team had to use its medical and nursing knowledge to identify the basic needs of the patients. Gremyr et al. (2009) argued that the explicit voice of the customer is sometimes insufficient as a main input; rather the voice of the process and the voice of compliance may take centre stage. As Miculic and Prebezac (2011) suggested, the Kano model was capable of classifying patient needs in the design phase and was shown to be a practical model to use when visualising and communicating patient needs in the organisation. Not only are there the customer needs in different dimensions, but it is also a picture of the current state and the degree to which the needs are fulfilled. The Kano model provided a systematic way of defining patient needs. Miculic and Prebezac (2011) also argued that managers receive valuable information when they use the Kano model; information that could be used when designing service. This was clearly what happened in this case.

According to Ellberg (2008), the care of mothers and newborns must be improved in order to satisfy the patients and the most important thing is to bring the family together. In the case of SkaS, this has been a major task. SkaS will probably become the first hospital in Sweden to integrate and collaborate its obstetric and neonatal care in the same patient process adapted building.

In an industrial context, the healthcare sector has seen a great influence of total quality management. These techniques are sometimes linear and there is an assumption that the healthcare context is more complex than the production process in a factory. Experiences from the patient are then crucial when carrying out high-quality services (Bergman & Klefsjö, 2001). Lengnick-Hall (1995) suggested that healthcare organisations that systematically incorporate patient preferences and requirements in their service design will achieve and sustain higher quality service accomplishments and reputations than those that disregard this relationship.

In the present case, as a development of using the customer concept from a patient perspective, the management team decided to involve the patients in the project in different ways later on. These included putting up boards where the patients could come up with ideas to make the new building better than today’s facilities, and inviting patients to work with improvements together with health care staff.

During this case, managers described the design process as “Fun”, “Feels contemporary”, and “We have thrown ourselves into something exciting and unknown, no one has done this before us”. The managers felt proud and visionary when talking about their project.

The management team managed to theoretically transform its organisation into a future system where the patient concept was highlighted and the patient was seen as a subject, experiencing events that are important for managers when making decisions regarding the design of new healthcare processes.

Conclusion

The result could be considered to be descriptive insights when using the customer concept in healthcare processes, and could also provide a framework for other practical implications. The study contributes to the current understanding of how patient processes in healthcare may be designed based on the patient as a customer. The study also suggests that the Kano model may be useful in a healthcare setting, visualising and communicating the fulfillment of customer needs. The importance of improvement knowledge, in addition to the professional knowledge in healthcare professionals, has an impact on the possibility to apply the *customer* concept from a patient perspective. The next proposed level is to involve the patient in the design of patient processes.

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How to improve Quality Cost Account?

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Category: research paper

Introduction

The quality cost account should be an important tool to assess the effectiveness of production processes. In theory, there are many models, structures and different ways of quality cost accounting. Many authors in the literature convince of the undoubted benefits of the application of financial measures to evaluate the quality management system. Unfortunately, the quality cost accounting in practice often does not work, as it may be demonstrated by the examples of some Polish companies. In other words, there is a gap between the cost account, presented in the literature, and its perception in practice. The aim of this paper is to present considerations about the strengths and weaknesses of the quality cost accounting. Indication of the most common weaknesses in cost accounting practice should enable analysis of the improvement solutions.

In publications, such as (Ciechan-Kujawa, 2003) (Balon 2006) (Szczepańska, 2009) (Szymonik, 2002) (Skrzypek, 2000), numerous models and cost structure of quality are presented, and aims of quality cost accounting are described. These are usually a diagnosis of the current state or transformation of classics' ideas, of Juran, Crosby, Deming, Bank. Some questions have been raised if such general information and reports are applicable in practice. In order to verify the sources of literature on the quality cost accounting, a research among Polish entrepreneurs was conducted. One applied a survey questionnaire, consisting of six questions relating to:

1. the elements of quality cost account (identification, records, planning, accounting, analysis) used in manufacturing enterprises,

2. causes of not-using of quality cost accounting in manufacturing companies,
3. departments which realize tasks related to running of quality cost account,
4. tools used for the analysis of quality cost accounting,
5. areas in which decisions are based on the quality cost accounting,
6. problems connected with running of quality cost accounting.

The questionnaire survey was filled in by forty-three Polish entrepreneurs (Table I). The dominant industry was the production of the ready metal products for machineries and equipment (17 companies). The questionnaire was mostly filled in by medium-sized enterprises (24 questionnaires). Only one company had not implemented a standardized management system, 19 had implemented the management system but had not certified it, the remaining 23 companies had both implemented and certified the management system. The respondents could indicate more than one answer in the case of questions of the quality cost accounting.

Table I. Analysis of the responses, provided by 43 companies, in a questionnaire survey concerning application of on the quality cost accounting.

21% of companies do not apply quality cost account		1 company with no implemented management system	The main reason for non-applying quality cost account is the lack of formal structures and guidelines, identifying costs of quality - 8 indications	
		8 companies have implemented and / or has certified management systems	Other causes: ignorance of a tool (1 indication), a lack of faith in the cost account (3 indications) high expenditures associated with its conduct (2 indications);	
79% companies apply elements of quality cost account	56% apply quality cost accounting in the departments of management and / or quality control and in the manufacturing department	63% of enterprises apply up to three elements of quality cost accounting		71% have problems with the use of quality cost accounting. Among the problems are: the reluctance of workers, lack of techniques to

	each of 16% in the Controlling Department and the departments of accounting and finance	37% companies apply more than four elements of quality cost accounting	all of them have been implemented and / or certified management system for more than 1 year	conduct quality cost and analysis of the structure of quality cost, high expenditures connected with distinguishing quality costs
			57 % use 3 or more tools for the analysis of quality cost accounting	
12% in all areas of the enterprise		75% have problems with the use of quality costing		

source: own work

In the further part of the elaboration, a focus was set on the selected issues, resulting from the analysis of surveys:

- I. why as many as 21% of the surveyed enterprises do not apply the quality cost accounting, and the others use only some of the elements?
- II. where does the problem of the lack of formal structures and guidelines of identifying quality costs come from - if there are so many models and interpretations of quality cost accounting?
- III. what is the problem connected with the available tools, used for the analysis of quality cost structure?
- IV. where does the reluctance of workers for applying this tool come from?

The problem of non-applying or applying only the elements of quality cost account.

To answer the first of the raised questions, a management theory was combined with the concept of quality management, according to ISO 9001:2008.

Advantages resulting from the implementation and certification of the quality management system, according to ISO 9001:2008, can be described in accordance with the eight principles of TQM. The company is focused on customer needs, whose requirements are realized by the committed staff led by a leader, top management maintains good relations with suppliers and takes decisions based on reliable data, which ensures continuous improvement, the organization is seen as a system, which

consists of related processes . Such a picture of the organization, seen through the prism of quality management principles, should convince for implementation of standardized management system. However, practice shows that what convinces management to the effort for implementing the system and incurring expenditures, related with the issue, are requirements of the market or the prospect of financial benefits. Economic effects associated with the quality management system may result from, for example:

- elimination of waste, what results from ordering of the internal processes (identification of processes),
- conscious and consistent designing, manufacturing, supplying and proper disposal of products (identification of the product, product design),
- manufacturing of products compatible with customer’s requirements,
- focusing on the quality of products - minimizing losses resulting from internal defects and any complaints,
- making objective decisions based on facts.

In order to make the benefits associated with the implementation of the QMS convincing, they ought to be expressed in specific values - indicating incomes or expenses. Revenue growth may occur due to many actions: research of the customer's requirements - greater demand for products adjusted to the needs of customers, the possibility of selling at higher prices – thanks to the improvement of product quality. To illustrate the evolution of costs before, during and after the implementation of QMS, it is reasonable to apply quality cost account. So the use of elements of quality cost accounting, as the analysis of literature and conducted research show, it is usually associated with the implementation and / or certification of the standardized quality management system. Quality Management System (QMS), understood as the enterprise management subsystem consists of some related and mutually interacting elements. Activities in the frame of QMS, realized in accordance with ISO 9001, can be referred to the function of management: planning, organizing, motivating, controlling [Table II].

Table II. Comparison of Quality Management System according to ISO 9001:2008 with the management functions

Management function	Theory of mangement	Points of the ISO 9001:2008 Standards
planning	<ul style="list-style-type: none"> · to establish goals, · determine types of targets, · selection of methods · specification of the desired level and measures to assess implementation · set a deadline for completion of action, 	4 - Quality Management System, general requirements 5.3 - Quality Policy 5.4.1 - Determining the quality objectives 5.4.2 – Planning of the system of quality management

	<ul style="list-style-type: none"> · determination of the place of realization of goals (Kozminski, 1997) 	7.1 - Planning of product realization 7.2 - Customer-related processes 7.3 - Design and development
organization	<ul style="list-style-type: none"> · designing of organization, determining structure · division of tasks, responsibilities, · acquisition and resource allocation, including human ones (Hamrol, 2005) 	5.5 - Responsibility, authority and communication 6.1 - Provision of resources 6.2 - Human Resources 6.3 - Infrastructure 6.4 - Environment of work 7.4 - Purchasing 7.5 - Production and providing services
motivating	<ul style="list-style-type: none"> · building of motivating system, which aims to encourage for beneficial for the company behaviours and avoiding of negative ones (Kozminski, 1997) 	5.1 - Management Commitment 5.2 - Customer Focus 6.2.2 - Competence, training and awareness
controlling	<ul style="list-style-type: none"> · setting of standards, models, and methods of measuring effectiveness · design of information feedback · comparison of the results with the plan · determining corrective actions (Kozminski, 1997) 	5.6 - Management Review 7.5.2 - Validation of manufacturing processes and supply 7.6 - Control of monitoring and measuring 8 - Measurement, analysis and improvement 8.5 - Corrective and Preventive actions
improvement – as a function of the quality management		8.5 - Continuous improvement, including corrective and preventive actions

source: (Hamrol, 2005) (Kozmiński 1997) (Norma ISO 9001:2008)

QMS assumptions are consistent with the theory and management functions: planning, organizing, motivating. Some differences in the activities are noticeable at the stage of control [Table1].

In the case of management at the control stage, there is the emphasis on assessment of efficiency. Efficiency is the relationship between the achieved results and the used resources (ISO 9000:2000). Therefore, we must not ignore metrics and indicators based on financial data. This makes communication of universal language of money easier and allows to compare the results.

In the quality management, stage called in theory of management “controlling”, should be called here “evaluation”. Activities within the scope of this stage are measurements, analysis and the resulting from it improvement. Monitoring, measurement and analysis are to ensure compliance of a product with requirements, efficiency of QMS and continuous improvement of effectiveness. Effectiveness is defined as the degree of activity realization and achievement of planned results (ISO 9000:2000). Thus, in the ISO 9001:2008 there is no monitoring requirement of activity effectiveness what distinguishes the subsystem of quality management from management.

Comparing the conclusions from the above analysis with of the responses from the questionnaire survey, one can conclude that the full quality cost accounting is not applied in companies since nobody requires it. Since the ISO 9001 standard does not directly demand the efficiency assessment, the quality management system is evaluated through the prism of the effectiveness or with the application of financial measures, indirectly or partially related to the quality management system.

The problem of lack of formal structures and guidelines to identify the cost of quality, since there are so many models and interpretations of the quality cost accounting?

The concept of quality costs is not precisely defined in the literature. For specialists in the field of quality management, quality cost is an element isolated from the total costs connected with manufacturing of products. For the economist, the costs of quality include the amount of costs incurred for the manufacturing of products of a specific quality, fulfilling requirements of customers.

The literature presents different views on the definition and classification of quality costs, such as:

- taking as a basis the extracted costs in the process of product manufacturing (narrow approach),
- taking into account all the costs incurred by the organization,
- relating to costs to be borne by the user,
- relating to costs that are incurred throughout the whole life cycle of products by all users (broad approach) (Balon, 2006)

The interest of quality costs in the enterprise often results from improvements of implemented quality management system in accordance with ISO 9001. The ISO 9001 does not refer directly to the issue of quality costs, the requirement for the assessment of the system leaves flexibility as to the methods used. International Standards

Organization developed the Technical Report ISO / TR 10014 for the management of economics of quality. In paragraph 7 of the report it was estimated that there are many approaches to the classification of costs, some examples include:

- PAF model in which costs are divided into groups: prevention, assessment, incompatibility (Prevention, Appraisal, Failure);
- process model in which costs are divided into groups: the compatibility and incompatibility;
- life cycle model in which the quality costs are divided into groups depending on the phase in the life cycle;
- a model that involves identification and measurement of the loss of value added, the so-called loss of quality model (ISO 10014:2006). model PAF, w którym dzieli się koszty na grupy: zapobieganie, oceny, niezgodności (Prevention, Appraisal, Failure);

In the traditional system costs (PAF): prevention, assessment, failures, represented also in the American model of ASQC (Zymonik, 2002), the costs of prevention and evaluation should be associated with expenditures related to achieving the expected level of quality, while the costs referring to the errors should be equated with the losses. The concept of cost, by definition, involves its purposefulness, therefore it is advisable to apply the concept of losses in relation to defects generated in connection with the activities of the company (internal and external).

Prevention costs are related to activities that are not allowed to generate errors, as well as identifying and eliminating causes of errors. Evaluation costs include expenditures designed to verify compliance with quality requirements. Losses resulting from errors or failure of the product quality requirements should be identified both inside the organization and in its vicinity (Table III) (Zymonik, 2002).

Table III. Sample costs of quality according to ASQC model

Prevention costs			Evaluation costs
Product production design of training employees in quality control	Quality quality measurement methods	Planning control methods	control of input materials control of products ancillary works associated with attempts maintenance of test and measurement equipment assessment of the quality of materials in warehouses
Internal losses			External losses

irreparable alterations identifying re-inspection service - transformation of the lower classes of quality	and causes of defects and tests sorting of discards	gaps repairs	customer after-sales processing of repair of replacement of technical errors associated with the installation of products	complaints service of returned products under warranty errors of the installation of products
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Source: Own elaboration based on (Zymonik, 2002)

Process model of quality costs results from the approach presented in code 9001 and assumes analysis of individual processes, in terms of occurring in them compatibilities and incompatibilities. Compatibility costs include expenditures to meet the actual and potential customer needs, with appropriate process progress: incompatibility costs are caused by improper conduct of the process. Both compatibilities and incompatibilities are treated as a source of savings (Balon, 2006).

Costs in the life cycle model can be attributed to the individual stages of product development and extract the generated costs associated with both the producer and the client side. The manufacturer shall bear the costs related to the design, development of a product, manufacturing, and sale, the customer bears the operating and often decommissioning costs (Sobańska, 2003).

Quality loss model based on Taguchi approach, namely the assumption that the customer requires improving the quality of the product offered and is willing to pay for improvements. Any failure to meet customer requirements is a loss for the manufacturer. Manufacturer's loss can be divided into tangible and intangible. Tangible loss result from the incompatibilities, hidden inside and outside the organization, whereas intangible one is associated with customer's dissatisfaction, lost opportunities, loss of customers, etc. (Balon 2006).

The classification of costs is based on division of the total expenditure into different groups and assignment of them into specific objects or processes. The effect of the classification of costs is the picture of their structure and forms the basis for the construction of quality cost account (Balon, 2006). The above presented cost classification models are not mutually exclusive, but can and even should be modified so that they would present quality cost in system that might be useful for analysis, monitoring, and decision-making in the enterprise.

In the further part of the paper, as a model of quality cost system – one adopts combination of the cost of a product life cycle [Fig. 1] with the PAF model. One has

given up here both the process model quality loss model. Process model is hard to generalize because it is closely linked to specific companies, with a unique network of internal processes. In the model of quality loss too much emphasis is put on the intangible costs, which may only be estimated.

In the life cycle, product takes on different forms and figures [Fig 1].

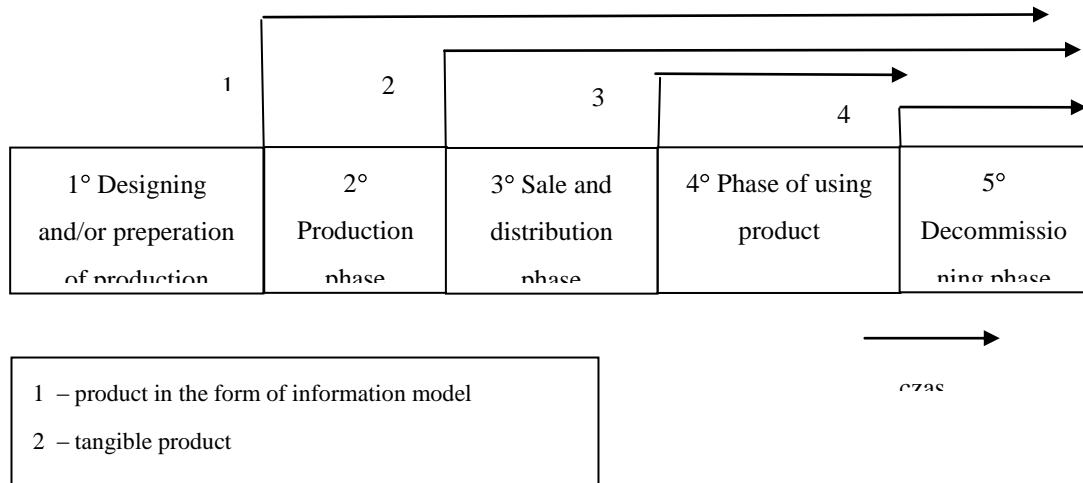


Figure 1. Structure of product existence, source (Mantura, 2000)

In the first phase, products occur as an informational or conceptual model. Then the preparation of the product realization processes take place. If the goods or services are new to a particular enterprise or innovative on a global scale, an important step in the design and construction phase. In the second phase, the product gains material form and is passed to the client, who realizes useful functions of the purchase. During decommissioning phase, the product has a material form but modified: recyclables and / or waste. With giving and modification of individual forms of the product - cost bearing is indispensable part. The costs are borne not only by the manufacturer, but also a customer, and even those not directly related to the use of the product (it mainly concern the decommissioning phase). Interpreting the cost of quality in broad terms, so the costs incurred throughout the whole life cycle of the product by all users, one can associate them with the PAF model [Tab. III]. So the costs may be grouped as: assessment, prevention, internal and external loss [Fig 2].

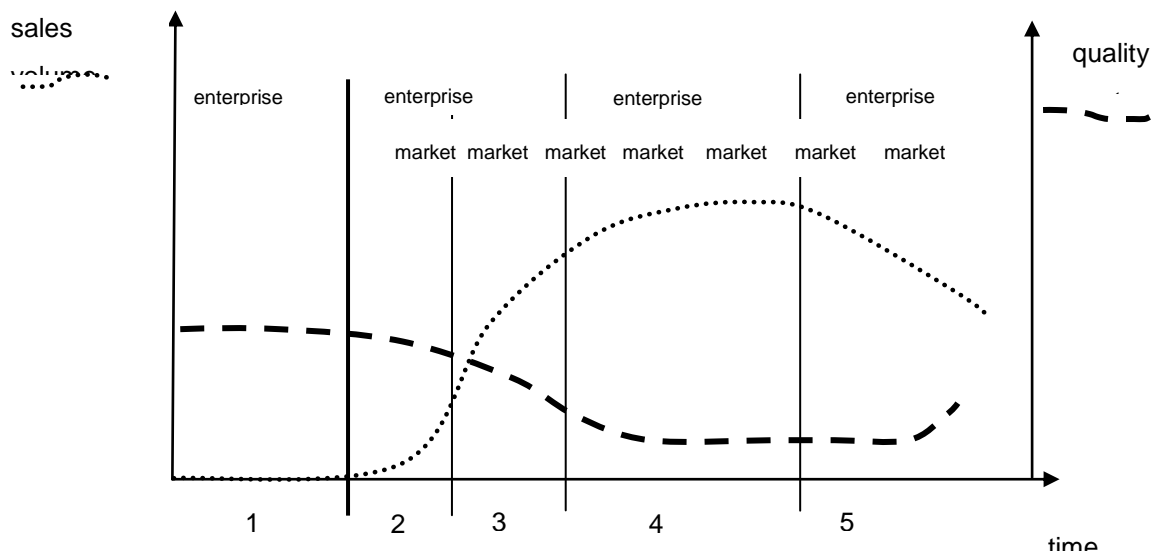


Figure 2. Costs of quality in the product life cycle [own work]

At every stage of life cycle, costs may be divided according to different criteria: those borne by the customer and the manufacturer, the external and internal in the case of the manufacturer, the costs of assessment prevention, external and internal losses [Fig 2] [Tab. IV].

Tab. IV classification of quality costs according to various criteria.

Phase in the product life cycle	Who bears the costs?	Costs of the enterprise	Costs according to PAF model
Conceptional	producer	external and internal	prevention
Production preparation	producer	external and internal if outsourcing	prevention
Manufacturing	producer	external and internal if outsourcing	prevention, assessment, internal losses
Sale and distribution	producer	external	external losses, prevention
Usage	client, producer	external and internal	external losses
Decommissioning	client, producer	external	external losses

Source: own work

Since both the ISO 10014:2008 "Guidelines for the realization of financial and economic benefits", as well as in the literature, various types of quality costs are given, it might lead entrepreneurs to the conclusion that there are no formal structures and rules. Information noise makes it difficult to choose the proper method of cost accounting. The lack of pattern makes verification of the developed approach to quality cost account, in a given enterprise, difficult. Thus, one should adopt and promote the most universal approach, which should ought to be built on the achievements of classics

of quality management, but at the same time adjusted to contemporary realities. Development of the concept of quality costs dates back to the 50th years of the twentieth century, so then developed ideas may not fit today's production methods, technologies, management methods.

The problem of the available tools for the evaluation of quality cost structure?

The entrepreneurs who took part in the research declared that they used tools to analyze the cost of quality, for example: comparison of results of different periods, the reference to other business metrics, comparison with the plan. At the same time, there were answers that one of the problems of accounting quality costs is the lack of tools to analyze the costs of quality.

An analysis of the literature suggests (Szczepańska, 2009) (ISO 10014:2006), that for the management of quality it is often proposed to apply the tools of quality management and others enabling processing and ordering of data, detecting waste, etc.

In publications concerning the quality cost accounting, authors usually focus on the purposes of running accounts and benefits of implementation of quality cost account. There is no answer, however, how to do it. For example, (Skrzypek, 2000) only goals of quality cost account are given, including:

- controlling,
- finding a basis for comparison in order to carry out awareness on how to shape the cost of quality in comparison with those of other undertakings in the same industry, an instrument is benchmarking,
- study on the costs to create the impetus to improve the rationality of actions
- possibility of quality planning, including costs
- possibility of better understanding of economics of quality requirements
- optimal planning of quality control, in terms of costs
- disclosure of excessive costs.

The question remains how to implement these goals? Most of them assume possibility of comparison of costs in a given enterprise with the results from previous periods, and even with the costs generated in other companies (benchmarking). Cost data as well as know-how companies are usually secured, so it is difficult to compare oneself to other

companies. Due to similar reasons, it is difficult to assess whether the planned and / or reached a value of cost or structure of quality costs is optimal.

The quality cost account is sometimes defined as a collection of costs, on the proper balance and off balance accounts, related to quality of production, occurring in all phases of product realization together with the analysis of development of these costs (Skrzypek, 2000) (Łańcucki, 1995) (Szczepańska, 2009) . An account of quality costs consists of: identification, documentation, planning, accounting and cost analysis. Definition and elements of cost accounting quality are consistent with the definition of cost accounting in the enterprise. Therefore, we refer the account to the overall cost of quality standards relating to the evaluation enterprise. In financial accounting and managerial function indicators to assess the condition of the company in many respects. For these indicators are assigned specific values or ranges of values that enable the interpretation. It could be postulated that after the adoption of a uniform, universal model of quality costs, could be valuable to define indicators to assess the cost structure to verify the quality or value of the various cost groups. This objective requires the pooling of cost data from various companies and generalization of these data.

The reluctance of workers

The reluctance of workers, which evoke the entrepreneurs as a problem in conducting quality cost account, probably stems from the above-described gaps in the concept. If the quality cost account is not a formal requirement, it can be treated as overtime, extra duty. Moreover, the multiplicity of models and structures, differences in the interpretation of the concepts create information noise. The weakness of the tools and the lack of tools dedicated to the quality cost account may cause the impression of uselessness of identifying quality costs.

Conclusion

Identification and analysis of weaknesses of quality cost accounting indicates what action should be taken to encourage entrepreneurs to apply it. It should also mobilize them to use the results of quality cost analysis as a measure of efficiency in the continuous improvement of production processes and improvement of the quality management system.

Possibility of changing the aspect, concerning the ISO 9001 standard, that is no requirement to assess the effectiveness of the system, are for obvious reasons, beyond

the reach of authors of the study. Thus, the quality cost accounting remains one of the tools that can be used for the realization of requirement to test the effectiveness or for the implementation of the rule of making decisions that are based on facts. Attention should be paid to other problems, indicated by entrepreneurs: unification and generalization of the structure of quality costs and propose tools that will affect its usefulness. The proposed in the paper structure of quality costs, based on the product life cycle and a PAF model, and inspired by the concept of Activity Base Costing, contemporizes cost interpretation. The next step will be to develop indicators to assess the structure of quality costs, assigned to homogeneous groups of companies. Identification and interpretation of the values of these indicators will enable benchmarking, which will not require high expenditure and collection of information outside the company, but will facilitate decision making concerning the location of funds at different stages of life of the product.

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DeCoDe+X in KitVes

Using the Demand Compliant Design in the Development of a Solution for Harvesting High-Altitude Winds for Energy Generation on Vessels

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Category: Research Paper

Introduction to KitVes

The Project “KitVes - Airfoil-based solution for vessel on-board energy production destined to traction and auxiliary services” is funded under the Seventh Framework Programme of the European Union and started in October 2008, with a duration of 36 months. Within the project, ten partners from seven countries work jointly in the development of a technical solution for harvesting high-altitude winds in the troposphere with the aim to generate energy for the auxiliary systems on vessels.

In comparison to near-ground winds, the wind in heights from 200 to 1000 meters has a higher velocity and is more constant. To use this advantage, the KitVes project aims to develop a wind-powered generator for the conversion of high altitude wind into electric energy. In detail, the generator is connected to a kite, which is equipped with sensors for the identification of the kite’s position, orientation and acceleration. This data will then be submitted to the vessel-based control unit and will be used to control the kite flight for an optimized energy generation. This control is carried out by the generator, which is equipped with double effect drives, and thus poses as a motor as well. In fact, the solution comprises two generators, one for each line. Therefore, the lines can be controlled separately.

To make the operating mode of KitVes fully comprehensible, it is further explained and shown in the following paragraphs and pictures:

Figure 32 shows a possibility how KitVes could be integrated on a ship, in this case on a cruise ship. Also, this picture shows the basic structure of the KitVes solution.

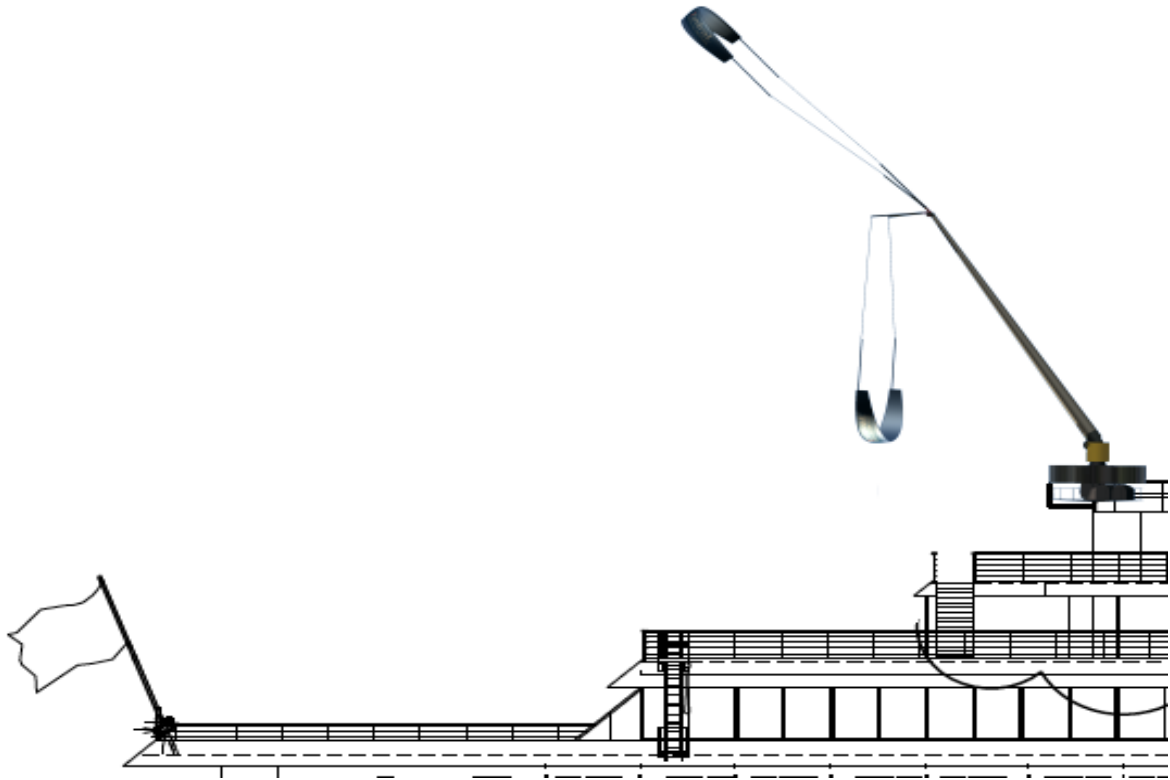


Figure 32: Possible appearance of KitVes on a vessel (project internal illustration)

Directly on the vessel is the Kite Steering Unit (KSU), which consists, among others, of the two generators mentioned above. The generators are each connected to one drum, on which the lines are reeled in. Attached to the KSU is the stem, which damps the lines movement.

During the ascent of the kite, the control makes it flying in ellipses, as shown in Figure 33. Thus, the amount of generated energy is maximised. The ascending kite pulls out the lines, what in turn causes the drums to rotate, so that energy can be generated. The project aims at 100 kW of average nominal power of the demonstrator.

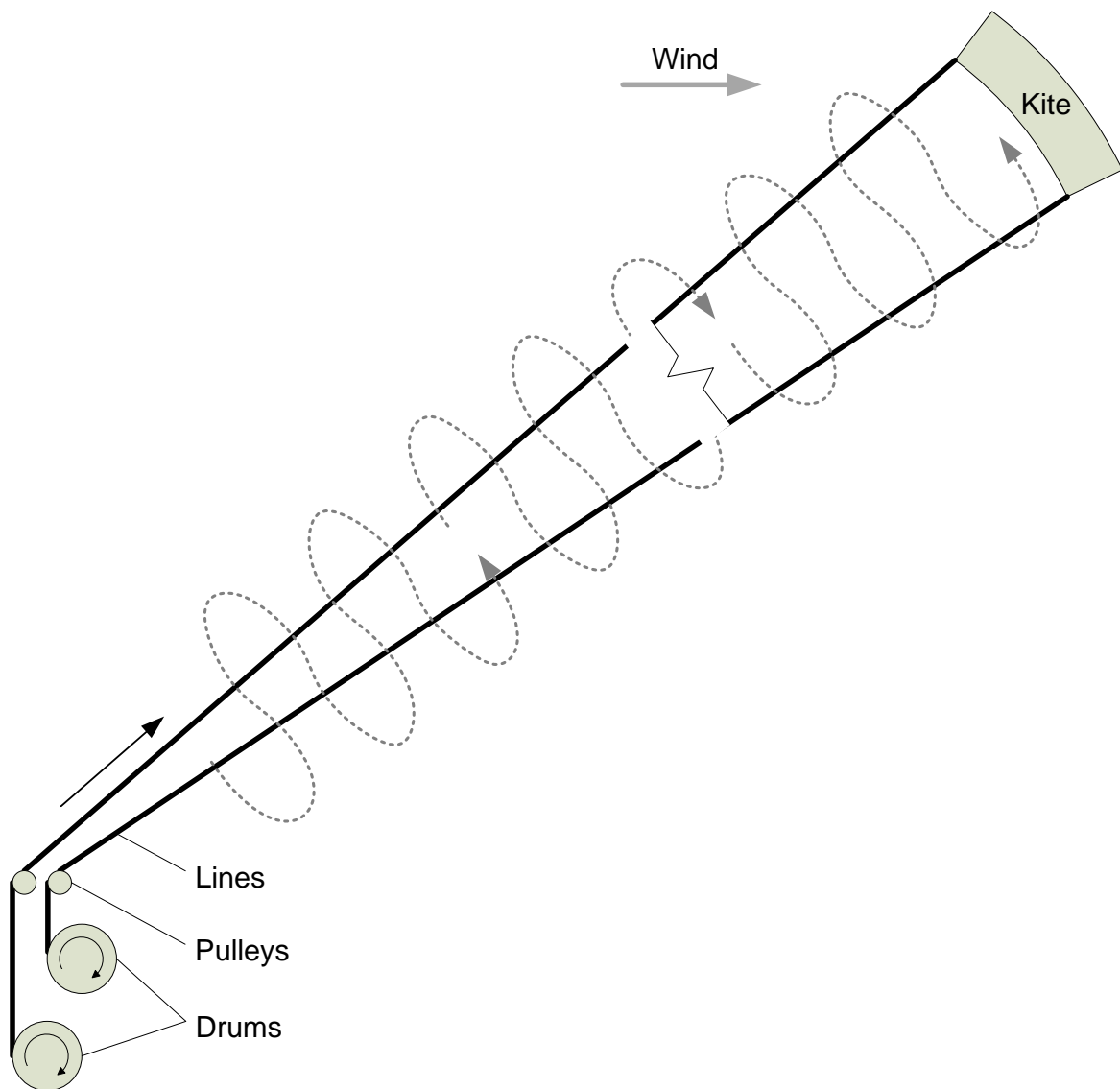


Figure 33: Schematic Representation of the Elliptic Ascent of the Kite

When the kite has reached the maximum height at approximately 1000 meters, it is pulled in. For this, the so called side slip manoeuvre is used, as shown in Figure 34.

Within this manoeuvre, the lines are pulled in with a short delay between the first and the second line. By this manoeuvre, the wing area exposed to the wind is minimized, and thus the kite can be pulled in with a minimal effort, using a minimal amount of energy.

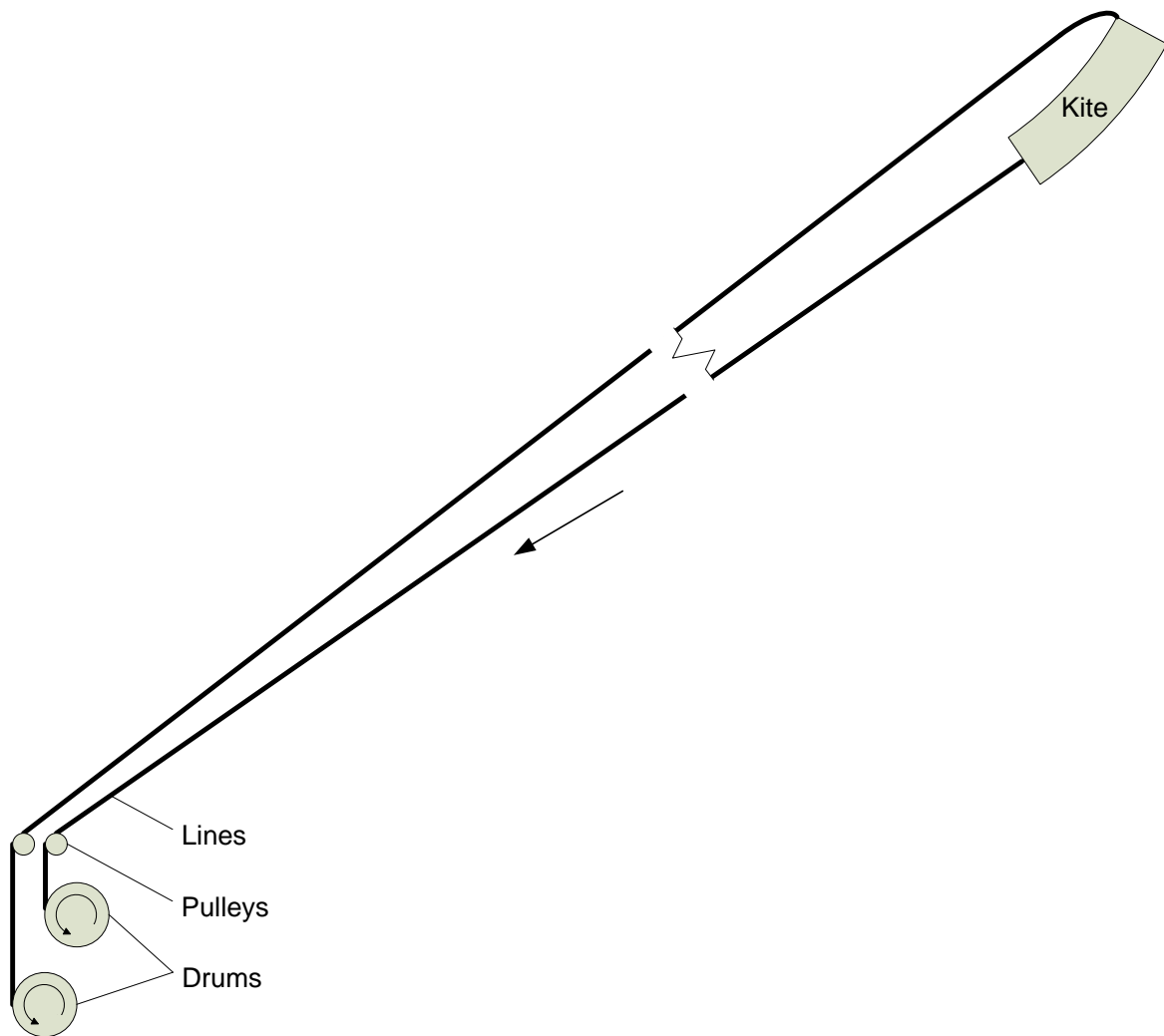


Figure 34: Schematic Representation of the Side Slip Manoeuvre

The Research Group "Product Safety and Quality Engineering" (ProQ) takes part in this project, mainly in supporting the system analysis and the risk assessment. During these tasks, three major problems have emerged:

- The complexity of the KitVes system makes a proper risk assessment that includes all necessary aspects rather difficult.
- Different reliability and quality methods have to be applied to the system, e.g. FMECA (Failure Modes, Effects and Criticality Analysis), RBD (Reliability Block Diagram) and FTA (Fault Tree Analysis).

- Due to the linguistic and professional diversity within the project, with partners from seven different countries, the conceptual understanding of the system and its elements widely differs.

These problems can be faced with a methodical approach towards the system. The approach used for KitVes will be presented in this paper.

Introduction to DeCoDe as Methodical Tool in Product Development

To handle the increasing complexity in the development of technical systems, the Demand Compliant Design (DeCoDe), a method for product development and systems engineering, divides the system in question into four different views on the system : requirements, functions, components and processes (cf. e.g. Sitte et al. 2005, Hartmann et al. 2011). By the identification of these elements and of the interrelations in between, DeCoDe supports the systematic description and modelling of technical systems, thus building a well-founded groundwork for the further analysis of the system. Furthermore, the early detection of potential conflicts and failures within the system is supported.

DeCoDe as a method supports a product development that is suitable to the requirements already in the early phases of the development. It features a well-founded basis for the analysis and the modelling of technical systems and of the interrelations within these systems. As mentioned above, this takes place by dividing the system into the four basic views. These views facilitate a structured collection of the system's elements, and thus a holistic assessment of the system and its borders to the environment (Müller et al. 2010).

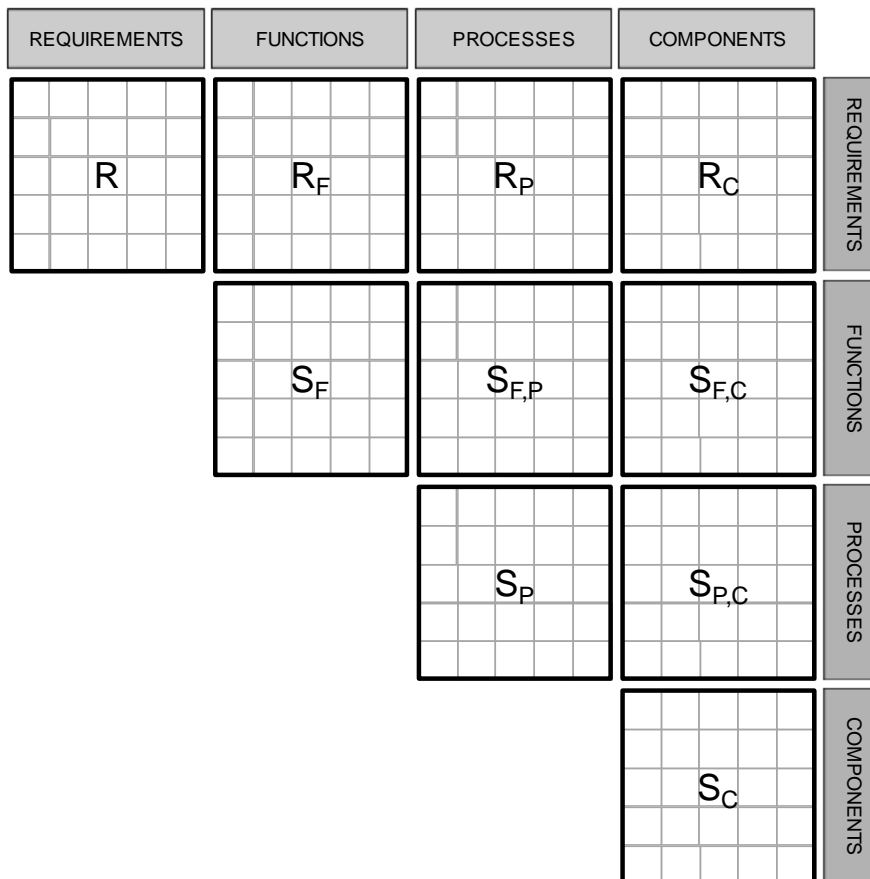


Figure 35: Concept of the DeCoDe model (according to Riekhof et al. 2010)

After the elements of the views have been collected or deduced, the next step is to observe the interrelations between and within the views with the help of tools, mostly matrices or graphs. As shown in figure, the single elements of the views are collected, arranged, structured and then connected among themselves. This connection takes place with the help of requirement (A_X) and system (S_X) matrices (Müller et al. 2010).

By the connection of the views with matrices, one can deduce potential conflicts - like conflicts of goals between requirements - and mutual interrelations like the influence on the function of one component by another, and those can be deduced quite early within the product life cycle. DeCoDe thus qualifies itself as a development-accompanying description tool with an iterative modelling approach, by successively completing the system's elements and their relations (Müller et al. 2010).

If a product or at least a very detailed idea for the product already exists, the product design team does not deal with a strict product development, but with reverse engineering, that is "the process of analyzing a subject system to identify the system's

components and their interrelationships and create representations of the system in another form or at a higher level of abstraction." (Chikofsky et al. 1990). Therefore, if dealing with reverse engineering, DeCoDe needs to be adapted accordingly. First of all, the main focus will be put onto the collection and definition of the components. Contrary to the product development from scratch, the demands are not the main focus. Instead, the functions and processes will be deduced by a thorough observation and analysis of the underlying system.

Furthermore, DeCoDe can be combined with established methods of quality engineering, reliability and simulation (e.g. Ishikawa, FMEA (Ott et al. 2007), RBD), by using conjoint definitions and defined interfaces (cf. e.g. (Rosendahl et al. 2009)). This approach, as it supports the application of different methods, is called DeCoDe+X. Using DeCoDe+X, a defined subsystem can be examined more detailed for a specified problem, and can be regarded beyond the four basic views (Müller et al. 2010).

The interlinking of the different methods with DeCoDe+X is carried out bidirectional. On the one hand, a system model mapped in DeCoDe delivers the input needed for the method execution, and on the other hand, the method's results are integrated back into DeCoDe and thus lead to an actualisation of the system model (Riekhof et al. 2010).

Use of DeCoDe within KitVes

As mentioned above, a thorough system analysis and risk assessment are necessary within KitVes. To support these tasks, the DeCoDe method has been chosen. The realization of DeCoDe within KitVes will be explained in the furthering. As the project is not yet finished, not all details can be presented here. Nevertheless, the methodical approach will be explained, stating advantages as well as problems that occurred during the use of DeCoDe within the KitVes project.

As a rough idea for the system already existed at the beginning of the project, the main focus was not laid onto the requirements, but onto the discussion and definition of the system's components. Thus, common ground was found for further cooperation during the development of the KitVes system. Based on this, DeCoDe was used as a supporting method throughout the developing process of the KitVes system.

Collection and Definition of the KitVes Elements

As mentioned above, the demands for the project have not been formulated beforehand. Instead, the first focus was laid onto the components. For this, several workshops were performed with some of the partners - chosen accordingly to their responsibilities in the project - in order to collect and define the KitVes components. Using mind maps as a tool in this stage, we chose a hierarchical top down approach, starting with a modular structure of only seven main components, as shown in

Figure 36. From here on, the components catalogue was subdivided further within several steps, resulting at last in a catalogue with up to seven hierarchical levels (depending on the “complexity” of the specific main component) and with the elements in the component view onto the KitVes system.

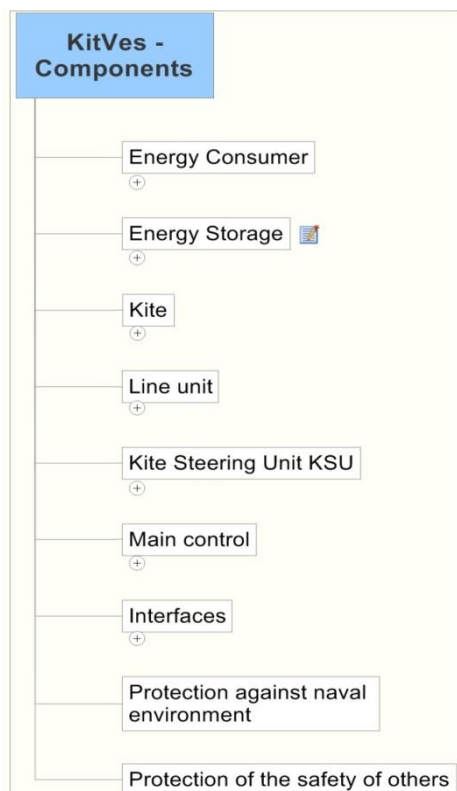


Figure 36 : Top Level of the Components Structure (Mindmap, project internal illustration)

At this point, we derived a component list from this component catalogue: Whereas the catalogue, which is presented in the form of a mind map or tree structure, containing a hierarchical, modular structure as mentioned above, the components list only contains

the “smallest” components on the lowest level; that means the component level which was not split into further subcomponents. This is due to the fact that this list will be used as input for the DeCoDe matrices. A non-hierarchical list can be handled much easier in the following, as there is no need to focus on the inheritance of attributes or interrelations between different levels of detail. This differentiation will be used for the process view and the function view as well.

In the next steps, several workshops for the collection and definition of the processes and the functions have been performed; the approach was nearly the same as for the components. These workshops lead to the following results:

- Components catalogue and list
- Processes catalogue and list
- Functions catalogue and list.

As a first output of the DeCoDe method, the catalogues were distributed to all project partners. As not all partners participated in all workshops due to the different responsibilities within the project, the catalogues served as a data base for the project-wide understanding of the KitVes system.

Furthermore, the lists serve as the first input for the collection and definition of the interdependencies between the elements both within one view as well as in between views. For this purpose, we use matrices as tools (cf. Figure 35). As a software tool for the next steps, LOOMEO (© 2011 Teseon GmbH, cf. <http://www.teseon.de/>) has been used.

Interrelations of the KitVes Elements

Within LOOMEO, the elements can either be connected within matrices or within graphs. For a systematic approach with as high a number of elements as in KitVes, the matrix view is to be preferred, as within a graph with a high number of elements, track can easily be lost.

As the analysis was started with the components, the first matrix to be filled and analyzed is the Components-Components-Matrix (S_C). The main question to be asked while filling this matrix is “Which component is physically depending on which component?”. In this first matrix, the direction of analysis is not important. Therefore, for each connection two cells have to be chosen accordingly, in the upper and in the lower half matrix. A section of the resulting matrix is shown in

Figure 37. There, the symmetric half matrices can well be seen.

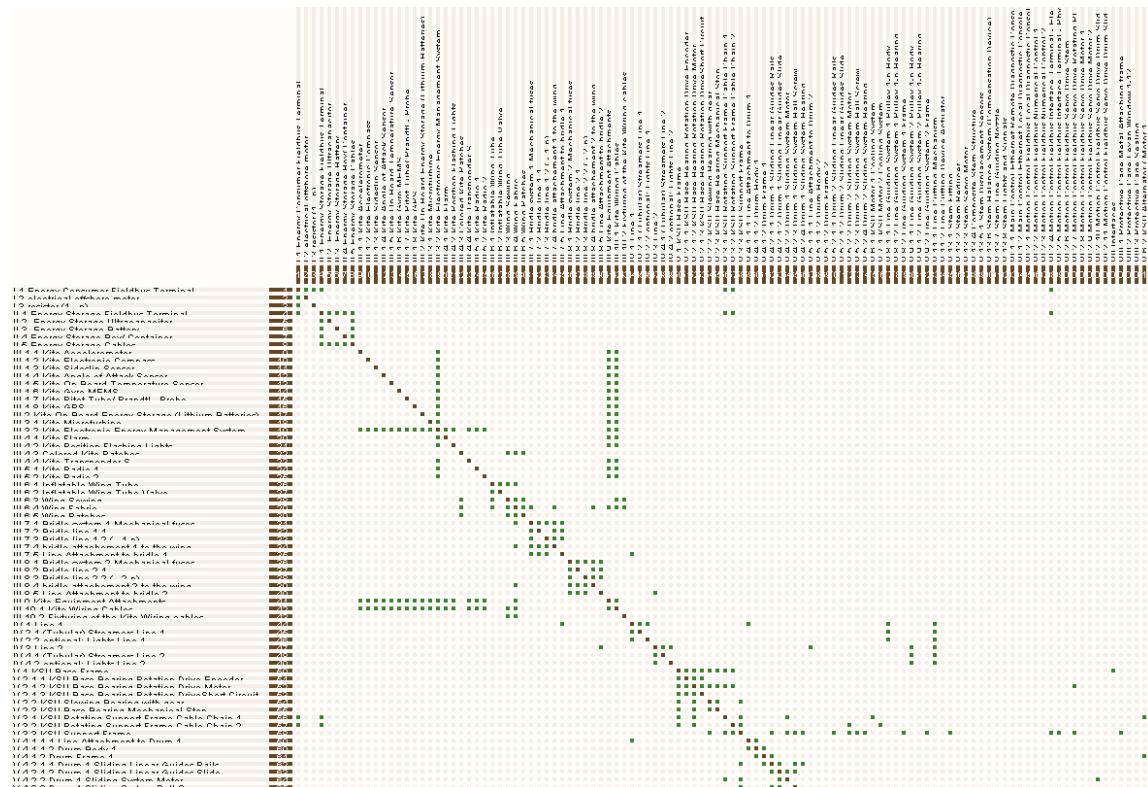


Figure 37: Part of S_C (Components-Components-Matrix)

During the process of filling the S_C -Matrix, the partners were forced to have a very detailed look into the physical interrelations of the KitVes system, as they had to point out clearly the contact points of each component to the surrounding components. Already at this point, DeCoDe helped to improve the system, as for example at the beginning it was not yet clear how the electronic equipment aboard of the kite would be fixed – and therefore how they would have physical contact. As the kite and the electronic equipment were to be developed by different partners, they were not aware of this problem before. They only noticed this gap during the discussion over the S_C -Matrix, and were then able to implement a solution for this by including a sort of equipment pocket. Furthermore, if single components have to be switched during the development, it can easily be determined which further components are influenced by these changes.

Having finished the S_C -Matrix, the S_{FC} -Matrix followed, which represents the dependencies of components and functions. To be more specific, the question that needs

to be asked while filling this matrix was “Which component realizes which function?”. Part of the resulting matrix is shown in Figure 38.

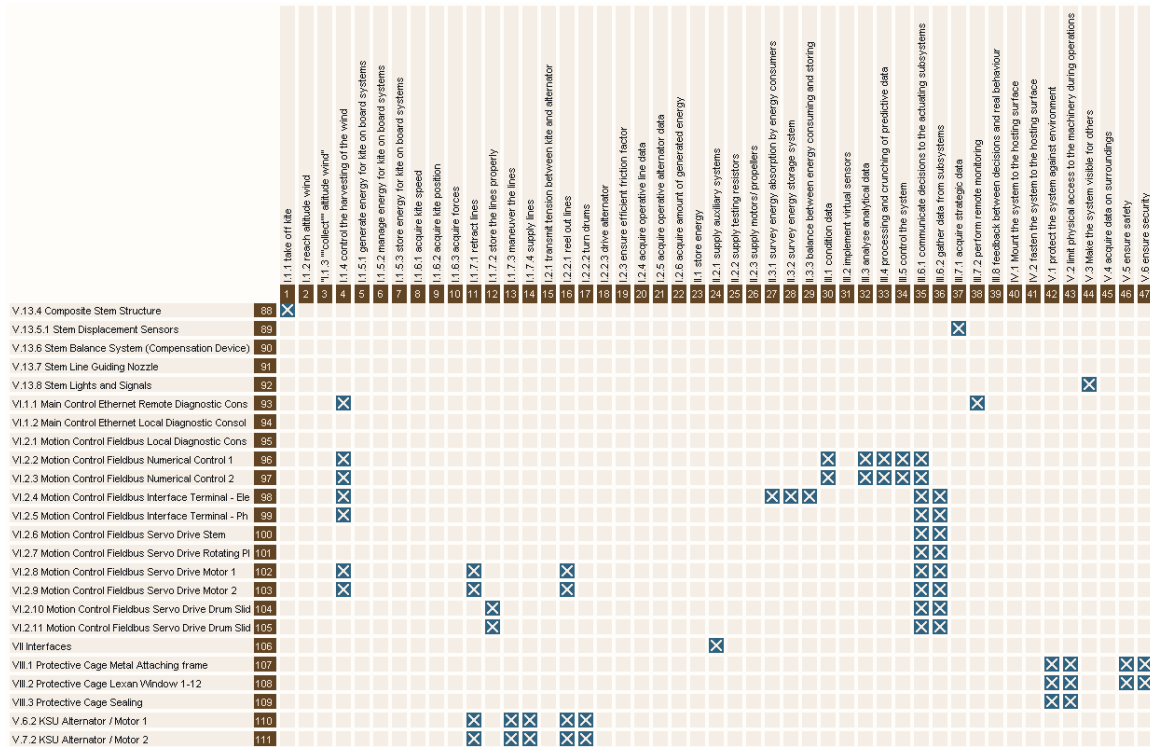


Figure 38: Part of $S_{F,C}$ (Components-Functions-Matrix)

Similar to the $S_{F,C}$ -Matrix, the $S_{C,P}$ -Matrix has been filled, whereas here the underlying question was “Which process uses which component?”.

Using the $S_{F,C}$ -Matrix and the $S_{C,P}$ -Matrix, a first draft of the $S_{P,F}$ -Matrix can be derived, showing the interdependencies of functions and processes, answering the question “Which process realizes which function?”. This derived matrix has then to be analyzed thoroughly, using the chance of detecting faulty or illogical interrelations as well as to add further dependencies, drawing conclusions for the underlying matrices as well.

Following this procedure, further matrices can be filled or derived, and in the furthering be analyzed. Besides those matrices, we can as well derive a full system graph, showing the interdependencies between all the KitVes elements. This graph is shown in Figure 39. It contains the elements for the components, functions and processes views and their interrelations.

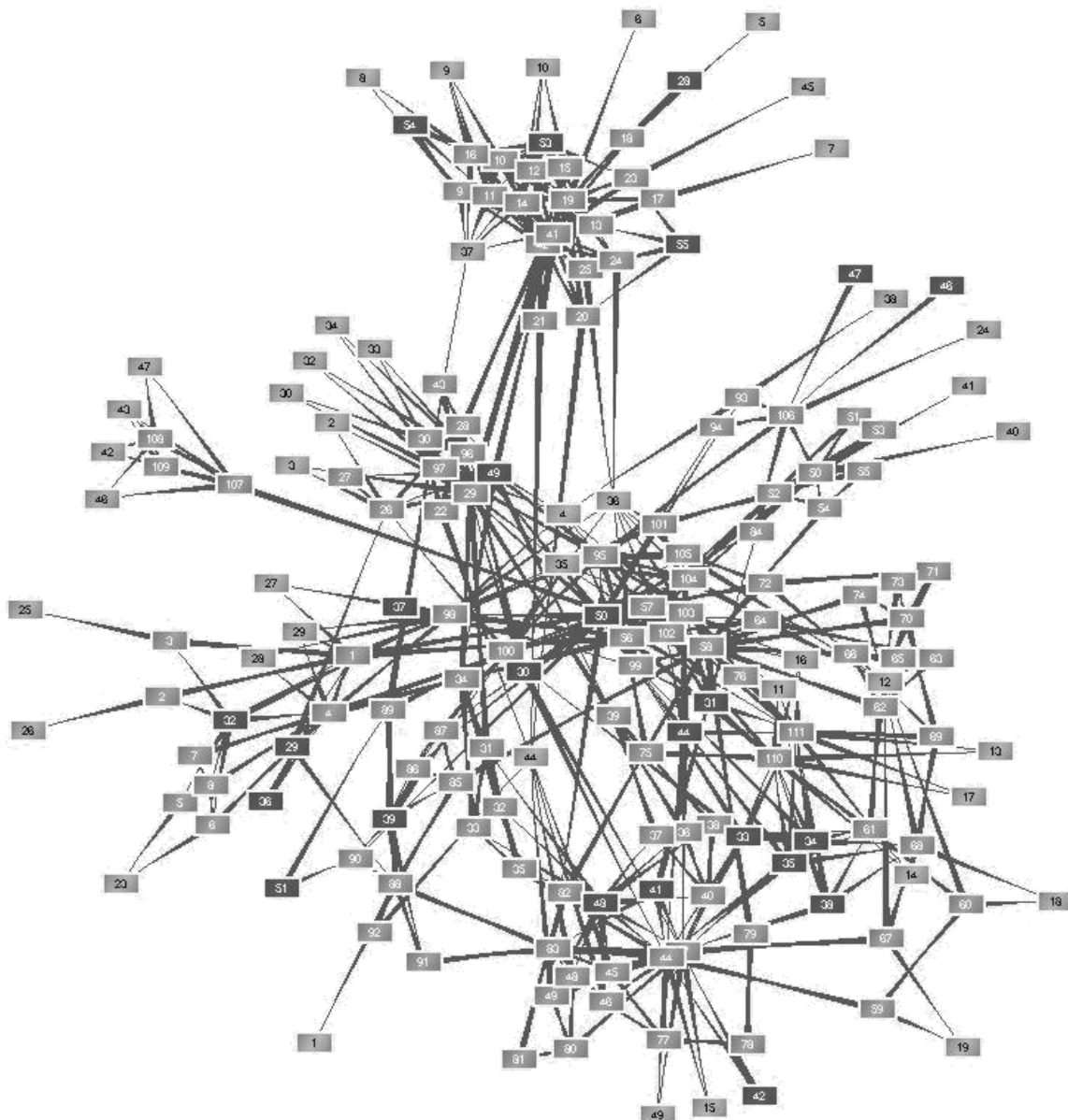


Figure 39: Interdependencies Graph

In the furthering, we can use the matrices respectively graphs to find peculiar elements and interrelations for the further analysis. This analysis, enabled by the combination of DeCoDe with several methods of quality engineering and reliability, is explained in the next chapter.

DeCoDe+X in KitVes

As mentioned before, ProQ had to perform several quality and reliability methods within the KitVes project, e.g. RBD (Reliability Block Diagram), FTA (Fault Tree Analysis) and FMECA (Failure Mode, Effects and Criticality Analysis). The methods will be presented briefly in the following, referring to exemplary literature sources.

- The FMEA (Failure Mode and Effects Analysis) is a systematic analytical tool to show possible failures of a product in the early stages of the development, aiming at the early identification of failures, their causes, their results and the possibilities of detection. By evaluating the probability of occurrence and detection as well as the severity of the failure, the risk priority number (RPN) can be calculated, enabling the comparison and prioritisation of failures (IEC60812 2006).

In addition to the FMEA, the FMECA (Failure Mode, Effects and Criticality Analysis) includes the criticality of a failure as the effect of redundant components within the calculation of the RPN. Here, the quantitative and the qualitative FMECA are differentiated (IEC60812 2006, Head 2006). The quantitative FMECA takes into account the failure rate of the components, thus is used if precise data already exists. If only imprecise or no data at all exists, the qualitative FMECA is used.

- The RBD (Reliability Block Diagram) shows the interconnection of the components based on the functioning of a technical system, in which the individual components are represented by rectangles. The central question of the RBD is: "What components must function so that the system works?" From the RBD, a Fault Tree can be derived (see below) (Biolini 2010). The RBD is composed of two basic system structures: serial and parallel structures. In a serial structure, all components need to work in order to ensure a working system. In a parallel structure only one of the components has to be intact, so that the system still works.
- The Fault Tree Analysis (FTA) aims to identify and investigate the factors that may lead to a specified main event (failure). This is shown graphically in a fault tree, basing on standard symbols of the Boolean algebra (c.f. IEC61025 2007).

DeCoDe+FMECA

In the context of the FMECA, DeCoDe supports the implementation of the methods through the component, process and functional structure as well as the matrices that include the components. Since it is not possible to perform a FMECA in complex

systems for all components - because of the large number of different components – the DeCoDe matrices can be used to identify critical elements, which are mainly components. Thus, for example, from the product of active sum and passive sum of components, i.e. the number of directed links from and to other elements, the criticality of a component can be derived by trend. Due to this possibility to prioritize, the effort for the determination of relevant components can be minimized. Moreover, the matrices support the implementation of the FMECA by providing information on further components and processes that are affected by occurring failures, using the component-component matrix and the component-process matrix and thus what functions are no longer feasible (components-function matrix).

The RPN and possible changes of components or processes (such as preventive maintenance or additional detection processes) are results of the FMECA. These results – the FMECA output – are then integrated within the system model. Within DeCoDe, the changed elements are labelled <Element'>.

Within KitVes, the FMECA is used for the identification of potential failures as well as for the deduction of suitable counter measures. For example, with the help of the FMECA, one simple and cost-efficient measure (amongst others) could be identified to screen the gradual dismantling of the connection between kite and line: The parallel line endings will both be marked at the same point, and these markings will be compared ahead of every start. A solution based on measurement technique would not have been suitable for the prototype, due to high costs and development effort.

DeCoDe+RBD/FTA

Due to their relation to Boolean algebra, RBD and FTA are considered together, since they regard the system once positive and once in negative logic. The representation of components for the realization of functions is supported by DeCoDe. Due to the complexity of the system and the existence of critical and risky processes, partial system processes are considered for the RBD and the FTA. For example, the process "Usage" is seen as critical to the success of KitVes system, as in critical conditions or in case of failures it is likely to result in far-reaching consequences that go beyond a temporary dysfunction of the system. To this end, various scenarios have been created in DeCoDe. To go through these processes successfully, functions are implemented by embedded components.

The components that are needed for the processes relevant for a scenario are used as input for RBD and FTA. Thus, DeCoDe supports and comprehensibly documents the selection of components by the component-process matrix and the component function matrix (Müller 2009). The implementation of the method then generates the attribution of components and processes, indicating the importance of individual components due to their structural arrangement in the system or because of their failure behaviour. Thus, they enable an additional attribution of components and interrelations, and point to fail-related vulnerabilities of the system. At the same time, processes can be assessed for their feasibility in context with the component assembly. The combination of RBD and FTA data with DeCoDe is part of current research. In principle, for different scenarios - such as the landing of the kite in normal and in emergency processes – the integrated components are to be pointed out and analyzed by FTA or RBD. In this way, lessons can be learned about whether the system can react to faults or failures by bringing the whole system to a safe condition, which excludes any risk.

Conclusion

During the implementation of DeCoDe within KitVes, it became clear that the success of the method strongly depends on the quality of the data that is maintained into the model.

Furthermore, the applied methods of technical reliability and risk reduction can be significantly improved in their efficiency and effectiveness when they exchange information through the DeCoDe+X approach as a system model, serving to systematize the methods and the optimization of the system description.

Within the KitVes project, these approaches are currently being tested. The aim must be to relieve the developer, to generate valid data and to document the system modeling in a comprehensible way.

By combining the methods of technical reliability by DeCoDe+X, a systematic, interdisciplinary description of the system is made possible, which in turn provides the desired structured, standardized input and output for the methods. Thus, a linkage of methods is made possible, and the effectiveness of the methods used increases, so that the system is not described again and again. This way, the change of the system can be made traceable. The completion of this approach is subject of current and future projects.

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A Contingency Theory interpretation of Quality based performance measurements and practices in service sector SMEs

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Introduction

Increasingly performance measurement is being seen as an emergent sub-discipline within operations management (Beasley and Thorpe, 2002) with commensurate development of theory (Garengo et al, 2005; Sousa and Voss, 2008) and practice (Johnston and Pongatichat, 2008; Martin-Pena and Diaz-Garrido, 2008). However existing studies are mainly predicated on the assumptions of large manufacturing organisations with a relative paucity of SME based studies (Garengo et al, 2005; McAdam et al, 2008). The literature reflects a paucity of studies on performance measurement in SMEs (Garengo and Bititci, 2007) ; Raymond and Croteau, 2009) and a representation of SMEs as scalar versions of large organisations or “little big organisations” with attendant assumptions. For example some implementation based performance measurement studies in SMEs use the term “Performance Measurement Systems”, which, as indicated by Garengo et al (2005) and Johnston and Pongarichat (2008) fails to recognise the informal and broader approaches to performance measurement practices adopted within SMEs. It is suggested that further research is needed to view an SME as a phenomena in its own right and that the focus should be on what Garengo et al (2005) refers to as “performance measurement practices”.

Within the performance measurement literature there is no dominant or overarching theoretical framework where the diversity of performance measurement practices adopted and applied by organisations has led to the development of the need for contingency based theoretical approaches (Sousa and Voss, 2008; Jusoh and Parnell, 2008), where performance measurement practices are viewed as contingent upon a range of contingency variables. This approach is consistent with configuration-based studies where a configuration is a constellation of conceptually distinct characteristics

that occur together (Nair and Boulton, 2008) The contingency approach is useful in exploring performance measurement practices in SMEs where there tends to be a focus on what works in practice (Verreynne, 2006) and a lack of ideology (Jarzabkowski and Spee, 2009). The mutual shaping of theoretical and practice based representations in contingency based studies of performance measurement practices in SMEs can help in avoiding a uni-dimensional understanding of the phenomena under consideration and allow for a richer and deeper interpretation than that of a single theoretical concept being applied (Johnston and Pongtichat, 2008).

To help in avoiding large organisation assumptions being transferred over to performance measurement studies in SMEs there is a need to move outside the manufacturing sector. The majority of performance measurement studies are based in the large manufacturing sector and there is a problem with the reification of findings and the subsequent application to other sectors and situations without a proper contextual critique (McAdam et al, 2008), which is consistent with Hultman and Shaw's (2003) reference to the lack of research in service based SMEs. It is suggested that studies on service sector SMEs will provide a two fold contribution; namely addressing the paucity of studies on performance measurement in service sector SMEs and also in helping to avoid the dominance of the large manufacturing operating assumptions within performance measurement.. Machuca et al (2006) suggests that there are two approaches to studying operations management issues in service sector companies. First, the service sector is treated as being totally unique, and second, that service sector organisations can be probed using a "service operations management" (SOM) viewpoint. Throughout this paper the service operations viewpoint is adopted where Machuca et al (2006) and Heineke and Davis (2006) suggest that such an approach is consistent with viewing performance measurement as a sub-discipline within operations management and allowing for meaningful comparisons and contrast to be made; whereas the former approach fails to fully recognise the operations nature of performance measurement.

Overall this discussion leads to the aim of the paper which is to explore the development and implementation of performance measurement practices in service based SMEs during a growth phase using a contingency approach. The achievement of this aim will lead to a contribution to theory development for performance measurement in service-based SMEs through the contingency approach, where Machuca et al (2006) suggests there is a need for more research in an operations management context and where SOM suggests less structured and more cross functional activity as is the case in service based SMEs. Moreover SME performance measurement practices can be

appraised in terms of relevance and fit with the organisations's direction and environment. The specification of a growth phase is included based on findings by Garengo and Bititci (2007) in relation to the lifecycle model of growth, which show that a growth phase can lead to increased organisational scrutiny of the relevance of performance management practices within SMEs due to changing strategic intent and the redundancy of existing measures (Johnston and Pongatichat, 2008).

Performance measurement and Contingency theory

Contingency theory has emerged as a lens for viewing and interpreting operations management practices (Sousa and Voss, 2008). These practices, including that of performance measurement practices, have proliferated under the banner of best practices (Raymond and Bergeron, 2008). However ensuing critical perspective literature has emphasised context and questioned the universality of best practice applications (Bititci et al, 2006; Sousa and Voss, 2008). This contextual emphasis, and the lack of an overarching theory within operations management and performance measurement (Raymond and Bergeron, 2008), has led to an evaluation of contingency theory as a means for developing more effective conceptual foundations and evaluation of promising practices for specific contextual application.

Essentially contingency theory, in relation to the development of performance measurement practices implies that a number of contingency factors, as defined by contingency variables (CVs), which can only be changed in the long term and with considerable effort (Sousa and Voss, 2008), and are related to performance measurement practices through a "fit" process (Johnston and Pongatichat, 2008), (Figure 1).

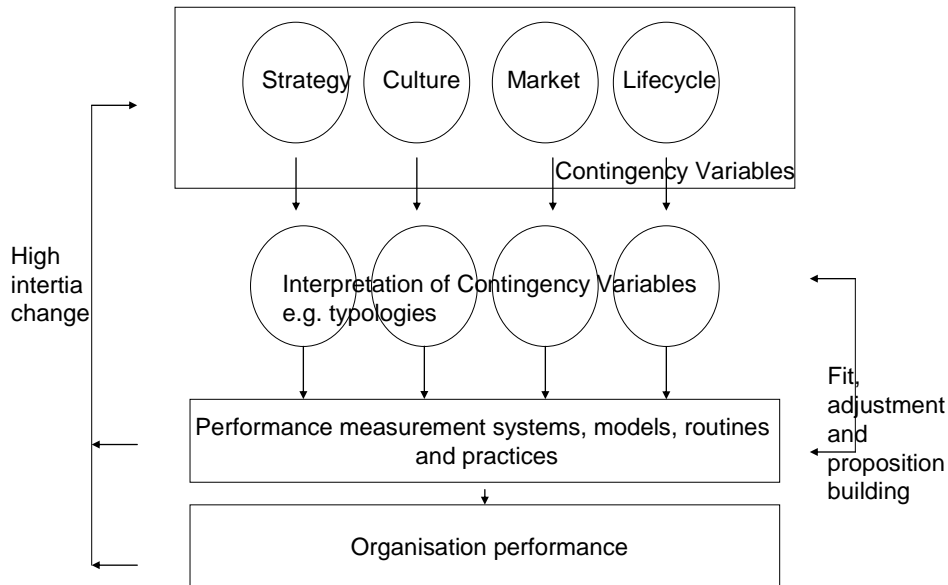


Figure 1 – Contingency framework

A set of contingency factors should be interdisciplinary in nature (Langfield-Smith, 1997) and hence will cover the wide and eclectic range of performance measurement practices (Bititci et al, 2006). Contingency theory implies that changes to the contingency factors for performance measurement due to outside influences leads to the need for realignment of the performance measurement practices through a process of fit or realignment (Figure 1). The underlying assumption is that contingency factors need to be derived for the context under consideration (Johnston and Pongarichat, 2008) and that bundles of operational practices (in this case performance measurement practices) should be dependant on changes in these factors through the fit process (Sousa and Voss, 2008). Hence, the concept of universal best practices, that are considered relatively independent of context, is questioned; rather it is suggested that the development of performance measurement practices, consistent with that of Bititci et al (2006), should be considered contextual and based on changes within the organisation across a range of contingency factors.

The process for applying contingency theory to performance measurement (Figure 1), consistent with that of Langfield-Smith (1997), is to first determine the contingency variables. Second, conceptual representation of each of these contingency variables is defined for determining subsequent influence on performance measurement practices. Third, the process of contingent fit between the contingency variables and the performance measurement practices is examined and represented in a set of loosely

organised propositions which can be further refined in future studies (Raymond and Croteau, 2009).

The generic rules from the literature for selecting contingency variables are that they should be interdisciplinary (Langfield-Smith, 1997), relatively independent and cover the bases of outside influence on performance measurement practices (Sousa and Voss, 2008). They should be exogenous to the manager responsible for the implementation practices (Bititci et al, 2006)) and should only be influenced to a very limited degree (i.e. high inertia) by changes in the implementation practices (Martin-Pena and Diaz-Garrido, 2008) (Figure 1). Overall one should be parsimonious in selecting CVs to avoid overt interdependencies (Martin-Pena and Diaz-Garrido, 2008; Sousa and Voss, 2008). For the current study Bititci et al (2006) and Raymond and Bergeron's (2008) set of contingency variables for performance measurement studies in SMEs were initially adopted. This list of CVs were then modified to reflect the SME service sector context of the current study, including the addition of new CVs to reflect the different context. Table 1 lists and explains the CVs along with supporting literature sources. This list of contingency variables is not exhaustive but is considered sufficient to enable a meaningful exploration of the study aim. Raymond and Bergeron (2008) and Garengo et al (2005, 2007) suggest that this parsimonious approach can help in identifying the affects of the both the CVs identified and in identifying the need for further CVs due to unexplained affects on the performance measurement implementation practices.

Table 1 – Contingency Variables

Contingent Variable	Supporting literature	Explanation
Strategy	Raymond and Bergeron (2008); Sousa and Voss (2008); Heineke and Davis (2006); Machuca et al (2006); Garengo and Bititci (2007); Jung et al (2009); Garengo et al, 2005); Reje (2004); Langfield-Smith (1997);	Strategic direction within the organisation is viewed as a contingent variable which affects the implementation of performance management practices
Culture	Sousa and Voss (2008); Garengo and Bititci (2007); Garengo et al, 2005); Reje (2004); Richie and Brindley (2005); Bititci et al (2004 2006)	Prevailing organisation culture is considered to be a contingent variable which affects the implementation of performance management practices
Customer Focus	Heineke and Davis (2006);	Within service based

	Hultman and Shaw (2003); O'Dwyer et al (2009); Garengo et al, 2005); Silvestro et al (1992); Silvestro (2001)	SMEs customer focus is viewed as a contingent variable which affects the implementation of performance management practices
Lifecycle	Raymond and Bergeron (2008); Garengo et al (2007); McAdam et al (2008)	Organisation lifecycle positioning is considered as a contingent variable which affects the implementation of performance management practices

As shown in Table 1 strategy is identified as a CV for a number of studies in SMEs. A number of existing studies of strategy as a contingency variable in performance measurement studies mainly uses the established Miles and Snow (1978) typology or variants thereof (O'Regan and Ghobadian, 2006; Raymond and Bergeron, 2008; Langfield-Smith, 1997). This typology (Figure 2) helps to represent strategic intent as a starting point for alignment with operational practices consistent with Johnston and Pongatichat (2008).

Raymond and Bergeron's (2008) and Sousa and Voss's (2008) observe that typologies to contextualise contingency variables tend to be borrowed from a range of fields and create a better understanding of strategy and common language for those involved in strategy and performance measurement. The four different categories of the Miles and Snow (1978) typology are: Defender – emphasis on efficiency and cost reduction to maintain existing markets; Analysers - simultaneous focus on maintaining and growing existing markets while seeking out new markets to sustain and increase growth; Prospectors - a focus on new service and market opportunities to drive growth as opposed to the duality of the Analysers; Reactor – no clear strategy with a tendency to react to market changes in a lag manner. Within the typology (Figure 2) there is support for the concept of equifinality within contingency theory; namely that the same outcomes can be achieved in multiple ways with different transformation processes (Jusoh and Parnell, 2008).

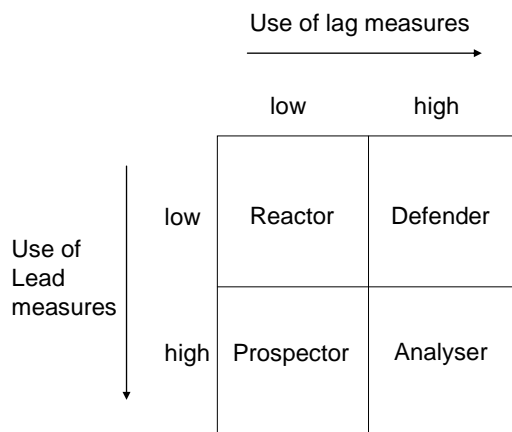


Figure 2 – Strategy Typology (Adapted from Miles and Snow, 1978)

The adoption of the service operations view point (Machuca et al, 2006; Heineke and Davis, 2006) allows for the application of this approach to service based SMEs. However O'Dwyer et al (2009) and Garengo et al (2005) suggest that any expression of strategy in service based SMEs may be formal or informal within SMEs and that informality should not be interpreted as paucity thereof. Verreyne (2006) and Jarzabkowski and Spee (2009) suggest that strategy-as-practice and emergent approaches to strategy, which are often used by SMEs, tend to be more informal. It is therefore suggested that each of the four elements of the Miles and Snow (1978) typology may be expressed on a formal – informal continuum that can be interpreted by managers and affect the subsequent development and implementation of performance measurement practices. Therefore a working proposition for the empirical research is:

Proposition 1: An organisation's approach to strategy as articulated in the typology of Figure 2, and the level of informality or formality by which it is expressed, will affect the development and implementation of performance measurement practices.

Table 1 also shows that organisational lifecycle is used as a CV following McAdam et al's (2008) and Garengo et al's (2007) studies of lifecycle effects on performance measurement. These studies, along that of Nair and Boulton (2008) suggest that using lifecycle, as distinct from organisational size (i.e. number of employees), or organisational age, is more relevant as size and age may mask dynamic lifecycle and

growth effects (Raymond and Bergeron (2008). Reference to the life-cycle models (Greiner, 1972; Churchill and Lewis, 1983, Bessant et al, 2006) provides insights into the relevance of the transformational process and the management challenges to an SME. The lifecycle models typically incorporates five stages. (Greiner, 1972; Churchill and Lewis, 1983). In a review of lifecycle model studies, Beverland and Lockshin (2001) indicates that the lifecycle stage model is a useful and robust representation in terms of being a “roadmap” and “timetable” for small firm development and growth. At each stage the organisation undergoes changes in management practices and style, organisational structure and degree of informality of systems and strategy (Greiner, 1972; Churchill and Lewis, 1983).

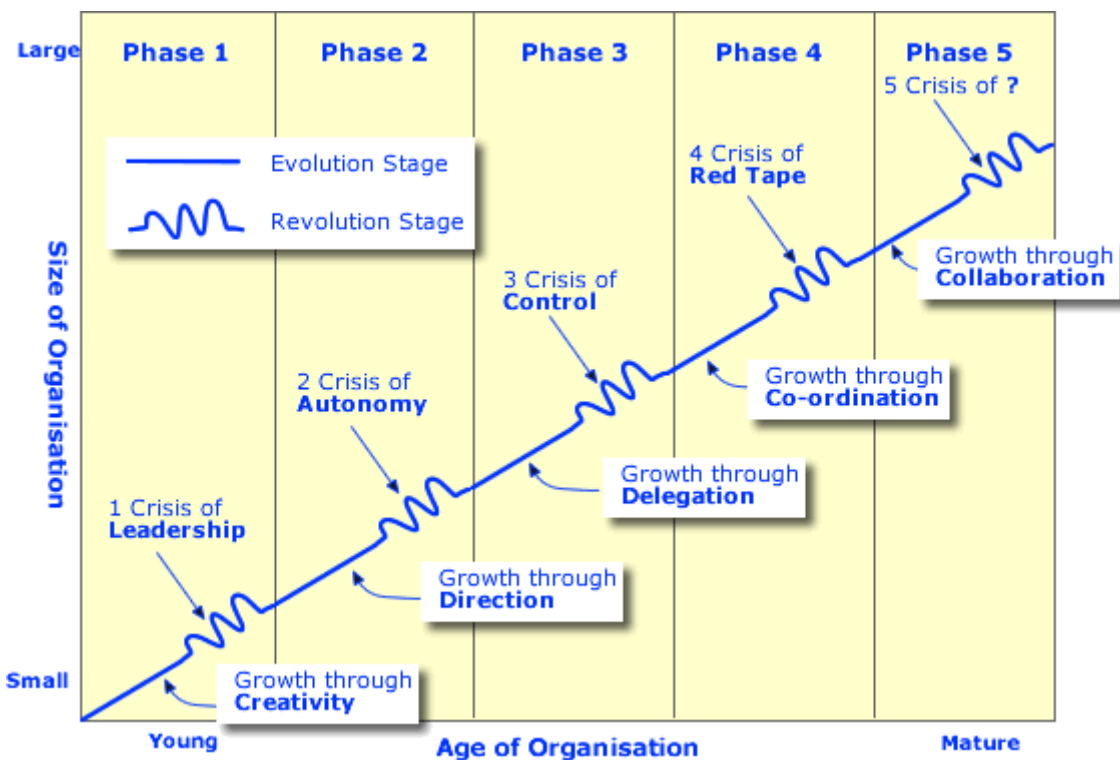


Figure 3 – Greiner lifecycle model (adapted from Greiner, 1972)

The Greiner lifecycle model (Figure 2) was chosen for the current study as critique by Beverland and Lockshin (2001) show that Greiner’s five stages are reflected in most lifecycle models and are sufficiently adaptable to cover a wide range of SME studies with different periods of growth. Greiner (1972) suggests that organizations go through five stages of growth: Phase One - growth through creativity; the founders go through a preparatory search phase of identifying matching resources and opportunities; Phase

Two - growth through direction; systems and procedures now provide direction through a functional structure; Phase Three - growth through delegation; decentralised decision making gives more autonomy; Phase Four - growth through co-ordination and monitoring from the centre of the organisation allows the decision makers to operate freely but the organisation maintains overall control; Phase Five - growth through collaboration means working together in small teams to accomplish tasks and using a wide range on industry networks. This model was also used by Garengo et al (2007) in studies of lifecycle effects on performance measurement in SMEs. The model also reflects an increasing level of formality in an SME's modus operandi as it progresses through the lifecycle stages (Figure 3). Based on these observations the Greiner's (1972) lifecycle model was chosen to interpret the empirical findings using the working proposition:

Proposition 3: An organisation's development and implementation of performance measurement practices will be affected by their respective lifecycle stage as represented by the typology shown in Figure 3.

The inclusion of Customer Focus as a CV (Table 1) reflects the service context of the current study and is consistent with that of Hultman and Shaw (2003) and O'Dwyer et al (2009) in studies of service based SMEs. These studies reflects the customer emphasis within service based SMEs consistent with Heineke and Davis's (2006) statement of the need for customer fit within SOM studies. Customer Focus is omitted from existing contingency studies on manufacturing SMEs where changes in customer requirements may be less direct subsumed within other contingency variables (Silvestro, 2001). Silvestro et al (1992) refer to as the need to appraise performance related activities over time in relation to customer needs and classifications and that performance measurement must be customer derived. supporting the role of customer focus as a contingency variable in the current study. Ng et al (2007) and Silvestro (1992, 2001) suggest a typology for customer focus of three key elements, namely: Professional Services; Service Shops and Mass Services (Figure 4).

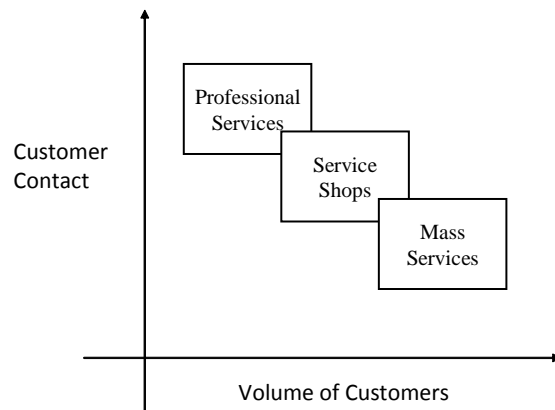


Figure 4 - Customer-focus typology

These categories relate to the levels of customer contact and customer numbers. Professional Services have a high degree of customer contact with high elements of customisation and process and front office operations and low numbers or volume of customers. Mass Customisation types have high numbers or volume of customers but low contact time, customisation and an emphasis on back office operations. Service Shops have medium levels of customer contact, customer numbers, and customisation. Silvestro (2001) suggests that all aspects of customer focus in service based organisations must address the performance measurement issues associated with the intangible nature of many service operations. Hultman and Shaw's (2003) study of service SMEs and performance measurement suggest that this issue of tangibility will also emphasise the transactional – relational response to a customer focus typology where transactional orientated actions tend to be used more where there are larger customer numbers and less customer contact time for any given customer. Transactional approaches tend to use traditional 4 P style approaches and relational covers the development of in depth relationships at personal and organisational levels including formal and informal networking (O'Dwyer et al, 2009). It is therefore suggested that the customer focus typology, as shown in Figure 4 should consider both transactional and relational issues in interpreting performance measurement in service based SME, leading to the proposition:

Proposition 4: An organisations approach to customer focus as represented by the typology of Figure 4 will influence its development and implementation of performance measurement practices including transactional and relational approaches.

Sousa and Voss (2008) and Bititci et al's (2004, 2006) studies of organisational culture and performance measurement state that from a contingency perspective organisation culture has an impact on performance measurement. Continuing with the concept of "borrowing" from other fields (Sousa and Voss, 2008), a comparison the Handy (1985), Ritchie and Brindley's (2005) review and Bititci et al's (2006) work on culture and performance it is suggested that Handy's (1985) culture typology has obtained sufficient credibility from these critiques as being sufficient in scope for the current study.

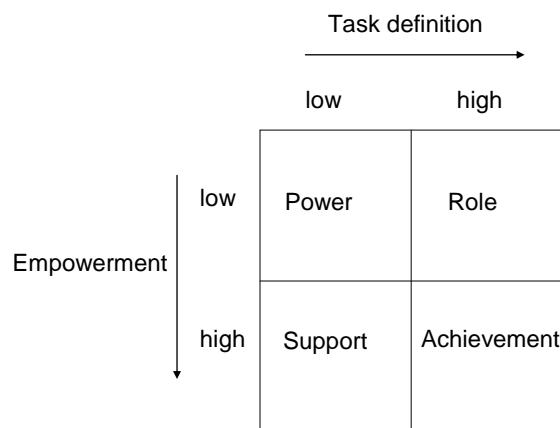


Figure 5 – Culture typology

The typology as shown in Figure 5 has four elements: Role culture: there is a focus on procedure, hierarchy and status; Power culture: dominant and authoritative person in charge with mainly informal or tacit rules; Achievement culture: task and purpose orientated approach with a can-do participatory orientation; Support culture: empowered environment with high levels of intrinsic motivation. As shown by Hultman and Shaw (2003) and O'Dwyer et al (2009) the application of the different elements of this typology is likely to have a differential effect on performance measurement in service based SMEs. The working proposition at this stage is summarised as:

Proposition 5: The prevailing culture within a service based SME as represented by the typology of Figure 5 will influence the implementation of performance measurement practices.

The issue of fit

Fit is based on the deviation between the CVs, as represented in typologies of ideal type, and the relevant practices within the organisation (Johnston and Pongatichat, 2008). It is a dynamic process of alignment as over time the level of fit decreases unless there is an intervention (Raymond and Croteau, 2009; O'Regan and Ghobadian, 2006) which is referred to as "the dynamic process of adjusting to environmental change and uncertainty" (Miles and Snow, 1978, p. 3). Therefore, as stated in Raymond and Bergeron's (2008) study of contingency in SMEs, "alignment cannot be prescribed in a universal fashion". Sousa and Voss's (2008) review refers to the idea of "quasi-fit" to allow for other theoretical considerations such as strategic choice theory and the Resource Based View to explain aspects of fit or miss-fit. Criteria for evaluating the level of fit are manager's degree of recognition of the need for fit; recognition of the affects of misalignment; ability to cope with changes in CVs and the effectiveness of alignment skills within the organisation (O'Regan and Ghobadian, 2006; Johnston and Pongarichat, 2008). As shown by Jung et al (2009), Jusoh and Parnell (2008), Johnston and Pongatichat (2008) and Garengo et al (2007) organisations often use a range of quality or business improvement tools such as the TQM, ISO 9001; BEM, BSC and the Performance Prism to help with the process of fit between CVs and performance measurement practices, where Garengo et al (2005) states that the establishment of a quality culture in SMEs has a significant effect on performance measures and practices. Verreynne (2006) concludes that the use of these approaches by SMEs often lacks sufficient depth and Machuca et al (2006) suggests there is a need for more research within this area in a service context. Moreover, Sousa and Voss (2008) suggest that the selection and role of these approaches needs to be clarified within organisations seeking to improve fit and that studies should thus focus on mature or established practices used by organisations such as those identified by organisations at advanced stages of the "quality journey" (Dale and Lascelles, 1997). By using these criteria and considering the role and application of these tools, the fit between performance measurement practices and each of the CVs can be explored leading to performance measurement practices being placed in Sousa and Voss's (2008) framework. This framework (Figure 6) uses two dimensions in relation to fit for the implementation of performance measurement practices, namely performance and degree of use.

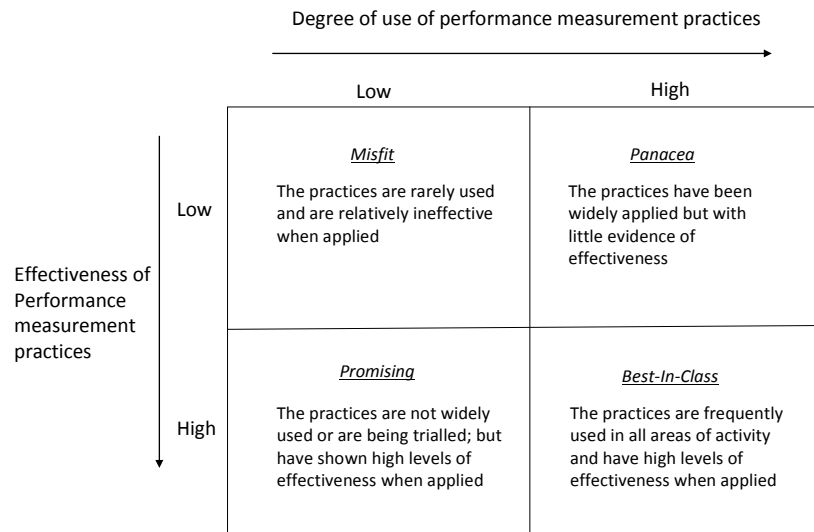


Figure 6 – Classification of performance measures and practices in relation to fit (adapted from Sousa and Voss, 2008).

The four classifications are Misfit: the practices are rarely used and are relatively ineffective when applied; Best-in-Class: the practices are frequently used in all operations and have high levels of effectiveness when applied; Promising: the practices are not widely used or are being trialled, but have shown high levels of effectiveness when used; Panacea: practices that have been widely applied but with little evidence of effectiveness. Although this framework helps to classify fit it does not readily explain the dynamics of fit. It is suggested that legitimacy theory may help where Weber (1947), Suchman (1995) and Johnson (2004) have developed a multi level approach to legitimation theory in organisations for the introduction of new knowledge or methods (i.e. new or modified performance measures and practices in the current context). Key constructs within this approach are normative evaluation and legitimisation. Normative evaluation is an innate resistive force and is based on comparing new knowledge against existing organisational norms, routines and practices (Alvesson and Deetz, 2002). Finnegan (2000) states that manager's and employee's views of organisational values and practices are encouraged to be normative. Suchman (1995) suggests that a cyclical pattern is created where normative evaluation takes place concurrently with attempts at legitimising new knowledge. Legitimation goes beyond evaluation and is formative in nature involving debate, opinion forming and critical reflection relating to the new knowledge (Alvesson and Willmott, 1996). Thus, as suggested by Suchman (1995) attempts to introduce new or modified performance measures and practices can be

viewed from a dynamic perspective as a cyclical process where legitimising forces, or attempts at establishing validity, constantly iterate with normative evaluation resisters (Johnson, 2004; Suchman, 1995).

This discussion gives rise to three interrelated research questions:

RQ1: What is the relationship and level of fit between the contingency variables and the development and implementation of performance measurement practices in service based SMEs?

RQ2: How is Quality Management models, routines and practices used in the implementation of performance measurement practices within service based SMEs?

RQ3: How can the working propositions (1-4) be further refined based on the findings from RQ2?

Research Methodology

Sousa and Voss (2008) suggest the need for theory building methodologies such as case research in contingency studies to build explanations and engage in a sense making process. This view is supported by both Yin (2003) and Eisenhardt (1989, 1991) who suggest the “how” and “what” style of the research questions are suited to this type of interpretative research philosophy to enable in-depth and cumulative theory building inquiry. In this approach multiple sources of data are embraced and analysed in a recursive sense making process in which results and discussion are compared and contrasted as suggested by Yin (2003) until a saturated level of understanding is achieved. This research philosophy capitalises on the rich practitioner based knowledge discourse of contingency studies and performance measurement practices (Garengo et al, 2007; Gunasekaran et al, 2001).

The chosen research methodology was that of multiple Case studies which is suited to the interpretive research approach (Yin, 2003; Eisenhardt, 1991). Heinske and Davis (2006) suggest that the service operations management perspective views each service industry as having unique operations leading to the need for a multiple case approach. Five Case organizations, as shown in Table 2, were selected to provide a wide range of companies and perspectives, as opposed to a single sector study, which created a richness through their inter and intra variation, as suggested Remenyi et al (1998). Each of the organizations chosen (as shown in Table 2) were service based SMEs which were experiencing growth based on the definition of growth at different stages of the lifecycle model. The growth criterion was chosen as SMEs faced with the challenges of growth tend to re-examine the assumptions and practices relating to their performance

measurement practices (Neely, 2005 Hayes et al, 2005, McAdam and Anderson-Gillespie 2008). The Cases selected as suitable were SMEs (EU SME guide (http://ec.europa.eu/enterprise_policy /sme_definition/index_en.htm)), and at least at the middle stages of the “quality journey” of Dale and Lascelles (1997) to address Sousa and Voss’s (2008) suggestion of looking at more mature approaches to get more meaningful results. The research process consisted of two stages.

Stage 1 - Scoping Meetings and identification of Cases

The SMEs were selected as being in a growth phase. Delmar et al, 2003 (cited by Dobbs and Hamilton, 2007) suggest that multiple measures should be used in defining a growth phase in relation to the lifecycle model. The selection of specific cases to meet the growth condition at different stages of the lifecycle model used a screening procedure which consisted of analysing documents and interviewing (n=20) people and stakeholders knowledgeable of potential candidates as suggested by Yin (2003). In particular help was obtained from the Government development and support agencies and The Centre for Competitiveness, (a private sector, not for profit, membership organisation endorsed by the Department of Enterprise, Trade and Investment).

Stage 2 – Interviews, focus groups and methods of analysis

For each case semi-structured interviews (n=9 for each case; 45 for all cases) were held with the Managing Director (or equivalent) and at least two other members of the management team who were most knowledgeable or responsible for each of the contingency variables and related performance measurement practices. The repeat interview technique was used with the interviewer sharing initial structuring for each preceding interview and attempts at proposition building with the interviewee at the next interview. The repeated interviews were supplemented with specific enquiries involving telephone calls, emails and document exchanges and enabled a relationship of trust and mutual exchange to be established (Remenyi et al, 1998). This developmental approach enabled the researchers to obtain reflective practitioner inputs as suggested by Yin (2003). All interviews were taped, transcribed and coded. Following the interviews focus groups (n=5) were held with each of the case organizations comprising on the Managing Director (or equivalent) and the management team where the entire research process and findings were reviewed with particular emphasis on apparently conflicting information, leading to further insights and developments as suggested by Remenyi et al (1998).

Other data sources included a range of organizational documents including each Case's BEM self assessment submission, company reports, Government reports, and minutes of meeting as suggested by Remenyi et al (1999).

Case summary

Case 1 (Hotel and Tourism). Although this business achieved only modest growth from 2007 to 2008, above average returns for industry sector measures have been realised. This business has developed substantially over the last few years ago in all areas of its activities.

Case 2 (Transport). This very profitable transport sector business has changed its business model to include an emergent "green" transport side to the business. The business is continues to grow.

Case 3 (Software development and licensing). This high growth company had a turnover in 2008 which was 183% higher than 2006. As a result of high marketing and research and development expenditure in 2008, profit levels for 2008 were significantly lower than 2007. The company continues to grow.

Case 4 (Construction services). This company has achieved significant growth (29% and 45%) for the last two years as well as increased profit margins due largely due to diversification into sustainable building services.

Case 5 (Business services). The company has achieved high growth over the last two years of 17% and 45% respectively, and has also increased its net profit before tax for the same period. For the first quarter of 2009, while others in the same sector suffered a 20% reduction in turnover, this business has continued to grow.

Table 2 – Case summaries

Case 1 – Hotel and Tourism	2006	2007	2008
Turnover	£2, 448,000	£2,743,000	£2,862,000
Net Profit before Tax	£144,000	£308,000	£270,000
Number of employees	54	54	54
Case 2 - Transport	2005	2006	2007
Turnover	£31,207,000	£34,545,000	£36,109,000
Net Profit before Tax	£11,574,000	£12,538,000	£13,603,000
Number of employees	208	196	197

Case 3 – Software and licensing	2006	2007	2008
Turnover	£1,200,000	£1,900,000	£2,200,000
Net Profit before Tax	Break even	£532,000	£88,000
Number of employees	22	28	35
Case 4 – Construction services	2006	2007	2008
Turnover	£2,700,000	£3,500,000	£5,100,000
Net Profit before Tax	£500,000	£850,000	£1,760,000
Number of employees	27	46	101
Case 5 – Business services	2006	2007	2008
Turnover	£2,800,000	£3,300,000	£4,800,000
Net Profit before Tax	£105,000	£175,000	£350,000
Number of employees	20	20	24

The method of analysis was similar to that used by Radnor and Boaden's (2004) in studying operations management issues using multiple case research data. First topics and categories were constructed from the interview transcripts under each of the four CVs. Second the findings were coded within tables. Third the findings were interpreted using the literature. Fourth the focus group data was used to add more depth to the findings, resolve anomalies, and add new findings.

Results and discussion

The results and discussion are combined, due to the Case-based and exploratory nature and interpretive case based approach to the research, as suggested by Yin (2003) and Simon et al (1996). The structure of this section is based on discussing the fit between the performance measurement practices and each of the CVs in relation to the research questions.

Table 3 – Case typology placings

	Strategy				Culture				Lifecycle				Customer Focus			
	D	P	A	R	Supp	Role	Power	Ach	S2	S3	S4	S5	PS	SS	MS	
Case 1 (Hotel and Tourism)	√					√						√		√		
Case 2 (Transport)			√				√		√					√		
Case 3 (Software and Liscensing)		√					√		√				√			

Case 4 (Construction services)			√		√						√		√			
Case 5 (Business services)		√						√		√				√		

Strategy

From the analysis in Table 3 and Figure 2 it is seen that Case 1 was in the highly competitive economy hotel and tourism sector and was thus focused on competitiveness and cost reductions using standardised operational procedures for room bookings and customer provision (e.g. room bookings and event management practices). To improve efficiency the organisation also had a high level of vertical integration with suppliers such as food materials and specialist event management functions. Potential new entrants were mainly economy based international hotel chains. These characteristics place Case 1 in the Defender category of Miles and Snow's typology (Table 3, Figure 2, 1978). Coupled with this strategic intent Case 1 had a number of performance measurement practices predicated on the use of quality management approaches including the Business Excellence Model, the Balanced Scorecard, Investors in People (IiP) and a service industry sector award model similar to the findings of Jusoh and Parnell (2008) and Garengo et al (2005). The organisation used an integrated version of the performance measurement criteria of the BEM and the Balanced Scorecard in a similar manner to that of McAdam et al (2008). The sector award performance measures were also covered in these criteria where the IiP criteria addressed employee development performance measures. However, even though the BEM results criteria and BSC criteria emphasis the use of lead performance measures in addition to traditional lag or financial performance measures (Jushoh and Parnell, 2008; Kaplan and Norton, 2001), there was a lack of use of lead performance measures in shaping performance measurement practices (such as the development of new service offerings based on market changes or employee training methods for analysing market changes) reflecting the defensive nature of the strategy which is consistent with the Defender strategic approach as shown in O'Regan and Ghobadian's (2006) strategy analysis of SMEs. Benchmarking practices were in-sector (i.e. hospitality) as opposed to innovation or out of sector benchmarking and led to efficiency savings rather than more radical innovation, consistent with Raymond and Bergeron's (2008) study in relation to Defenders. The growth within the organisation was driven by efficiency based practices and measures rather than lead based performance measurement practices. Although

none of the Cases were in the Reactor category O'Regan and Ghobadian (2008) and Langfield-Smith (1997) suggest that this category also tends to focus on lag based measures without a strategic set of practices based on lead performance measures.

Cases 2 and 4 were classified as being Analysers (Table 3, Figure 2) i.e. they had to simultaneously focus on maintaining and growing their existing markets while seeking out new markets to sustain and increase growth similar to that found by Jusoh and Parnell (2008) and Raymond and Croteau (2009) in relation to SME Analysers Case 2 focused on maintaining growth in their traditional transport services (e.g. road haulage) operations while seeking to develop new markets in terms of "green" based alternatives involving transport using green or renewable energy sources. Similarly Case 4 had a traditional focus on construction services such as design and build of traditional building developments but was also moving towards providing services for sustainable developments. This duality or "balance" (Raymond and Bergeron, 2008) was reflected in the performance measures and practices used by these cases. For example Case 2 used finance and process measures and practices which addressed the traditional side of the business such as financial measures (profit, turnover, sales, fixed and recurring costs), delivery time, load planning and scheduling. These measures were used to guide performance measurement practices such as budgeting, schedule planning, and load balancing (return and outward journeys). The development of the "green" market involved using lead measures such as carbon equivalents for operations, costs per alternative energy source and potential payload measures, which were incorporated into practices to scan for new technology, benchmarking emerging practices, and analysis of potential markets. In Case 4 these practices were also evident where they were driven by lead performance measures such as heat retention for new materials, cost saving practices in terms of waste generation and lifetime sustainability measures. Overall Cases 2 and 4 had high levels of flexibility to maintain both sets of markets conditions as found by Raymond and Croteau (2009) in relation to Analysers.

Case 3 and 5 were classified as Prospectors (Table 3; Figure 2) which reflected a focus on new service and market opportunities to drive growth as opposed to the duality of the Analysers (Jusoh and Parnell, 2008; Raymond and Bergeron, 2008). This focus was reflected in the predominance of lead performance measures and associated practices for these cases consistent with O'Regan and Ghobadian's (2006) findings for Prospectors. Case 3 which was based on software development and licensing had to design and offer new services to existing customers while seeking out new markets with these services and offerings. Typical lead performance measures related to innovation, which was mainly based on the Balanced Scorecard rather than the BEM (as found by

Jusoh and Parnell, 2008), were market trends, technology effectiveness, return on investment and training in new methods. These measures were reflected in practices such as out of sector benchmarking (in contrast to Defenders (O'Regan and Ghobadian, 2006), market scanning and investment decision making. Case 5 were similar to Case 3 in that their provision of business services had to seek out new services and markets to drive growth. This direction led to the use of lead performance measures such as numbers of new services developed, lifecycle of existing and anticipated services, which were reflected in similar practices to that found within Case 3 and studies of Prospectors by Raymond and Croteau (2009).

In relation to the dynamics of fit throughout the cases a continual process of change was observed at two levels in relation to fit. First there was a dynamic at an operational level which involved trying new performance measures and practices, developing modifications, and discarding old ones, in relation to strategic intent. Second a range of quality related methods and models were used in a continuously changing manner as the catalyst for the performance measures and practices (e.g. BEM, BSC, IIP, ISO – Jung et al, 2009). It is suggested that these dynamics can be interpreted using the multi level approach to legitimacy theory (legitimation theory of Weber (1947), Suchman (1995) and Johnson (2004)) where changes due to fit considerations need to be legitimised or successfully adopted at all levels. Using the key constructs within this approach of normative evaluation and legitimisation it is suggested that each case when seeking to align their performance measures and practices with the strategic intent of the organisation face innate resistive forces which are based on comparing new measures and practices against existing organisational norms, routines and practices (Alvesson and Deetz, 2002). Finnegan (2000) states that manager's and employee's views of organisational values and practices are encouraged to be normative or to maintain the status quo. This resistance was most noticeable in the Analyser category (Cases 2 and 4). Both of these cases were introducing new aspects to their business ("green" transport in Case 2 and sustainable building practices in Case 4). The forces resisting the development of the new performance measures and practices were twofold. First, employees did not see the need to change due to a lack of understanding of the new strategy where managers did not adequately communicate the change or train employees in the new methods required in a timely manner. Thus, a cyclical pattern is created (Suchman, 1995) where normative evaluation takes place concurrently with attempts at legitimising the performance measurement practices. Similarly, in Cases 2 and 4 belated efforts were made to improve the communication and introduce training based around the quality methods and models to drive lead performance measurement practices. However the previous use of these models had previously been that of

focusing on efficiency measures and practices and now they were being reconceptualised to address a drive towards more innovative approaches. Hence the legitimisation process was multilevel and time consuming (Suchman, 1995). What initially appeared to be a simple switch-over practice became a time consuming process which was formative in nature involving debate, opinion forming and critical reflection relating to the need for the new performance measures and practices (Alvesson and Willmott, 1996). In cases 1, 3 and 5 the respective Defender and Prospector categorisations had a more single focus than the duality of the Analysers as found by O'Regan and Ghobadian (2006). The resultant fit dynamic for these categories was therefore mainly at the operational level with an emphasis on changes to performance measures and practices with the use of the quality models and methods being relatively fixed in either an efficiency mode (Defender) or innovation or lead mode (prospector).

In appraising the classification of fit between the strategic focus and the performance measures and practices of the cases based on Figure 2 (Sousa and Voss, 2008), there was little evidence of Misfits or Panaceas. However as Cases 2 and 4 continue to grow the new side of their businesses there is a potential for old technology, market measures and practices to become redundant through the legitimisation process which ultimately could lead to Sousa and Voss's Panacea definition (widespread application of ineffective processes in relation to strategy). The promising practices category mainly covered practices using lead performance measures and practices, especially within the Prospector cases such as out of sector benchmarking and environmental scanning (Cases 3 and 5). However these practices were limited by their degree of use and also by the limited range of lead performance measures incorporated within these practices. The wider use of these practices depended on the speed of the legitimisation process in overcoming innate resistance (Leseure et al, 2004). For example Case 5 had a relatively limited range of lead based people development measures incorporated within their investment decision process and Case 3 had Case 2 used only a limited set of process innovation measures within their practices for evaluating new and emergent technology. The wider use of these practices depended on the speed of the legitimisation process in overcoming innate resistance (Johnson, 2004). These findings for the strategy contingency variable enable the initial working proposition (P1) to be revised:

Revised P1: A service based SME's approach to strategy as articulated in Figure 2, will tend to have increased use of lead performance measures and practices for the Analyser and Prospector categories in comparison to the Reactor and Defender categories.

Culture

Based on the culture typology of Figure 3 the cases were analysed and situated as shown in Table 3, Case 1 was classified as having a Role culture. This finding reflects the focus on procedure, hierarchy and status within the hotel and hospitality industry where there are clearly defined roles, responsibilities and reporting links. This hierarchy was reflected in the cascade approach to performance measurement and practices where formalised measures were devised by the management team and communicated downwards to all levels and areas of operation. This approach ensured consistency of the performance measures used throughout the organisation, however the lack of empowerment led to sub-optimal performance measures being applied at operational levels as found by Bititci et al (2004) in relation to Role cultures and performance measurement translation in SMEs. The Balanced Scorecard approach was used to aid this process however the same Balanced Scorecard was used at all levels as opposed to operational team developing their own devolved scorecards through strategy mapping practices as suggested by Jushoh and Parnell (2008). At an operational level efforts to improve performance measurement practices such as room turnaround between guests and provision of outside contractors for special events had to rely on imposed measures which were too generic (e.g. overall cycle time, recurrent cost and quality check list measures) when more precise and localised measures of each operational step were needed to lead to continuous improvement at a localised level. This approach was also reflected in Case 1's approach to Benchmarking practices where clearly defined approaches were laid out but the practice was applied to internal and in sector benchmarking using generic performance measurements, similar to that found by Jung et al (2009) and Garengo et al, 2007 (e.g. average service rating - from a sector quality model and the BEM, employee turnover, absenteeism and training needs analysis). There was a corresponding lack of employee development measures and associated performance measurement practices as reflected in this Role culture category (Bititci et al, 2007).

Cases 2 and 3 were analysed as having Power cultures (Figure 3, Table 3). Each of these cases had a strong leader (Managing Director - MD) with a knowledge of, and influence on, all levels and operations within the organisations which, as shown by Ritchie and Brindley (2005) is characteristic of Power cultures. In Case 2 (Transport) the MD had led the company since its inception and continued to have a hands-on role at both strategic and operational levels. However his reliance on his tacit knowledge resulted in a lack of formalised procedures and an informal approach to performance measures and practices. The management team and the operational level employees had a tendency to

“check with the boss” which is a characteristic of Power cultures (Bititci et al, 2004). Similarly in Case 3 (Software and Licensing) the MD was a technical expert in software design and tended to impose an informal performance measurement approach based on his tacit knowledge. The drive for new business compounded this informal and tacit approach where new services were developed without clearly defined and formally applied quality performance measurement practices leading to lack of clarity at operational levels.

The culture typology suggests that Case 4 (Construction Services) has an Achievement culture (Figure 3, Table 3) with a task and purpose orientated approach combined with a can-do participatory attitude. This finding is indicative of Case 4’s employment of professional staff (e.g. Engineers, Surveyors, Architects), each with their own role and purpose and with a professional ethos. The multifunctional nature of the business services projects (such as design and build) suited the participatory approach of the Achievement culture (Bititci et al, 2004; Handy, 1985) The Achievement culture was reinforced by a focus on employee development performance measures for each area of professional staff (manual staff tended to be fixed term or sub contractors) with an employee recognition scheme for exceptional efforts. The performance measurement practices included professional development practices for each of the specialisms within the organisation. The task nature of the achievement culture with Case 4 was also reflected in the use of ISO 9001:2000, ISO 9014 and ISO 18000 Standards and practices. These criteria added resulted in a formalised and procedural driven approach to performance measurement practices in terms of compliance with the Standards which reflects an Achievement culture as shown by Bititci et al (2006) and Ritchie and Brindley (2005).

A Support culture was found within Case 5 (Business Services) with an emphasis on empowerment and high levels of intrinsic motivation (Handy, 1985). This approach reflected the strong emphasis on developing new services for new and existing markets. The empowerment culture encouraged employees at all levels to develop ideas for improving and developing new services as found by Bititci et al (2006). This approach also tended to lead to continuous change in terms of performance measures and practices with a commensurate lack of formalised approaches. For example efforts to apply the BEM and IiP were marginalised due to the ever moving base line measures and the degree of bureaucracy these models were seen as imposing. There was a strong focus on developing employee development measures, consistent with the empowered culture, such as levels of proficiency in new skills training, number of employee recognition awards at different organisational levels and number of suggestions for new

services and service improvements. These measures were incorporated within relatively informal performance measurement practices such as new service development, staff appraisal and training and development needs analysis.

In relation to culture the dynamics of fit process for the culture CV was mainly limited to one level for all of the cases; that of performance measures and practices with minimal influence at the second level of the quality methods and models. This finding reflected the relative rigidity of the Cases within their culture categories. Hence the dynamic of fit from a culture CV perspective was limited to legitimising the degree of alignment with each respective culture category rather than seeking fundamental questioning of the status quo (Johnson, 2004).

In relation to the classification of fit between the prevailing culture and the performance measures and practices of the cases based on Figure 3, there was some evidence of Panaceas where Case 1 adopted and applied the BEM practices across the organisation. However the model had not been sufficiently adapted for service based organisations leading to confusing language which had a manufacturing origin and hence problems with legitimation in lack of change driving forces (Suchman, 1995). The promising practices in relation to culture mainly related to people development. For example in Case 5 practices in line with the Support culture included time allocations for new service development activities and development of multi-skilling. However, these promising practices tended to be somewhat localised due to the informal and tacit nature of their use and needed increased formalisation for legitimation and overcoming normative resistance across all areas of the organisation. Overall the findings for the culture contingency variable enable the initial working proposition (P2) to be revised:

Revised P2: A service based SME's approach to culture as articulated in Figure 5, will tend to have more informal and tacit approaches to the use performance measurement and performance measurement practices for those SMEs in the Power and Support culture categories in comparison to those SMEs in the Role and Achievement categories.

Customer Focus

Table 3 and Figure 4 places Case 1 (Hotel and Tourism) in the Mass Services category of Customer Focus. This analysis is consistent with Case 1's emphasis on increasing their customer numbers with a focus on efficiency and an economic customer offering consistent with the Mass Services type (Ng et al, 2007). There was an emphasis on the

use of models such as IIP, BEM and hospitality sector award models to form performance measures and practices as found by Jusoh and Parnell (2008). The continuous improvement ethos within these models was consistent with the enhancement of services ethos across a large number of customers. However the effective application of the BEM was limited due to its innate large manufacturing organisation language. Typical customer measures tended to be more transactional than relational and included efficiency measures such as room occupancy levels and room turnaround times and practices. This finding reflects Silvestro (2001) and Hultman and Shaw's (2003) findings that Mass Services type focuses more on transactional dealings with customers.

Cases 3 and 5 were located in the Professional Services category where the emphasis is on the unique proposition offered (Ng et al, 2007; Silvestro, 2001), which focuses on their service offerings being complete and relatively distinct within the market place (Design and Build services in Case 3; Integrated Business Services in Case 5). This approach led to an emphasis on relational customer performance measures and practices. For example, Case 3 had a small number of large customers where relational performance measurement practices included practices for partnering with suppliers and customers and other stakeholders (including regulators) in developing licenses.

Case 4 (Construction Services) and Case 2 (Transport) were in the Service Shop category where the emphasis was on the duality of the business, i.e. the traditional business which was mainly transactional in terms of performance measures and practices and the new or emergent part of the business which was more relational in nature. For example in Case 2 transactional measures included cost effectiveness per tonnage delivered while relational measures included networking levels with "green" stakeholders in the travel industry.

In relation to the dynamics and classification of fit between the customer focus category and the performance measures and practices of the cases based on Figure 4, there was little evidence of Misfits or Panaceas or Best-in-Class practices however there were indications of Promising Practises and Best-in-Class practices. For example in Case 1 the new/improved service provision and development and joint development teams between customers and large clients for event management were informed by customer analysis. However their initial application was predicated on the BEM language for large organisations which limited the application of the practices. However there were signs that the switch to the Balanced Scorecard was improving the situation. Thus in terms of legitimation (Suchman, 1995) the drivers for increasing the deployment of the

promising practices were customer needs and awareness of those needs at all levels in the organisation. Normative evaluation and resistance came from the entrenchment of existing processes (Johnson, 2004) and reliance on transactional and efficient based performance measures and practices. Based on the discussion of Customer Focus as a contingency variable Proposition 4 has been revised as follows:

Revised Proposition 4: A service based SME's Customer Focus categorisation as articulated in Figure 4, will tend to result in performance measures and practices being more relational based than transactional for the Service Shop category in contrast to the Mass Services category.

Lifecycle

Case 1 (Hotel and Tourism) was placed on stage 5 of the Lifecycle model (Table 3; Figure 5) where performance measures and practices reflect a fully networked organisation achieving a level of maturity and consistent growth (Greiner, 1972). In Case 1 performance measures and practices were well established and had a level of robustness through clearly defined procedures. A limitation of this engraining process was the lack of agility in relation to responding to innovations in the marketplace (O'Regan and Ghobadian, 2006) where new sets of performance measures and practices are required often leading to redundancies in terms of existing measures.

Toward the other end of the Lifecycle model Cases 2 and 3 were located in Stage 2 where there is an emphasis on growth through direction following the establishment of the firm (Nair and Boulton, 2008) For example, in Case 2 there was a clear emphasis on developing new greener modes of transport services in addition to the existing provision. This approach led to the development of new performance measures and practices which were less established and defined but which addressed the new emerging marketplace which was being targeted (e.g. performance measures such as carbon equivalents and practices such as scanning for new technology). Similarly in Case 3 there was an emphasis on growing new markets using licensing of software services which led to a search for new performance measures and practices which were contextual rather than relying solely on prescriptive measures from quality models.

Cases 4 and 5 were situated in the middle region of the Lifecycle model i.e. Stages 4 and 3 respectively. In Stage 3 the emphasis is on growth through delegation which was consistent with Case 5's approach to developing performance measures and practices to empower employees to develop service and organisational improvements (Greiner,

1972). Stage 4 emphasises growth through increased coordination (Nair and Boulton, 2008). This situation was reflected in Case 4's project based approach to design and build in their traditional markets and their coordination with customers and suppliers in relation to their new renewable markets. Thus their performance measures and practices were not as established as those of Case 1 (Stage 4) however there was more agility within the measures and practices to accommodate innovations in services and markets as found in Raymond and Bergeron's (2008) study.

In relation lifecycle dynamics and classification there was a dynamic at both performance measurement and practice, and quality management method and model levels for all of the Cases. This dynamic resulted from all of the cases being in state of growth (case selection criteria) and thus being in a state of transition either inter or intra lifecycle stage(s). In Case 1 the need to develop performance measures and practices to support increased agility led to normative resistance from well established approaches which addressed plateau states within the business and which did not conceptually identify with an overall pattern of lifecycle growth. A lack of out of sector benchmarking tended to reinforce the status quo with minor changes rather than legitimising the need for increased growth. Similar attempts to reconceptualise the use of quality models such as the BEM into a driver for innovation and agility measures met with similar resistance. Cases 2, 3, 4 and 5 which were located in lower stages i.e. Stages 2-4 where the emphasis was on directed growth (Ritchie and Brindley, 2005) following the establishment of the firm led to the management driving the implementation of more innovation orientated performance measures and practices using the quality management methods and models in a growth mode with more focus on customer measures and involvement of empowered employees to meet customer expectations. This approach created an interesting duality with normative evaluation and resistance emphasising the need for stability to guarantee continues existence while the legitimising forces focused on the need to grow and the fallacy of relying on traditional markets which were being eroded (Johnson, 2004).

In relation to the classification of fit between the Lifecycle model and the performance measures and practices of the cases based on Figure 2, there was little evidence of Panaceas or Best-in-Class. However in the Promising Practices category there was some evidence from the cases that in the earlier stages of the Lifecycle model measures and practices were more fluid and could accommodate change and innovation; however at the latter Stages such as 4 and 5 the relative rigidity of established performance measures and practices could potentially limit opportunities from market and technology innovation ultimately leading to Misfits as the market place continues to

move on and develop. Hence legitimation of new or modified performance measurement practices and overcoming normative resistance may take longer as an organisation progresses through the lifecycle model. Based on the discussion of Lifecycle contingency variable Proposition 5 has been revised as follows:

Revised Proposition 5: A service based SME's Lifecycle categorisation as articulated in Figure 5, will tend to result in increased rigidity of growth based performance measures and practices as the SMEs progress towards the Latter stages of the model.

Conclusions and recommendations

The development and implementation of performance measures and practices in the service-based SME Cases, in relation to RQ1, were found to be dependant of a number of contingency variables. Adopting a services operations management viewpoint for services proved useful and enabled meaningful comparisons to be made with existing studies of non-service based SMEs and helped in analysing the performance measures within the SMEs. The contingency variables of strategy, culture, lifecycle and customer focus, while not exhaustive, enabled performance measures and practices to be explored from a wide range of influences. Each of the contingency variables had been identified in the literature where some were used in single variable studies however the use of multiple contingency variables, as suggested by Sousa and Voss (2008) and Garengo et al (2005), added different perspectives and richness to the study and helped explain the development of the performance measurements and practices within the cases. Interpreting the contingency variables by using established typologies borrowed from the literature, as suggested by Sousa and Voss (2008), helped in understanding the fit or alignment issues for the performance measures and practices.

In relation to RQ2 Quality management methods and models emerged as key approaches within the alignment or fit process for both prompting and aggregating performance measures and practices to a given typology category in a similar manner to that found by Jusoh and Parnell (2008) and Jung et al (2009). In some situations the existing use of such models was challenged and required a change in focus (e.g. from efficiency to innovation).

The typologies enabled a number of what Raymond and Croteau (2009) refer to as loose propositions to be developed in addressing RQ3. In relation to each of the contingency variables and the relationship to the performance measures and practices. These propositions were initially developed from the literature and then refined using the Case

analysis as suggested by (Garengo and Bititci, 2007) and Raymond and Bergeron (2008). In relation to strategy it was concluded that Analyser and Prospector categories tend to have increased use of lead performance measures and practices in comparison to Reactor and Defender categories. The culture analysis revealed that those Cases in the Power and Support categories tend to have more informal and tacit approaches to the use performance measurement and performance measurement practices in comparison to those SMEs in the Role and Achievement categories. The Customer Focus analysis showed that the SMEs in the Professional Service category tended to have performance measures and practices that were more relational based than transactional in comparison to the Service Shop and Mass Services categories. Overall these findings show the need to consider a wide range of organisational issues when attempting to understand the effective design and implementation of performance measures and practices.

The contingency variables led to a range of fit or alignment issues. Sousa and Voss's classification scheme (Figure) proved useful in separating out best in class, panaceas, miss fits and promising practices. However, contingency theory was also helpful in seeking to explain the dynamics of fit (Suchman, 1995; Johnson, 2004) within Sousa and Voss's (2008) framework where legitimising forces for developing and applying new or modified performance measures and practices seek to overcome the normative evaluation and resistance of the status quo (Johnson, 2004). The lack of upward change pressure on the CVs from the performance measurement practices and quality models and methods reflected both the customer demand led nature of service based SMEs (Hultman and Shaw, 2003) and the quasi stability of the CVs (Langfield-Smith, 1997).

It is recommended that the study could be further developed in two respects. First, by using a larger number of Cases from different service classifications leading to new or further refined propositions, and second by developing the propositions into hypothesis as part of a cross sectional theory testing study.

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The influence of the tidy work environment in the reliability of the conscientious individuals.

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Introduction

The relationship between personality and job performance has been a frequently studied research topic in Management, Organizational Behavior and Psychology in the last decades. A number of studies have identified that individual behavior at work can be significantly influenced by personality traits and several researchers have studied the predictors of job performance (e.g. Barrick and Mount, 1991, Hough et al., 1990, Ones et al., 1993, Tett et al., 1991). In this paper, an important part of individual performance is considered: reliability. This component of performance is analyzed in the relation between personality trait called conscientiousness and the tidy work-environment.

Psychologists have identified literally thousands of personality traits and adjectives that differentiate one person from another. But for some decades, researchers have identified five fundamental factors or dimensions of personality. Each of these factors consists of a group of more specific traits. The five factors are commonly called the “Big Five personality traits”. Thus, the Big Five refers to a type of taxonomy or personality traits classification system used to describe personality dimensions (Goldberg, 1990, John, 1989, Digman, 1990, Costa and McCrae, 1992, Costa et al., 1991). This taxonomy has been systematized and recognized as a reference tool for personality analysis and now is especially relevant to organizations in the last decades. The Big Five dimensions are Extraversion, Agreeableness, Conscientiousness, Neuroticism, and Openness. Costa and McCrae (1995) have suggested that, within each personality dimension, there are facets (essentially first-order factors) that combine to form the entire construct. They described six facets for each domain. The names for each facet are derived from the items that contribute to it. For example, the conscientiousness facets are competence, order, dutifulness, achievement-striving, self-discipline, and deliberation.

From the Big Five personality traits, conscientiousness has been the most consistent personality predictor of job performance across all types of work and occupations (Barrick et al., 2001, Schmidt and Hunter, 1998, Barrick and Mount, 1991, Salgado, 1997, Ones et al., 2007, Mount et al., 1998, Mount et al., 1999, Witt et al., 2002, Witt, 2002, Behling, 1998). Conscientiousness is a broad personality dimension defined as the extent to which a person is able to self-regulate and be purposeful, achievement oriented, responsible, and persistent (Digman, 1990). High conscientiousness people are described as organized, reliable, and ambitious (Costa and McCrae, 1992, John and Srivastava, 2001). Furthermore, they are also skilled planners who maintain impulse control (e.g., act cautiously, delay gratification, and follow rules and norms), which often leads to enhanced task performance (John and Srivastava, 2001). Thus, it is logical that individuals with high conscientiousness have a better performance since they are characterized by a high level of reliability.

Many authors have suggested that some traits of personality may change over time (Mischel and Peake, 1982, Roberts and Caspi, 2001, Helson and Stewart, 1994). The path to finding stability in personality traits requires one to take into account the situation and its impact on an individual; and this may be identified in the stable interactions between traits and circumstances (Mischel, 2004, Cervone, 2004, Furr and Funder, 2004). This would imply that the situation or environment in which the person is working can alter or modify his expression of conscientiousness, as one traits of personality. This implication leads us to consider the effect it could have on the

employee a work environment based on conscientiousness, i.e., a work environment that has the characteristic of to be essentially described with at least one of the facets of the conscientiousness (e.g. tidy work environment). It is interesting to know the effect of this type of work environment on the performance of employees, especially reliability, since this environment is based on a facet of conscientiousness. The present article does not conclude on the dynamic relation between work environment and trait consistency because it does not employ a dynamic methodological framework for observations collected over several time periods. Nevertheless, the cross-sectional model's main results of this article may motivate future researchers to study these dynamic effects in an extended statistical setup, which may evidence changing personality traits in different work environments.

In this article, one of the six facets that compose the conscientiousness, i.e. the order (tidy), is considered. Hence, this work aims to study if there are interactions between work environment based in tidiness and conscientiousness that affect work reliable of the individuals.

To the best of our knowledge, there has been no research on the reliability of employees conditional on both the order trait of work environment and the employees' conscientiousness personality trait. Hence, the contribution of this article is the novelty of having studied the relationships among the following three subjects: work environment based on the trait of order, conscientiousness and reliability of employee.

The remaining part of this article is structured as follows. First, the definitions of order facet are examined to use these concepts as a guide to design a work environment for our experiment. Once the meaning of tidy and messy work environment is defined, it is hypothesized how these environments can mediate in the relation between conscientiousness trait and reliability. Then, an experiment is employed to test these hypotheses and the main empirical results are summarized. Finally, implications of these results and suggestions for future research are discussed.

Defining a work environment based on the order trait

Order facet reflects the tendency to apply structure to one's working environment. According to Costa and McCrae (1992, 1999, 1998), high scores on the order facet are characterized by being neat, tidy, clean and well-organized; keeps things in their proper places. The order as tendency to keep one's environment tidy and well-organized is familiar from several personality inventories (Costa et al., 1991). Low scorers might

therefore be described as dirty, messy, untidy, disorganized, slovenly, and sloppy, “but those terms are so harshly evaluative that many psychologists, especially clinicians, would be reluctant to use them. In feedback to the client it would probably be more politic to say ‘not well organized’ or ‘not excessively neat’” (Costa and McCrae, 1998).

The present research focuses on the work environment based on the order. The above definitions of personality trait of order are used as a guide to design a work environment that is based on this trait. In this sense, the *tidy work environment* would be defined as the environment of work where everything is orderly and organized in the right place. And the *messy work environment* would be defined as the environment of work where everything is untidy and disorganized.

Reliability, work environment and conscientiousness trait

With respect to reliability, an employee that is reliable can be trusted or believed because he/she works or behaves well in the way firm expect. In this sense, reliability is the ability of an employee to perform and maintain his/her expected work in routine circumstances, as well as hostile or unexpected circumstances. The organizations have expectations, which must be concrete and realistic in order that they can assess reliability. Thus, expectations “represent the institutional and role beliefs about how a task is to be performed and typically take the form of rules, regulations, standard operating procedures, organizational goals, and normative standards” (Ramanujam and Goodman, 2003).

Human reliability is related to the field of human performance, which it can be affected by many factors such as age, state of mind, physical health, attitude, emotions, propensity for certain common mistakes, errors, etc. Reliability is the first of the qualities any job performance predictor should possess. Reliability can be measured in a huge number of ways within business. One of these ways is by human error, which it is a cause or contributing factor in wastage and accidents in many types of business. A considerable number of these human errors might be fitted inside what Ramanujam and Goodman (2003) define as *latent errors*. According with these authors the principal characteristics of latent errors are: (1) a set of organizational expectations, (2) deviations from these expectations, and (3) absence of direct consequences. The type of work environment could influence the reliability of the employees, inducing them to work in a defective way or deviations that do not produce direct and immediate adverse consequences.

In summary, we hypothesize that the relationship between conscientious trait of the employees and their reliability are mediated by the influence of the work environment in which they operate, according to if this environment is tidy or messy.

According to the theory that we have seen before in the introduction, individuals with high conscientiousness are more productive and reliable than individuals with low conscientiousness. The question is if these differences in productivity and reliability are maintained in spite of the fact that the work environment is tidy or messy. As a result, we propose the following hypotheses:

Hypothesis 1: In a messy work-environment the employees with high conscientiousness make fewer mistakes than the employees with low conscientiousness.

Hypothesis 2: In a tidy work-environment the employees with high conscientiousness make fewer mistakes than the employees with low conscientiousness.

Besides, one must ask if there are differences in reliability among the individuals with high conscientiousness by the fact of working in a tidy or messy environment. The same question would be for the case of individuals with low conscientiousness. In the past literature, this relationship has not been studied. Therefore, the hypotheses of this article state that these two types of environments could influence the reliability of the individual. It is more intuitive that a messy environment could influence negative in individual reliability because is an environment that would lead to be annoyed or to be not concentrated on the work. Thus, we propose the following hypotheses:

Hypothesis 3: Employees with high conscientiousness make more mistakes in a messy work environment than in a tidy work environment.

Hypothesis 4: Employees with low conscientiousness make more mistakes in a messy work environment than in a tidy work environment.

Figure 1 depicts the reliability relations that arise in these hypotheses.

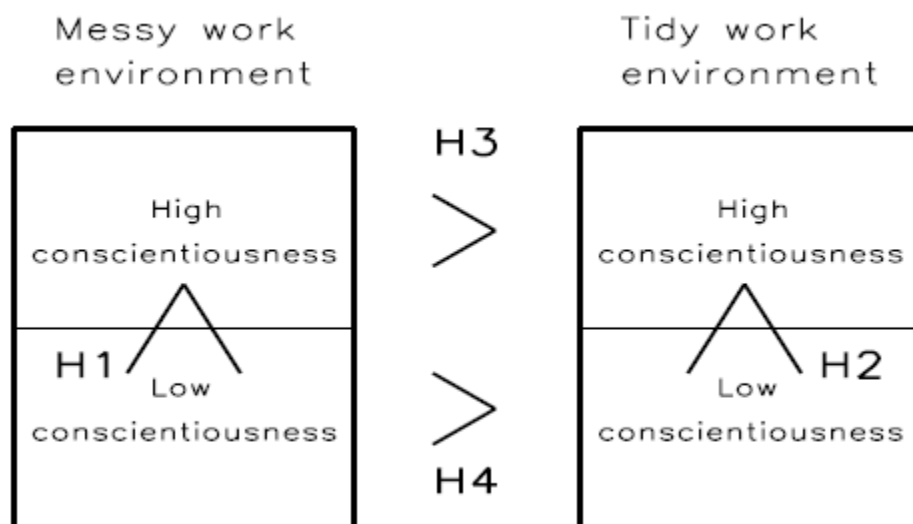


Figure 1. Hypotheses H1-H4 about the average relative errors of individuals in different situations

Note: The signs "less than" (<), "greater than" (>) and "equal" (=) denote in which situation the individuals make less, more or equal mistakes, respectively.

Method

Study design

To test these hypotheses, an experiment is employed. A field experiment is conducted, where subjects performing a simple task in a highly controlled environment are exogenously sorted into two different treatments. The experiment manipulates one independent variable: things in work environment that are evident that are not in its place, i.e. that they are in a messy condition. There are two levels or treatments: a) messy work environment, i.e. an environment of many papers and objects of work scattered on the desk and workplace, where it is evident that these objects were not in its place; b) tidy work environment, i.e. an environment where there is nothing out of place. The focal dependent variable is the reliability level of the individual. Reliability is measured computing the right answers and the relative error of the individual, i.e. number of incorrect answers divided by number of total answers.

Participants

All of our subjects are university students recruited from different schools of the University. The final dataset comprises 80 students of whom 31 are male and 49 are

female. Their median age is 20 years. Fifty four percent of the participants are students of the School of Economics and Business Administration.

Students have been asked in announcements posted on notice boards and Website of University if they would like to do a simple short-term job requiring no previous knowledge. In the announcement, it has been stated that the job is a one-time 2-hour job and it pays € 14 (1 € \approx 1.35 US\$), that it is part of an academic research and also that they would fill out a personality test.

Students have applied by e-mail. After receiving their applications, each participant has been randomly assigned to one of the two treatments and we have informed them of the precise date and location where they are expected to carry out the job. There has been a different date for each treatment. Each participant has come only to one date. A total of 85 subjects have participated in the experiment. Once five clear outliers have been eliminated, there are 39 subjects in the messy work environment treatment and 41 in the tidy work environment treatment. Both treatments have been performed in a computer lab of the University in October 2010.

Procedure and Task

A simple and easy to measure work task is chosen that required no previous knowledge. In this task, students transcribe the results of a survey. A survey through an online program called Encuestafacil.com has been designed (program access is available at: www.encuestafacil.com). The survey simulates a market research about the preferences of recent graduates in the selection of the firms to work. The survey includes multiple choice questions. The answers are chosen by mouse clicks, except the first question in which it is necessary to write the number of the survey.

Before the experiment, we have filled out the survey that we had designed in the online program, in order to create thus the responses of 80 supposedly different individuals. The surveys that we give to the participants are the printed results of the data that we had filled earlier in the online program. Thus, each participant has received a package of 80 surveys that supposedly already had been filled out by 80 different subjects. Each survey has contained 44 answers (inputs) to transcribe (to enter) in the online program. Moreover, each survey has included an identification number and the 80 surveys have been arranged in ascending order according to this number. The objective of the participants has been to transcribe the surveys in the order in which has been given

them. The surveys data, type and model of computer, identification numbers and order of the surveys are the same for all participants.

Upon arrival, subjects are welcomed and informed about their task of transcribing the results of a survey and the procedural details. Thus, participants probably have perceived this task as a "real" work. The participants have not known neither what duration of the two contracted hours is to be spent to work. Moreover, they have not been informed about that their work performance has been measured. They have worked one hour in the transcription of the surveys. Afterwards, they have filled in the NEO PI-R personality test and finally they have filled in a brief questionnaire about their impressions of the physical environment of work in which they have worked. Payment is independent of output and has been paid by electronic transfer. The procedure is exactly the same for both treatments.

In the messy treatment, participants have a work environment with many papers and documents on the desks that are unnecessary; pencils, clips, staples scattered on the desks and floor; many papers and some empty boxes scattered on the floor. It is important to clarify that the location of these things does not interfere with the operating capacity of the participants, i.e. they have had sufficient free space on the desk to maneuver the surveys. In contrast, in the tidy work environment treatment, there have not been untidy or unnecessary things both on the desks and in the floor. Thus, on the desks of the participants there have been only the surveys and the computer.

Measures

Reliability. Reliability is measured computing the relative error of the individual, i.e. number of incorrect inputs divided by number of total inputs. Each survey answer that the participant clicked on is counted as an input. The identification number of each survey that he/she had to transcribe is also counted as an input. An input is considered to be correct when the participant enters an answer that coincides with respective survey received in the beginning of the work task. If a participant omitted or repeated a survey, this was counted as 44 incorrect inputs, i.e. the total number of inputs of the survey. The program of the website Encuestafacil.com has a tool that collects in an Excel sheet all the answers (inputs) filled in by the participants. This allows us to compare the answers of the participants with the answers filled out previously by us.

Conscientiousness. The Revised NEO Personality Inventory (NEO PI-R) (Costa and McCrae, 1992) is used to measure the Conscientiousness factor, which is a 240 item set

of self-statements that assess the five dimensions of personality along with six facet scales for each factor. This is an instrument with well-established reliability and validity (Costa and McCrae, 1992).

Work environment. A short questionnaire has been employed to ask participants about how they have perceived the physical environment of work: tidy-untidy and other physical conditions. The aim of this questionnaire is to confirm if the participants have perceived the environment according to the type of treatment that they have been assigned.

Clustering with respect to conscientiousness

In order to study the hypotheses stated before, individuals with high and low conscientiousness are identified in the sample. Two clusters of high and low conscientiousness individuals are formed for each treatment (tidiness and mess) separately. This clustering procedure yields the next four groups (G) of individuals from the sample:

- (G1) high conscientiousness (*h*) individuals in the treatment of tidiness (*t*),
- (G2) low conscientiousness (*l*) individuals in the treatment of tidiness (*t*),
- (G3) high conscientiousness (*h*) individuals in the treatment of mess (*m*), and
- (G4) low conscientiousness (*l*) individuals in the treatment of mess (*m*).

Each treatment is clustered separately instead of clustering the pooled sample of both treatments because the fact of tidiness or mess may affect the measurement quality of the conscientiousness variable and clustering the two treatments separately can control for this problem and therefore provide more robust results.

The clusters of conscientiousness are created using the Ward's linkage clustering procedure (Ward, 1963) and the Euclidean distance measure is used in the clustering procedure. Ward's linkage clustering method is applied because several past papers, which compare alternative clustering techniques, conclude that Ward's method tends to identify better clusters than other methods. For example, Kuiper and Fisher (1975) in a Monte Carlo comparison of six agglomerative procedures, find Ward's method generally the best, followed closely by the complete linkage method. Moreover, Jain et al. (1986) conclude that the complete linkage and Ward's methods are generally superior to other hierarchical clustering methods.

Comparison of cluster means

After forming two groups for each treatment, the four hypotheses stated previously are tested by comparing the mean relative errors of each two clusters stated in the hypothesis. First, the following notation is introduced for the mean relative error of individuals in each group G1-G4 defined in the previous subsection:

(G1) Let μ_{ht} denote the mean relative error of high conscientiousness individuals in the treatment of tidiness.

(G2) Let μ_{lt} denote the mean relative error of low conscientiousness individuals in the treatment of tidiness.

(G3) Let μ_{hm} denote the mean relative error of high conscientiousness individuals in the treatment of mess.

(G4) Let μ_{lm} denote the mean relative error of low conscientiousness individuals in the treatment of mess.

Using this notation, the four hypotheses presented before can be reformulated as follows:

H1: When there is messy work environment, the mean relative error of low conscientiousness individuals μ_{lm} is greater than to the mean relative error of high conscientiousness individuals μ_{hm} , i.e. $\mu_{lm} > \mu_{hm}$.

H2: When there is tidy work environment, the mean relative error of low conscientiousness individuals, μ_{lt} is greater than to the mean relative error of high conscientiousness individuals μ_{ht} , i.e. $\mu_{lt} > \mu_{ht}$.

H3: The mean relative error of high conscientiousness individuals in a messy work environment μ_{hm} is greater than high conscientiousness individuals in a tidy work environment μ_{ht} , i.e. $\mu_{hm} > \mu_{ht}$.

H4: The mean relative error of low conscientiousness individuals in a messy work environment μ_{lm} is greater than low conscientiousness individuals in a tidy work environment μ_{lt} , i.e. $\mu_{lm} > \mu_{lt}$.

Notice that each hypothesis is about the comparison of mean relative errors between two clusters.

Therefore, the H1-H4 hypotheses can be verified by the following three alternative two-sample mean difference tests (T):

(T1) two-sample mean difference test with equal variance;

(T2) two-sample mean difference test with unequal variance and use Satterthwaite's (1946) approximation formula to evaluate the significance of the test statistic; and

(T3) two-sample mean difference test with unequal variance and use Welch's (1947) approximation formula to evaluate the significance of the test statistic.

The T1 test assumes that the variance of relative errors in both clusters is equal. However, T2 and T3 do not make this restrictive assumption and employ alternative approximation formulas in order to evaluate the significance of the corresponding test statistic. As a consequence, the three alternative test results check for the robustness of the two-sample mean difference tests.

Results

The results of the work environment questionnaire confirm that the participants had perceived the environment according to the type of treatment that they were assigned. The 93% of participants in treatment of mess answered that the room was very messy. The 55% of participants in treatment of tidiness answered that the room was very tidy and 29% that the room was slightly tidy.

Table I summarizes some descriptive statistics of the conscientiousness and relative error variables for the pooled sample of individuals and for various subgroups of the full sample. The pooled sample is divided by two binary variables: the type of treatment (tidiness and mess) and the cluster of the level of conscientiousness (high or low). Table 1 informs about the distribution of individuals in the different groups reporting the number of individuals for each group. Moreover, Table 1 presents the mean and standard deviation of conscientiousness and relative error for the pooled sample and its subgroups.

Table I. Descriptive statistics of data

Conscientiousness				Relative error					
		Messy WE	Tidy WE	Total			Messy WE	Tidy WE	Total
Low	Count	21	34	55	Low	Count	21	34	55
consc.	Mean	34.00	39.21	37.22	consc.	Mean	1.43%	1.56%	1.51%
	SD	3.63	6.53	6.12		SD	1.72%	2.62%	2.30%
High	Count	18	7	25	High	Count	18	7	25
consc.	Mean	46.61	59.43	50.20	consc.	Mean	3.92%	0.68%	3.02%
	SD	3.90	5.03	7.18		SD	4.48%	0.63%	4.07%
Total	Count	39	41	80	Total	Count	39	41	80
	Mean	39.82	42.66	41.28		Mean	2.58%	1.41%	1.98%
	SD	7.37	9.91	8.83		SD	3.48%	2.42%	3.02%

Note: The SD denotes standard deviation. The Messy WE and Tidy WE refer to messy work environment and tidy work environment, respectively.

Table II summarizes the results of the two-sample mean comparison tests. These tests evaluate the four hypotheses H1-H4 of this article. First, tests T1, T2 and T3 reject the H1 hypothesis ($\mu_{lm} > \mu_{hm}$) at the 5 percent level of significance. We evidence that the opposite relation is significant at the 5 percent level of significance: $\mu_{lm} < \mu_{hm}$. Thus, high conscientiousness individuals on average make more relative errors than low conscientiousness individuals when both are in a messy work environment. Second, the T2 and T3 tests accept the H2 hypothesis at the 5 percent level of significance, i.e. $\mu_{lt} > \mu_{ht}$. Thus, low conscientiousness individuals on average make more relative errors than high conscientiousness individuals when they are in a tidy work-environment. Third, the T1, T2 and T3 mean comparison tests evidence that $\mu_{hm} > \mu_{ht}$, i.e. when high conscientiousness individuals are considered, the level of relative errors have committed is higher in treatment of mess than in tidiness treatment. Thus, we accept H3. Fourth, all mean comparison tests reject H4 ($\mu_{lm} > \mu_{lt}$), i.e. we find that $\mu_{lm} = \mu_{lt}$. This means that independently of the tidiness or mess of the working place, low conscientiousness individuals perform the same level of relative errors during their work.

Table II. Two-sample mean comparison test results

H1	H ₀ :	$\mu_{lm} = \mu_{hm}$	$\mu_{lm} = \mu_{hm}$	H2	H ₀ :	$\mu_{lt} = \mu_{ht}$	$\mu_{lt} = \mu_{ht}$
	H _a :	$\mu_{lm} < \mu_{hm}$	$\mu_{lm} > \mu_{hm}$		H _a :	$\mu_{lt} < \mu_{ht}$	$\mu_{lt} > \mu_{ht}$
T1		1.2%	98.8%	T1		80.6%	19.4%
T2		1.8%	98.2%	T2		95.4%	4.6%
T3		1.8%	98.2%	T3		95.4%	4.6%
<hr/>							
H3	H ₀ :	$\mu_{hm} = \mu_{ht}$	$\mu_{hm} = \mu_{ht}$	H4	H ₀ :	$\mu_{tm} = \mu_{lt}$	$\mu_{tm} = \mu_{lt}$
	H _a :	$\mu_{hm} < \mu_{ht}$	$\mu_{hm} > \mu_{ht}$		H _a :	$\mu_{tm} < \mu_{lt}$	$\mu_{tm} > \mu_{lt}$
T1		96.4%	3.6%	T1		42.1%	57.9%
T2		99.6%	0.4%	T2		41.3%	58.7%
T3		99.6%	0.4%	T3		41.3%	58.7%

Note: The table presents the p-values associated to the mean comparison T1, T2 and T3 test statistics. The T1 test assumes that the variance of the variable is equal in the two samples. The T2 and T3 tests assume that the variance of the variable is not equal in the two samples and apply the Satterthwaite (1946) and Welch (1947) approximation formula, respectively, to evaluate the significance of the test statistic. The *l*, *h*, *t* and *m* sub indices of the expected values μ denote low conscientiousness, high conscientiousness, treatment in tidy work-environment and treatment in messy work-environment, respectively. Figures in bold script indicate the acceptance of the alternative hypothesis at 5 percent level of significance.

Figure 2 presents these findings on the relations of relative errors among different groups of the sample studied.

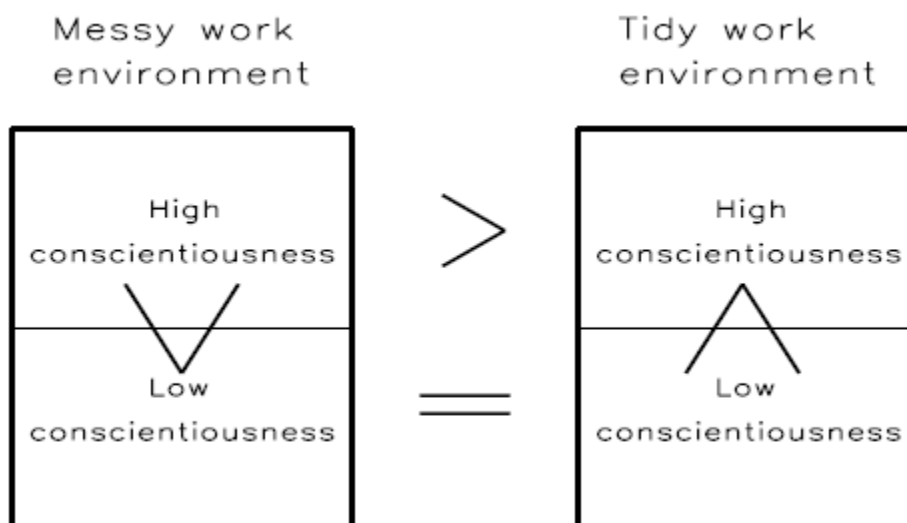


Figure 2. Implications of the two-sample mean comparison test results on group mean relations

Note: Figure shows the results about in which situation the participants make more (>), less (<) or equal (=) mistakes.

In Figure 3, we can see the negative influence that has messy environment in reliability of people with high conscientiousness. Figure shows that the level of relative error is highest in the case of individuals with high conscientiousness that are in a messy environment, i.e. they make even more mistakes than those individuals with low conscientiousness in messy and tidy environments.

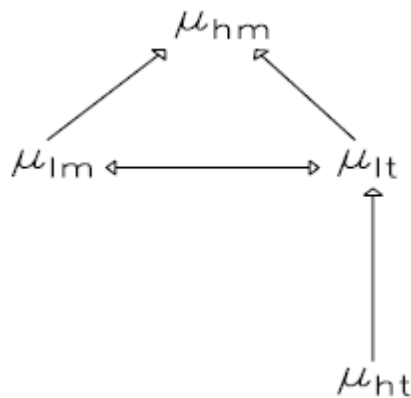


Figure 3. Relative error mean in relation with the other groups

Note: The arrows show decreasing level of relative error. The double arrow shows equal level of relative errors.

Discussion

There are many studies that suggest that people with high conscientiousness tend to have a better performance in his/her work and therefore a better reliability. Nevertheless, the results of this study suggest that a physically messy environment can influence in the reliability degree, doing that the people with high conscientiousness tend to commit more mistakes in the task that they work. Thus, the reliability of these individuals is lower when they are compared with individuals with high conscientiousness in a tidy work environment, as well when they are compared with individuals with low conscientiousness in a messy and tidy work environment, as specified in Figure 3. One way to explain this negative influence could be because conscientious people like the appearance of orderliness and tidiness, i.e. they have

tendency to keep their environment tidy and well organized and being in a messy environment perhaps makes them feel uncomfortable, annoying or to be not concentrated on their work.

On the other hand, when people with high conscientiousness are in a tidy environment then there are fulfilled the predictions of that they are more reliable than people with low conscientiousness. This result indicates that tidiness could promote that those individuals with high conscientiousness feel comfortable to work concentrated on their task and behave with the level of reliability that characterizes their personality trait.

Mess can stop motivation of people with high conscientiousness and prevent them from doing their best. They will not do their work as well as they can, because they are intolerant with mess and therefore a messy environment keeps them from focusing on their work by constantly demanding their attention. Their lack of concentration in this kind of environment could influence their reliability, inducing them to work in a defective way or to make mistakes. This mean a greater expense in the production since it would imply a greater waste in the consumed resources. This fact has even more relevancy for work environments where are bring into play the life of other people, such as operating rooms, pharmaceutical laboratories, air traffic control towers, nuclear power plants, etc. It is important that the physical working environment in these places be tidy, for thus avoid errors that could be fatal.

People with low conscientiousness perform the same level of mistakes in a messy work environment than in a tidy work environment. This result may mean that mess do not influence in their level of concentration on their work, probably because low scores on the conscientiousness scale correlate with people who are unorganized and therefore they are more accustomed to living in an environment like that.

From a practical point of view, when the work environment is tidy, the results provide empirical evidence that conscientiousness trait should be congruent with the performance criterion that it is seeking to predict. Nevertheless, this criterion changes when the environment is mess. On the basis of this result, performance prediction can be improved by accounting the level of tidiness in environment as a potential moderator of relationships between personality and job reliability.

People are fallible, even the best make mistakes. It is human nature to err. Because of their fallibility or innate characteristic of imprecision, human beings are vulnerable to many external conditions that cause them be unreliable. Vulnerability to such conditions

makes people susceptible to error. “Countermeasures are based on the assumption that although we cannot change the human condition, we can change the conditions under which humans work” (Reason, 2000). The messy work-environment possesses the characteristics to be called as *latent error*, in the sense that this mess is a “deviation that does not produce direct and immediate adverse consequences” but it is a “condition that deviates from expectations, and may cause adverse consequences of organizational significance” (Ramanujam and Goodman, 2003). Thus, a distinguishing feature of high-reliability organizations should be their collective preoccupation to improve the conditions of tidiness under which employees work.

Finally, this work has several limitations. First of all, the sample is small with eighty participants. Second, the task was restricted to introduce data in a computer. There are several kinds of tasks where the response of workers to the tidy work environment could be different. It is necessary develop new experiments with other tasks. Another limitation is that only there were seven participants with high conscientiousness in the treatment of tidy environment. Nevertheless, this is the first attempt to quantify the importance of tidy work environment in terms of moderator of relationships between personality and job reliability, and may contributes to reduce wastage and accidents in many types of business.

Conclusions

The most important contribution of this research is the novelty of having studied the relation that exists among these three subjects: work environment based on the tidiness, conscientiousness trait and reliability of employee. The results offer some insight into the process through which a work environment based in tidiness affects reliability of people with high conscientiousness. The finding of differential results for tidy and messy environment suggests not only that people with high conscientiousness commit more mistakes in a messy environment than in a tidy environment but also that they commit more mistakes than people with low conscientiousness when both are in a messy environment.

The main conclusion of this experiment is that there is empirical evidence to support the suggestion that a tidy work environment can influence the reduction of mistakes and improve reliability in workers with high conscientiousness. More generally, our research suggests that it is important that managers ensure that the environment in where employees are working should be usually tidy, instilling in them values and

methods that promote tidiness, achieving by this way a better reliability in the employees.

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Innovation through the Common Assessment Framework in a public administration

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Introduction

Innovation is the main component in the current economy in private sector as well as in public sector. In the Lisbon strategy, the innovation stimulation is clearly highlighted to be able to tackle globalization and demographic change. In this sense, several reforms have been undertaken in which the innovation is the key lever aiming at improving the quality of public service and at offering new services to citizens.

The objective of our study is to identify the key factors, which lead to the innovation in the public administration through the common assessment framework (CAF) model. Also, an identification of the limits of the model and the lack factors is made. The CAF model is an innovative tool that has known 2 000 applications in Europe (Staes & Thijs, 2010). This tool is based on the excellence principles coming from the European Foundation for Quality Management, which is the principle of continuous improvement and innovation. Since the new version in 2006, this concept was emphasized within the leadership, the strategy and planning and the processes.

The public research centre Henri Tudor has been involved since 2006 in the continuous improvement program whose main objective is to promote, sustain and develop the continuous improvement in public administrations and the innovation in public sector in order to reach a better performance and a service quality concerning citizen's needs. In

this perspective, the article aims at modeling the innovation process based on two main innovative services in a public administration through the CAF.

Next to the literature review of the innovation and the CAF, we present our global approach through the main steps to develop the new innovative services. In the third part, we focus on the specific case study through the innovation process and we draw up this process based on the CAF model. At the end, we discuss on the limits of this study.

The literature review

Innovation is the core activity in the numerous private companies whereas in the public sector, the organizations are less pushed to innovate. Nevertheless, these last few years, this has become an issue. In this sense, we explore the innovation concept before introducing the CAF model that promotes the innovation in public organizations.

The innovation process

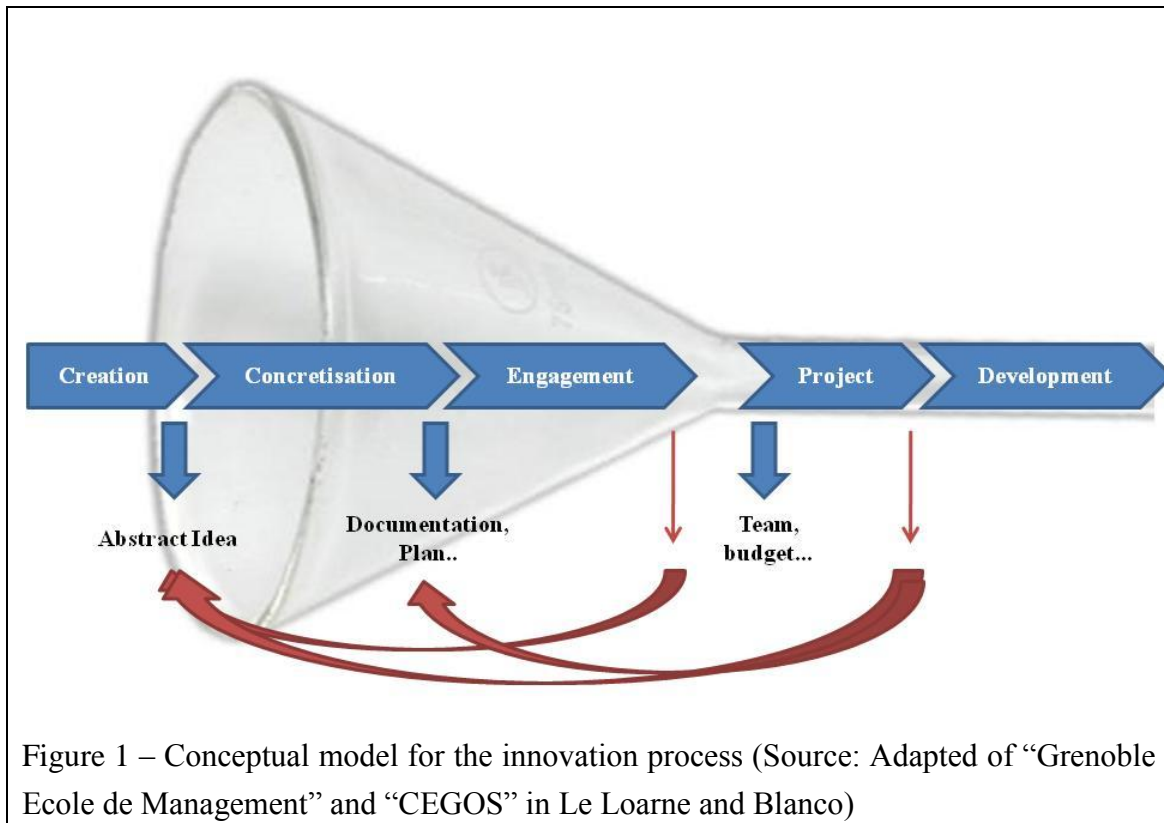
Oslo manual defines innovation as “the implementation of a new and significant improved product (good or service) or process, a new marketing method or a new organizational method in business practices, workplace organization or external relations” (OCDE, 2005, p 46-47). In this definition, four types of innovation are highlighted: product innovation, process innovation, marketing innovation and organizational innovation. The product innovation involves a good or service that is new or significantly improved; the process innovation involves a new or significantly improved production or delivery method; the marketing innovation involves a new marketing method involving significant changes in product design or packaging, product placement, product promotion or pricing; organizational innovation involves introducing a new organizational method in the firm’s business practices, workplace organization or external relations. The innovation must allow to increase the competitiveness and overall profitability. In the framework of our study, we focus on the service innovation in the public organization. Thus, service innovation can be defined as “a new or considerably changed service concept, client interaction channel, service delivery system or technological concept that individually, but most likely in combination, leads to one or more (re)new(ed) service functions that are new to the firm and do change the service/good offered on the market and do require structurally new technological, human or organizational capabilities of the service organization” (Van Ark et al., 2003). According to (Moore and al. 1997, Hartley 2005), “those changes worth recognizing as innovation should be globally (or at least locally) new to the

organization; be large enough, general enough and durable enough to appreciably affect the operations or character of the organization; or be consciously designed or adapted as a response to a perceived problem by some level of the organization”. This definition underlines the fact that the innovation is considered as a success. In the public sector, the innovation allows to improve the performance of the organization; and in this sense, it will increase the quality of services offered to citizens. Innovation may include reinvention or adaptation to another context, location or time period. In the public sector, the diffusion of innovations to other organizations, localities and jurisdictions is particularly important (Rasham and Hartley 2002, Hartley 2005). This is an important difference between public and private sector innovation. Innovation in the private sector is driven by competitive advantage – this tends to restrict the sharing of good practice to strategic partners. By contrast, the drivers in the public sector are to achieve widespread improvements in governance and service performance, including efficiencies, in order to increase public value (Moore, 1995, Hartley, 2005).

Many studies have been conducted on the important elements required to achieve the successful application of a new idea, but in general all relate to three basic steps to be considered (Cumming, 1998, Kenny, B. and Reedy, E.):

- 1) Idea generation (creativity);
- 2) The successful development of that idea into a useable concept;
- 3) The successful application of that concept.

These different steps are highlighted in the innovation process. Indeed, the innovation process is “the development and implementation of new ideas by people who over time engage in transactions with others within an institutional context” (Van de Ven, 1986). The innovation process consists in two main phases: the exploration phase, during which the actors of the organization seek ideas for innovation and the exploitation phase that consists in the development of selected ideas into practical innovations, products, processes or innovative services (Le Loarne and Blanco, 2009). At the beginning, the innovation process includes a key step to generate creative idea based on the specific techniques (Brooke, 2010; De Brabandere, 2005). Creativity is the personal ability to recognize unusual patterns, relations and produce new ideas or things. It is a pre-requisite for innovation (Tang, 1998). To represent the innovation process, numerous models exist; these models represent the different stage that organizations follow in order to promote the innovation from the ideas creation to the innovation implementation. Figure 1 represents an innovation process model in funnel.



To conduct the organizations in the change perspective, the innovation culture seems to be an important factor. An innovation-based organizational culture must possess the following values: client-orientation, commitment towards objectives, challenge and initiative, exemplary behavior, team work and permanent improvement (Canalejo, 1995 in Kenny, B. and Reedy, E.).

In the public sector, many administrations use the CAF model (Staes & Thijs, 2010), a tool that allows to conduct the organizations towards the change and to introduce new innovative services. Thus, the next part presents the model and explains these principles, that allow to consider the CAF as a tool for the innovation.

The “Common Assessment Framework”

To promote the innovation in the public sector, the CAF is a very innovative process tool that encourages administrations to launch it in the continuous improvement process. This tool was defined by the Innovative Public Services Group of the European Public Administration Network in 2000. The CAF is a total quality management tool inspired by the excellence model of the European Foundation for Quality Management and the model of German University of Administrative Science in Speyer. The idea of the CAF model is that excellent results in organizational performance, citizens/customers, people and society can be achieved through leadership driving

strategy and planning, people, partnerships, resources and processes (European Institute of Public Administration, 2006). Figure 2 represents the model through the nine key criteria.

A distinction should be made between the cause-effect relationship between the left part of the model (the enablers-causes) and the right part (the results-effects). This study, which analyses the enablers of the innovation, is focused on the left part.

The two main innovative services, which are identified in the case of the studied administration, are results. The criteria of the results are both the key performance results and citizen/customer oriented results). The issue is to understand the main enablers, which drive to these results innovative services.

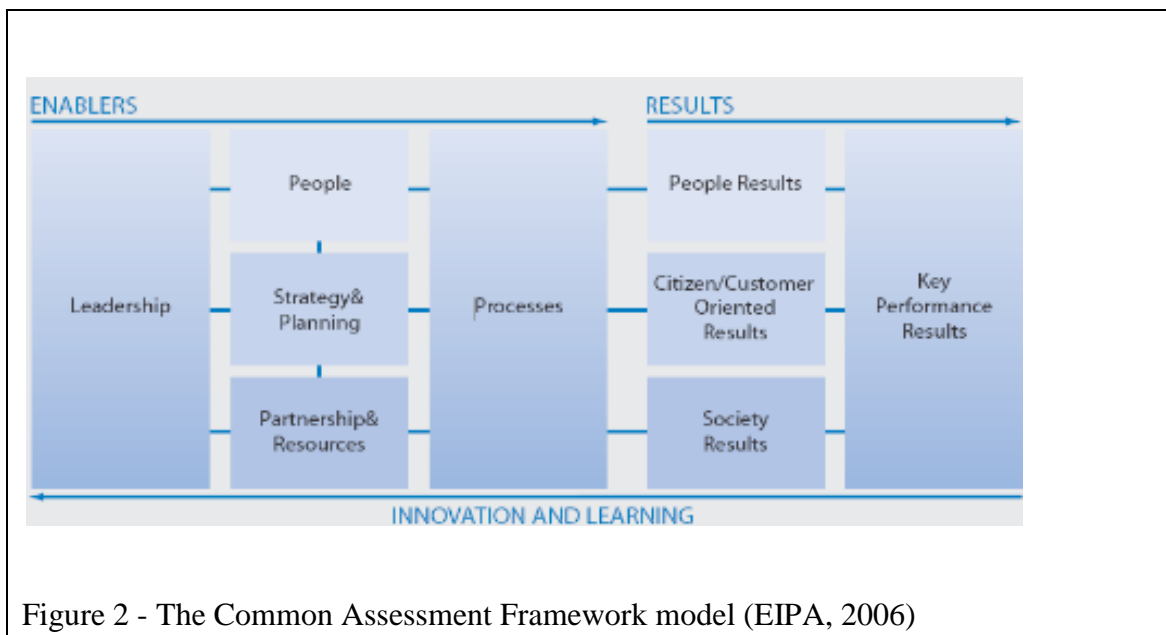


Figure 2 - The Common Assessment Framework model (EIPA, 2006)

As a tool of Total Quality Management, the CAF's criteria make reference to the fundamental principles of excellence as defined by the European Foundation for Quality Management: results orientation, customer focus, leadership and constancy of purpose, management by processes and facts, involvement of people, continuous improvement and innovation, mutually beneficial partnerships and corporate social responsibility. The CAF aims at improving the performance of public organizations on the basis of these principles (EIPA, 2006).

In the light of these criteria, the administration must assess its strengths and weaknesses. This assessment conducts the organization to identify these improvement efforts.

The Caf model is used in a global process of continuous improvement, which is designed and carried out in a number of ways, ten steps to improve organisations with CAF (CAF 2006) :

Phase 1 – The start of the CAF journey

- Step 1 Decide how to organise and plan the self-assessment (SA)
- Step 2 Communicate the self-assessment project

Phase 2 – Self-Assessment Process

- Step 3 Compose one or more self-assessment groups
- Step 4 Organize training
- Step 5 Undertake the self-assessment
- Step 6 Draw up a report describing the results of self-assessment

Phase 3 – Improvement plan/prioritisation

- Step 7 Draft an improvement plan, based on the accepted self-assessment report
- Step 8 Communicate the improvement plan
- Step 9 Implement the improvement Plan
- Step 10 Plan next self-assessment

At this time, the CAF was implemented at the European level in numerous public administrations. Indeed, we currently count more than 2 000 users in Europe and beyond Europe's borders (Staes & Thijs, 2010). In the transfer perspective, different events were organized with the objective of presenting good practices where the use of the CAF has led to improved results (Staes & Thijs, 2010).

Next to the presentation of the CAF model, we present the conducted approach in the framework of our study and we focus on the two main innovative actions that were implemented in the specific administration.

Research Framework

In this paper, we chose to present the case study led in the specific public administration. The case study enables us to justify our findings with concrete data. Indeed, Yin (1994) stipulates that single cases may be used to confirm or challenge a theory, or to represent a unique or extreme case. In this sense, several steps have been conducted in the framework of our work.

During the continuous improvement program, our team of researchers has followed the administration in order to identify the main steps of the process. Between 2007 and 2011, several workshops have been regularly organized with the centre's team and the staff of the administration (project manager, top management). The key data concerning the launch and the progress of the approach have been registered in reports, which include the action, the participants, the date, the delay, the decision, the obstacles and the material resources.

Our team participated in the important events of this process (first meeting with the ministry, training, launch of the self-assessment, report to the management, information session, action plan definition, action plan presentation, follow-up of the plan).

Globally, the team of researchers is composed of 3 persons that have participated in 14 working groups between 2007 and 2011.

After 5 years, an interview was conducted with the administration director in order to discuss the main innovative services of the action plan. This semi-directive interview was based on a questionnaire of 15 questions, which was decomposed in 6 steps:

- Context,
- Motivation, objectives :
 - o what were the triggers of the improvement approach ?
 - o What were your expectations at the beginning?
- Difficulties, obstacles, development:
 - o How was the team of the project chosen?
 - o What was your reaction during the self-assessment?
 - o What was the degree of general satisfaction during the process?
- Main actions
 - o What were the main actions of the actions plan?
- Implemented actions or not,
 - o What is the progress of the implementation of the actions plan?
- Impact of the actions.
 - o What are the results of the actions ?

- Is there a change of the image of the administration?

The interview, which was recorded, was the subject of a transcript for data analysis. In the framework of this interview, the global process was discussed as well as the key performance results get next to the implementation of the two main innovative services.

On the base of this interview and the previous workshops, we selected two main innovations of services (see below) following the features of an innovative services described in the literature.

In this global process, we identified the most important steps of the improvement approach (26 in total), which led to these new services. These steps were classified in the CAF model following the enablers (five first criteria) and its examples (table 1).

In this study, we decided to focus on the actions, which lead to innovation service, that is why the results criteria of the model aren't directly included in the classification.

Nevertheless, we can underline that the two innovative services have had an impact on the different criteria "results" of the model CAF. These main impacts have been significant on the citizen/customer oriented results and on the key performance results.

The CAF experts and the research team validated this classification.

For the classification, we defined some rules:

- The step must be only classified in one sub criteria;
- If certain steps could be classified in different sub criteria, we chose the sub criteria in function of the main representative example;
- In the CAF model we have two kinds of criteria, factors and results. To classify our steps, only the five factors were used. The idea is to see which factors conduct to the innovation of services.
- The examples are only mentioned to justify our classification, other examples could be defined.

Case study

Case study description

The case study concerns the Factory Inspectorate administration in Luxembourg. This public administration has a mission of systematical inspection of the well-being of

workers, on the one hand, the relationship and working conditions, and on the other hand, the health and safety of workers at work.

For example, the Labour Inspectorate and Mines is responsible in particular for:

- Ensuring the implementation of legal, regulatory, administrative and agreements relating to working conditions and protection of employees;
- Providing information and advice to employers and workers;
- Bringing defects or abuses to the attention of the Government;
- Ensuring the implementation of mining legislation;
- Intervening in setting permit conditions for establishments classified as dangerous;
- And ensuring the implementation of legislation on the protection of workers against ionizing radiation and monitoring of facilities.

Before the involvement in the continuous improvement program (see below), there were 2 important external assessments in 2002 and 2003. The first one was a peer review or a benchmarking of the Factory Inspectorate in comparison with other Factory Inspectorate in Europe, the second one was an external audit realized with the International Labor Office.

In 2007, the administration started with the continuous improvement program, which was the first internal approach (bottom up) contrarily to this previous approach.

In the context of the administrative reform, the Ministry of Civil Service and Administrative Reform in Luxembourg launched in 2006 a continuous improvement program (Figure 3) using the self-assessment tool for the public administration.

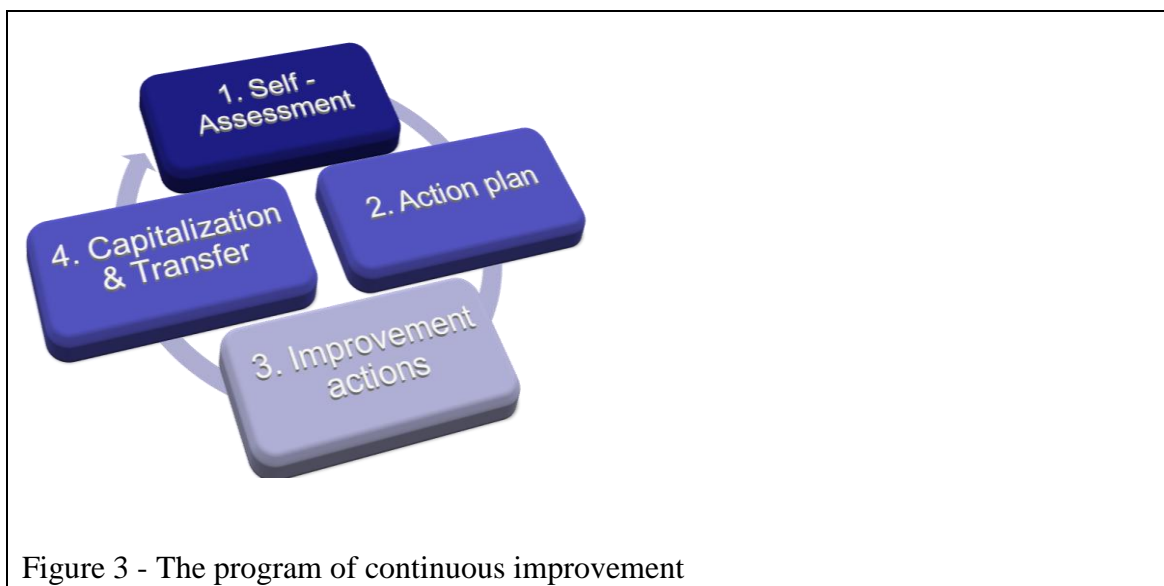


Figure 3 - The program of continuous improvement

The program is implemented by the Ministry in collaboration with the Public Research Centre Henri Tudor. In the first step, a self-assessment is realized in conformity with the excellence model. In the second step, an action plan is defined by the management team in order to improve the organization. The third step is the implementation of the action plan followed by the last step (capitalization and transfer). Until 2011, more the 25 administrations were involved in this process the Factory Inspectorate was one among them.

Innovations studied

During the continuous improvement program, an action plan was defined, 80% of the plan was implemented after 2 years. The global approach produced several results as the creation of a duty holder, a training plan for the staff, a frequently asked question on the website, the definition of key performance indicator, a new organization chart and prevention campaign on TV spot and the helpline service.

This study was focused on the two main innovations in order to analyze the different steps of this global improvement approach. These main innovations, which are the prevention campaign on TV spots and the helpline service, was chosen on the basis of the definition of product innovation in literature. This two services are new in this administration and in general in the public service in Luxembourg, they include the use of new information and communication technology and they have a direct impact on the mission of the factory inspectorate.

Since 2009, the helpline has been implemented with a direct line and with email. The objective is to provide an answer to all the questions related to safety and health at work. With the helpline, the factory inspectorate has had a reduction of 50% of the number of questions in the other services, and they were able to treat the pending requests.

The TV campaign on spots was launched with scenes of 6-8 minutes on several topics (safety, fire, health, law) and TV shows of 20 minutes. This information was in line with the frequently ask questions in order to disseminate information widely. The TV spot are at disposal in podcast on the website on the factory inspectorate.

Process description

The aim of this study is to understand the innovation process, which drives to the innovation services. Based on the continuous improvement program planning and the project follow-up, we introduced the different steps of this process. In a following part, these steps are identified in the criteria and sub criteria of the CAF model.

Steps of this process:

1. In 2003 and 2004, two external assessments with benchmarking and involvement of the stakeholders.
2. Presentation of the continuous improvement program by the Ministry of the administrative reform (Information meeting).
3. Risk identification in the administration environment (re-organization by an external committee).
4. Identification of the continuous improvement program as an opportunity to fight against this risk.
5. Strategic thinking and decision to involve the administration in the continuous improvement program.
6. Team selection (project manager, members).
7. Quality training of the top management.
8. Internal communication at the beginning of the approach (general meeting and email).
9. Call for participation of the employees.
10. Training of the staff and quality awareness.
11. Self-assessments following a quality excellence model with a representative team.
12. Report of the self-assessment presentation of the top management.
13. Constitution of the working group to define the action plan.
- Structured method to define the solutions with external support :
 14. Analysis and selection of the main improvement area, (during workshop).
 15. Collective sense making of the problem and solution.
 16. Innovative solutions finding (during workshop).
 17. Definition of an action plan with the management.
18. General communication with the staff and the ministry (action plan introduction).
19. Following of the implementation of the plan by the duty holders.
- Implementation of the action concerning the helpline and TV campaign :
 20. Helpline procedure definition.
 21. Helpline team selection (job description definition, internal recruitment).
 22. Budget definition for the helpline and the TV campaign.
 23. Infrastructures (room) and materials (Phone, computer) selection.

- 24. Discussion with the TV partner, definition of the final concept.
- 25. Monitoring of the impact of the helpline and TV spot.
- 26. Adjustment of the actions.

Thus, 26 steps were identified in the innovation process to conduct to the two main innovative services in this administration. After this identification, we propose to classify these steps in the different factors and their sub criteria of the CAF model.

Establishment of this process in the CAF model:

In the first part, we classify the 26 steps of the process in the factors and sub criteria of the CAF model. To facilitate and to justify the classification, we indicate the examples of the sub criteria, which are the most representative to the step. Two elements are subject to the discussion. In the CAF model, two steps did not refer to the sub criteria. In the table I, each step is numbered following the chronological order of the process.

Table I: Classification of the innovation process steps in the sub criteria of the CAF model

CAF criteria – sub criteria (enablers)	Steps of the approach of innovation products
1. Leadership	
1.2. Developing and implementing a system for the management of organization, performance and change.	
l. Communicating change initiatives and the reasons for change to employees and relevant stakeholders.	8. Internal communication at the beginning of the approach (general meeting and email). 18. General communication with the staff and the ministry (action plan introduction).
k. Identifying and setting priorities for necessary changes regarding the organisational design and business model.	14. Analysis and selection of the main improvement area, (during workshop).
2. Strategy and planning	
2.1 Gathering information relating to the present and future needs of stakeholders	
b. Systematically gathering and analysing information about stakeholders, their needs and expectations.	12. Report of the self-assessment presentation of the top management.
d. Systematically analysing internal strengths and weaknesses.	1. In 2003 and 2004, two external assessments with benchmarking and involvement of the stakeholders. 11. Self-assessments following a quality

	excellence model.
c. Regularly gathering and analysing information, its source, accuracy and quality. This may include information about important variables such as social, ecological, economic, legal and demographic developments.	2. Presentation of the continuous improvement program by the Ministry of the administrative reform (Information meeting).
2.2. Developing, reviewing and updating strategy and planning taking into account the needs of stakeholders and available resources	
a. Developing and applying methods to monitor, measure and/or evaluate the performance of the organisation at all levels ensuring the monitoring of the strategy's implementation.	25. Monitoring of the impact of the helpline and TV spot.
b. Systematically reviewing risks and opportunities (e.g. SWOT-analysis) and identifying critical success factors by regularly assessing these factors in the organisation's environment (including political changes).	3. Risk identification in the environment of the administration (re-organization by external committee). 4. Identification of the continuous improvement program as an opportunity to fight against this risk.
2.3. Implementing strategy and planning in the whole organization	
c. Translating strategic and operational objectives of the organisation into relevant plans and tasks for departmental units and individuals within the organisation.	17. Definition of an action plan with the management.
e. Assessing the need to reorganise and improve strategies and methods of planning.	26. Adjustment of the actions.
2.4. Planning, implementing and reviewing modernization and innovation	
c. Planning of changes leading towards the process of modernisation and innovation (e.g. applying net services) on the basis of discussions with stakeholders.	5. Strategic thinking and decision to involve the administration in the continuous improvement program. 19. Following of the implementation of the plan by the duty holders.
3. People	
3.1 Planning, managing and improving human resources transparently with regard to strategy and planning	
a. Regularly analysing current and future human resource needs, taking into account the needs and expectations of stakeholders.	6. Team selection (project manager, members).

3.2. Identifying, developing and using competencies of employees, aligning individual and organizational goals	
h. Planning of training activities and developing communication techniques in the areas of risk and conflict of interest management.	7. Quality training of the top management. 10. Training of the staff and quality awareness.
3.3. Involving employees by developing open dialogue and empowerment	
b. Proactively creating an environment for gaining ideas and suggestions from employees and developing appropriate mechanisms (e.g. suggestion schemes, work groups, brainstorming).	9. Call for participation of the employees.
c. Involving employees and their representatives in the development of plans, strategies, goals, the design of processes and in the identification and implementation of improvement activities.	13. Constitution of the working group to define the action plan.
4. Partnerships and resources	
5. Processes	
5.1. Identifying, designing, managing and improving processes on an on going basis	
a. Identifying, describing and documenting key processes on an on going basis.	20. Helpline procedure definition.
b. Allocating resources to processes based on the relative importance of their contribution to the strategic aims of the organization.	21. Helpline team selection (job description definition, internal recruitment). 22. Budget definition for the helpline and the TV campaign. 23. Infrastructures (room) and materials (Phone, computer) selection.
5.3. Innovating processes involving citizens/customers	
b. Involving stakeholders in process innovations e.g. by piloting new services and e-government solutions.	24. Discussion with the TV partner, definition of the final concept.

In the CAF model, two steps are not covered namely:

- 15. Collective sense making of the problems and solutions;
- 16. Innovative solutions finding (during workshop).

These elements will be explained and analyzed in the next part of this communication.

A model through the five factors of CAF model is proposed in the figure 4 in which the 26 steps of the innovation process are identified in a logical chain.

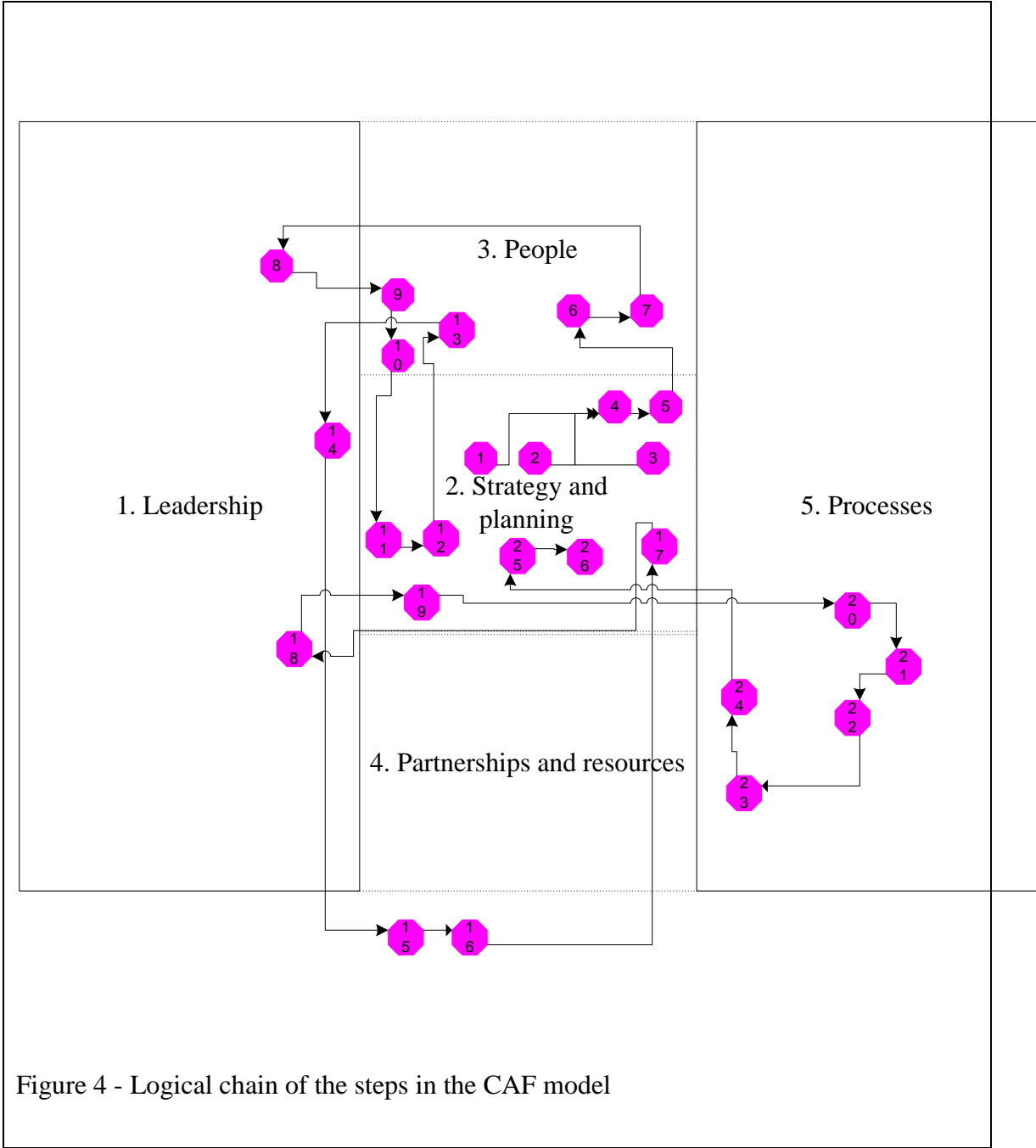
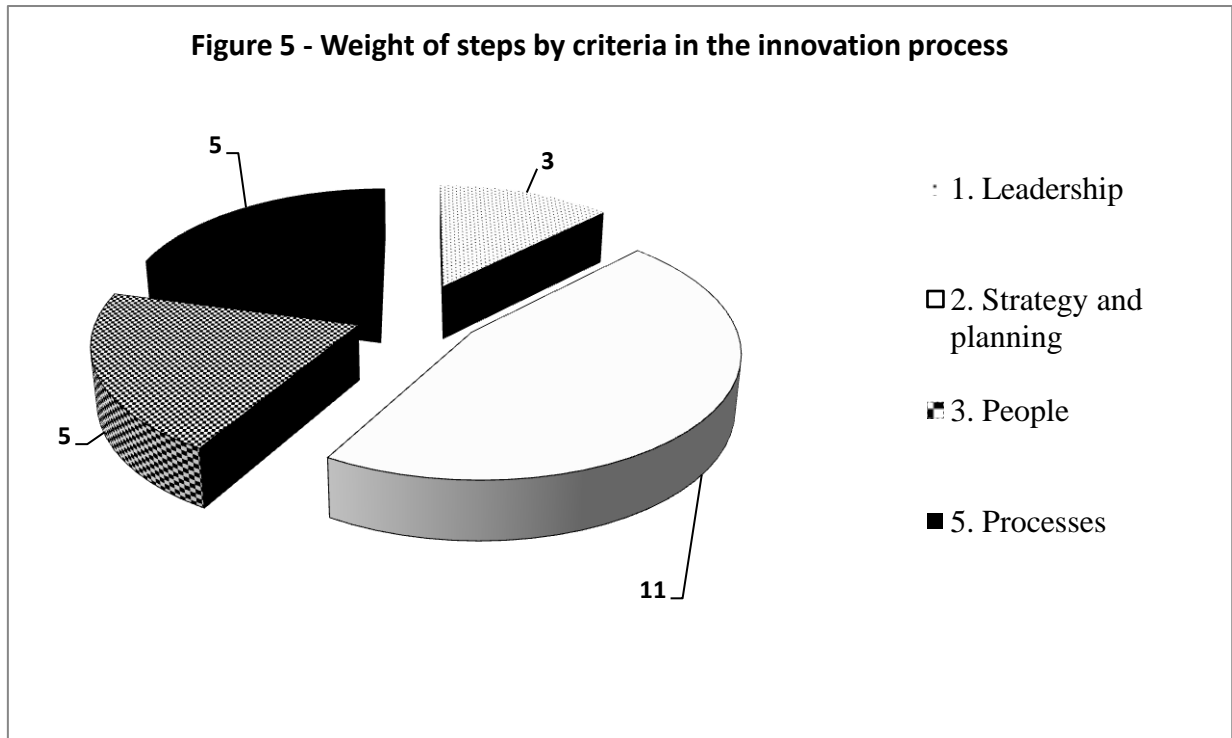


Figure 4 - Logical chain of the steps in the CAF model



Among the 26 steps of the innovation process (Figure 4), which drive to the product innovations, 11 steps come from the second criteria of the CAF model, the strategy and planning. The other steps are shared between the criteria 1, “leadership” (3 steps), the criteria “people” (5 steps) and the criteria 5, “processes” (5 steps).

Discussion

Two main objectives were aimed at in the framework of our study:

- the identification of the key criteria in the model CAF which leads to innovation;
- And the identification of missing elements, which are key for innovation.

Four main criteria have been identified in the model CAF that constitute elements to lead to innovation.

The criterion, “strategy and planning” gathers the majority of steps of the innovation process. In this criterion, the triggers of the process have been identified, the two external assessments in 2002 and 2003. These approaches have created the need to change with the identification of problems and the areas of improvements. More recently, the proposition of a re-organization by an external committee has been perceived like a “treat” by the top management. In this context, the continuous improvement program was perceived like an opportunity to start the internal change, which could limit the risk of external re-organization. A good perception of the

environment is a key element in this situation, both for the risk identification as well as the opportunity detection. All these triggers are in link with the criteria 2, strategy and planning.

This triggers drive to the strategic decision to involve the administration in the continuous improvement program with an objective of modernization and innovation. Thus, the administration defines an action plan, following by the monitoring of the actions progress and the adjustment of actions.

The second main criterion is people, which contains five steps of the innovation process. It demonstrates the crucial importance of involving the employees in a spirit of collaboration. A participative approach seems to be a key factor of success for innovation. In this way, the approach was opened to all the employees through a global communication.

The employees and the management must be trained and must be aware of the quality and continuous process.

The second main criterion at the same level of the “people” criterion (same number of steps) is “processes”. The different steps of this criteria aim at designing the concrete solution and at managing them. The technical material, the infrastructure, the financial and human resources are defined in line with the new processes.

The last main criterion is “leadership”. The top management supports the project with a strong communication during a global information session in the beginning of the approach and after the action plan definition in order to introduce the plan to all the administration and the stakeholders (ministry).

We could see that the criteria “partnerships and resources” is not covered in the innovation process. If another classification and rules is to be defined, some steps could be classified in this criterion and could change this fact. Nevertheless, in this case, the factor “partnerships and resources” is not a key element to the conduction of the innovation.

Two main steps of our innovation process could not be clearly classified in the CAF model:

- “Collective sense making of the problems and solutions”;
- And “innovative solutions finding (during workshops)”.

The “collective sense making of the problems and solutions” is one of missing elements in the CAF model. Weick (1969) refers to sense making as making sense of uncertainties in environments through interaction. He applies this theory to demonstrate how the members of the organizations make choices (or are forced to make choices) when uncertainties arise. Weick (1995) argues that sense making examines the critical issues of organizational behavior and also the meanings that are constructed with/within organizations. Numerous employees intervene in the innovation process that conducts to the interaction between them in order to go in the same direction. In this perspective, the “collective sense making of the problems and solutions” seems crucial to reach the innovation.

Although this element wasn't clearly mentioned in the CAF model, we agree that this element could be classified in a large vision “people” criteria (sub criteria 3.3 for example), but we remark that this element is not clearly included in the model (absence in the sub criteria and in example). This approach of “sense-making” was underlined like a key element by the top management during the interview; it launched a collective action of innovation.

The concept of “ideation” is the step of creativity step “Innovative solutions finding (during workshop)”. In the same way, this element could be classified with a large vision in “strategy and planning” criteria (sub criteria 2.4 for example). For the same reason, the step is not clearly present in the model. The research of innovative solutions is a main step to imagine the new solutions and the future, which drive to implementing innovative solutions. The step of “ideation” is frequently mentioned in the processes of innovation in the literature (Le Loarne and Blanco, 2009; Brooke, 2010; De Brabandere, 2005).

As illustrated in Figure 4, these steps are in a logical chain with frequent “round trip” through the criteria. Nevertheless, there is not a clear sequence between the different criteria or sub criteria. The process begins in the criterion “strategy and planning”, continues in the people “criterion”, goes to the “leadership” criterion, returns into the people criterion, with a loop to the strategy and planning.

If we compare our innovation process to the theoretical innovation process (figure 2), the 26 steps follow the same logical process from the idea creation to the development and implementation of product/service.

Previously we introduced the ten steps of improvement in a public administration described in the guideline for improving organisations in addition to the CAF model. In this guideline, a clear sequence of steps is recommended with the start of CAF, the communication of the project, the self-assessment group composition, the training organisation, the improvement plan design, the implementation of the plan. The guideline contains in itself the main steps of the innovation process.

As a consequence, the innovative services are the result of the combination of the CAF model and of the guideline for improving organisations, which creates the precious sequence of events.

Conclusion

In this paper, the idea was to demonstrate that the CAF model is a tool that supports the administration to innovate. Thus, we identify the main factors and the missing factors of the CAF that enter in the innovation process.

It was interesting in the first time to explain the generic innovation process and the CAF model criteria before identifying the main steps of our innovation process that have been deployed in the specific public administration. The next step of our study consisted in the identification of the main steps of the innovation process defined to conduct the administration to innovate.

Indeed, the innovation is a complicated process of applying new ideas for gainful purpose (Tang H.K., 1998). Thus, rapid innovation requires an effective innovation process. "The process of innovation is a rhythm of search and selection, exploration and synthesis, cycles of divergent thinking followed by convergence" (Leonard D. and Sensiper S., 1998).

After presenting the main steps of our innovation process, we identified the criteria and sub criteria of CAF model that intervene in order to develop new innovative services. These different steps have been modeled in the CAF through the different criteria. In the framework of our case study, two new innovative services that have been developed and implemented in the public administration, allowed to build this study. Four main enablers of the CAF model have been identified in the innovation process :

Strategy and planning: It contains the triggers of the approach with the environment perception (risk and opportunity) and with the strategic decision to start in a improvement program.

People: The involvement of the personal is a key element to create an “open innovation”.

Processes: The different operational steps aim at designing the concrete solution and at managing them

Leadership: The top management supports the approach with a global communication and implication.

Nevertheless, two key steps, which drive to innovation, aren't clearly mentioned in the CAF model: the collective sense making of the problems and solutions, and the creative solutions finding (Ideation).

In the innovation perspective, the administration must, beyond the identification of criteria, define an innovation process. The innovation process is not a random chain; it follows a logical process with the triggers steps namely the decision of involvement, the planning, the design, the follow-up and the adjustment of the actions. In this sense, the organization must manage an innovation process with a coordination of each key criterion. The organization must not focus its efforts on the criteria only; the criteria are only a support in the building of this logical innovation process. A clear sequence is introduced in the guideline for improving organisations in addition of the CAF model in ten steps.

In consequence the innovation is both the results of key points (environment perception, risk and opportunity, strategic decision, staff involvement, leadership implication, collective sense-making creation and creative solutions finding) and the combination of the element in a logical chain. If the model CAF contains the key elements for innovation, with the exception of the collective sense making and the creative solution finding, a logical combination of all these elements in a precise sequence have to be introduced in the guideline for improving organisations.

Limits of this study:

Although the study through the CAF model allowed the identification of the main factors in our innovation process, some obstacles have been encountered such as the classification of the different steps of the innovation process in the CAF model.

In this study, we decided to focus on the actions, which lead to innovation service that is why the results criteria of the model are not included in the classification.

Nevertheless, we can underline that the two innovative services have had an impact on the different criteria “results” of the model CAF. These main impacts have been significant on the citizen/customer oriented results and on the key performance results. Another study could focus on the results that the innovation process through the CAF model produces.

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Serious Games as an Approach to create Innovation and Sustainability taking Gender Aspects into Consideration

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Keywords: Serious Games, Gender, Innovation, Sustainability, Interdisciplinary, Engineering Degree Courses

Category: Research paper

Introduction

Engineering degree courses do not seem to be as attractive as required, neither for men nor for women. The number of engineering students is too small, and the number of female engineering students is obviously underrepresented. In 2003, about 28 percent of the engineering students in Germany were female /destatis 2003/. To underline the necessity of a higher number of engineers the following quotation is given: ‘The lack of engineers threatens our competitive advantage and thereby in the end our prosperity’ Louis Gallois told in an interview /Welt am Sonntag, 19.4.2011/. To intensify this statement the ICB (Institute for Work Market and Education Research, Nürnberg, Germany) expects a ‘substantial lack of engineers if no countermeasures were taken’.

The Institute of the German Economy assumes that in 2020 230,000 engineers will be missing / Welt am Sonntag, 19.4.2011/.

The lack of engineering students leads to two problems: to increase the number of engineering students, especially female engineering students, and to enable these students to create innovation and sustainability.

Supporting and hindering factors concerning female engineering students have been investigated in several studies, especially by the European projects INDECS (2001) and WomEng (2005). The main result is that interdisciplinarity attracts more women. Due to this observation, some of the engineering degree courses involve more non technical subjects into their curricula than traditionally usual.

Mechanical Engineering and Security and Safety Engineering are two degree courses at the Faculty of Engineering at the University of Wuppertal. Both courses show a rather small percentage of female students: Mechanical Engineering about 14% and Security and Safety Engineering about 13%. Within the engineering curricula the students take different modules and in between both degree courses a 'management module' is offered. This management module includes subjects like project management, management methodologies as well as creative methodologies. The module is not structured in the same way for the two engineering degree courses but similar. And both modules combine non technical lectures.

Due to the two hypotheses that interdisciplinary modules attract more (female) students on the one hand and on the other hand that serious games are a holistic methodology to train management and decision making skills as well as soft skills and therefore train innovation and sustainability abilities this module combines two measures to verify a sustainable engineering education.

Application of Serious Games

General Remarks

Serious games are known for many years right now and their advantage is to offer the possibility to learn individually in a holistic context. These games can be used as tools for life-long-learning /Baalsrud Hauge et al. 2009/. The students just have to be enabled to carry out, to play the games. By playing they increase their competences by getting individual skills and knowledge /Piekkola 2004/. Depending on the content of the game

the students are lead towards innovative and sustainable solutions. It turned out that the students, especially the female engineering students liked the risk free environment for active experimentation. They enjoyed the individuality of solving the given tasks, the creativity. Playing enables the students to develop creatively problem solutions and to get a holistic view. At the same time the team competencies as defined by /Haug 1998/ are improved through simulation of various and changing conditions. This course of the games supports the network competencies as well and enables the students to realize a diversity management. Through serious games content and methodologies are trained, the results are students being able to work interdisciplinary and innovative.

Serious games belong to the media ecology of the 21st century doubtlessly and the support and improve unexpected learning processes (Klimt, 2008). Serious games do not have to be digital related educational tools; many non-digital easily applicable serious games exist as well which do not use any digital equipment.

Nevertheless, it is quite unusual to apply serious games within university lessons. When participating in the QMOD Conference 2009 in Verona the authors met a manager of the LEGO Company, who was a keynote speaker at the conference. And he invited all participants of the conference to get involved in a game. We enjoyed playing as everyone did and decided to apply this game in classes. The LEGO Company offered the necessary stuff and descriptions of the game.

Since 2009, we carry out this LEGO Racers Championship with our students in two engineering degree courses: mechanical engineering and safety and security engineering.

In general, the applied game aims at improving management skills just as the ability to take decision, to work in a team, to communicate, to install management structures, to show social responsibility, and methodological knowledge. Its application is within a module including management and creative methodologies.

Situation in class

Within the lectures one actual project is being worked out during the entire lecture of the whole semester like to build up a company to produce bicycles. The students are trained to work in groups, to present results, to work interdisciplinary and to think holistic; the lectures are mostly non-technical.

At the time we apply the game the students knew each other and they knew the lecturers for at least some weeks. Demands of lecturers as well as of students were discussed; the atmosphere is driven by confidence and trust.

When we start the LEGO game we did not discuss any pedagogical issues of the game, and usually the students did not ask for them. This leads to the following general conditions:

- The students did not get any information about the game at all before it starts.
- They may not use any additional equipment just the stuff offered by the lecturers.
- The students may communicate with each other (in between their group) during the whole game.
- They are split into groups of about 10 students playing at the same time at different places.
- The group members are chosen by the lecturers. Due to the fact that we knew the students, we knew about extroverted and introverted students, about their personality, we knew about the female students and about their behaviour in class, so, we always tried to arrange a balanced group. Balanced group for us meant to get one of the male peer students in each group as well as one of the female peer students e. g.
- After building the groups, the students got the instructions and the opportunity to ask and get explanations. But they did not get any information concerning pedagogical sense and aims of the game as already mentioned. Usually they do not ask for any pedagogical goal, just for the superficial game goal itself, how to win the game. We did not discuss the pedagogical aim in advance. The students were interested in playing the obviously offered game, and they do not care about any pedagogical background.

Description of Game

The following description is mainly given by an internet link by LEGO which does not actually work [/http://www.nff.dk/index.php?option=com_content&id=67/](http://www.nff.dk/index.php?option=com_content&id=67/); some variations for the students had been made to simplify the application. Here it is quoted the way it is used in class:

„LEGO Racers Championship

As you may know, the LEGO racing team is the best in the world, but in order for the team to stay that way, they will need your help. The reason why the team is number one is that they have the most stable cars in the world. However, before the next race they will need three new cars and that is where you come in. Because of your expertise, The LEGO racing team has hired you to select the three new cars.

The game is divided into two phases:

- a **preparation phase** and
- an actual **race phase**

Preparation phase: chose the cars and prepare for race

Race phase: you attempt to score as many points as possible

Duration is 20 Minutes, including both phases, for example if you spend 12 minutes on preparation, you have 8 minutes left for the actual race and vice versa.

Preparation Phase

- The **track:** you have to start at the launch area and to reach the bull's eye (scoring the most points)
- The **preparation phase rules:**
 - select *three cars*,
 - you may use the *given materials* –scissors, cardboard, boxes e.g.- to build whatever construction you might like to help the cars hit the bull's eye
 - you are only allowed to *build within the launch area*
 - you may *change the construction at all time* during this exercise
- The team leader: *I will choose the team leader* when I am done explaining the rules.
- Only the team leader can *start* scoring points process by clapping into his/her hands and saying '*Go!*'

The Race

- The **three cars** you have chosen must all be used in the race, and they **must take turns.**
- The amount of points you score depends on where the **front wheels** of the car stop. Both wheels have to be inside the same ring.

- You can **lose points**:
- If the car stops outside the bull's eye you will lose **1,000** points.
- You will lose **5,000** points if you touch a car in motion.
- You will lose **5,000** points if you damage a car.
- You have to administer your time! Total amount of 20 minutes!

Advice

- You can buy an advice from me at any time during the game.
- An advice in the preparation phase will cost you 500 points.
- An advice in the race phase will cost you 5,000 points.”

These instructions are offered to the students via a power point presentation.

Methodological Approaches and Empirical Performance

Field Work

Case studies including focus group discussions and participating observations are carried out at two universities, one settled in Germany and the other one located in Slovakia. The students belonged to engineering degree courses. 12 case studies were carried out.

The instructions as mentioned were offered to the students via power point. The students got the opportunity to question and after clarifying all questions the game started. This procedure was carried out in the same way during all case studies. All lecturers were female.

Due to our hypotheses that serious games enhance the ability of innovation and the ability to create sustainable solutions on the one hand and on the hand those interdisciplinary modules attract (female) engineers we decided about the parameters to investigate on.

Therefore, the observation of the students' behaviour was focused on /Hoeborn and Bredtmann 2011/

- *General attitude* towards the game: Are their gender and cultural differences? Taking personality differences into consideration.

- *Roles of students* (team structure) within the group: Does any gendered or cultured leadership behavior appear?
- *Solution of tasks and decision making process*: Do the students get the pedagogical sense of the game and therefore solve the tasks in an adequate way, and is this recognition driven by gender or culture? What about any decision making process within the game, is it gendered or cultured?

All observations were carried out by at least 2 observers (female lecturers), mostly by 3 or 4. All observations were recorded and after finishing the game the different observers evaluated their results. At the end of the game, the game was discussed with the students, and the results of the observations were offered to and discussed with them as well and as a final step the students were interviewed (as a focus group) about their experiences and feelings concerning the games. Additionally the students were interviewed about their attitude towards interdisciplinary offers and especially towards serious games as teaching and learning methodology and *to investigate on the supporting character of the interdisciplinary module and especially of the serious games to increase the number of female engineering students on the one hand and on the other hand to gather the influence of serious games on innovation and sustainability.*

Two female groups were carried out as control groups as well, even if the situation in class differs a bit for these case studies.

Observation and Description

All students focused on winning this game by getting as many points as possible. They did not reflect possible reasons for the lecturers' choice or think about the pedagogical aims of the game. The lecturers did not explain that the game can only be won by co-operation and team play. It was up to the students to recognize these demands for winning the games. There was always a competition with at least a second group.

- *General attitude* towards the game: Are their gender and cultural differences? Taking personality differences into consideration.

In general, the groups behaved very heterogeneously depending on their national backgrounds (German, Indian, Chinese, and Pakistani) or their gender. In other groups some of the female students seemed on edge, but mostly because they had to play with

their male classmates. Some students were very reserved at the beginning and some started with enthusiasm. The game always turned out as funny and valuable.

In Slovakia it turned out quite different due to extremely different pedagogical ways of teaching. The groups behaved totally reserved, they did not know at all how to react to the given task of playing, and they felt like doing an exam. The students really felt uncomfortable which was not intended. The lecturers explained the games several times taking small language skills of the students into consideration on the one hand and on the other hand –and this was weighted even higher- the students were not used to apply serious games or to carry out group work. When the game was carried out the first time it was a disaster which was not discussed due to students' feelings, the students did not solve the given tasks. After teaching some hours by using creative methodologies and creating an atmosphere of confidence the game was offered a second time. The students started to play and the game turned out as funny and valuable.

- *Roles of students* (team structure) within the group: Does any gendered or cultured leadership behavior appear?

The leadership behaviour being performed varied a lot. The lecturers determined the team leaders as already mentioned before. Performance clusters in between the groups:

Differences in accepting male or female leaders were performed. Groups partly accept the boy as leader even if they did not show any adequate team structure, but there was no competitive or discriminating atmosphere observable. But groups having a female leader- did not react to the leader and her instructions. The boys did it their way even if the leader intervened. In one case one of the male students disturbed any teamwork anytime and behaved as a self-appointed leader and the other team member react to him in the required way. The atmosphere in between the group was competitive and discriminating – intentionally forced by the self appointed leading male student. Concerning all groups the students did not discuss any role distribution.

In Slovakia the male leaders²⁰ distributed roles and all male students behaved as assumed for their roles, but the female students were very shy and introverted, and they took by their own choice and accepted a subordinated role to their male classmates. All male students showed a much bigger extroversion. The group members as well as the

²⁰ We chose male leaders because the male students were more extroversive, and we hoped for a bigger success of the game by their support.

leaders did not try to motivate all members to participate and to solve special tasks having just one exception when they needed the language skills of a female student.

Experienced student groups (master studies) performed co-operation and team work. The leader distributed roles and the students behaved as expected for their roles. But there were obvious differences concerning extroverted behaviour due to different national backgrounds and language skills. But the group members as well as the leader tried to motivate all members to participate more obviously.

Female control group: The students did not discuss any role distribution, but often women turned out to be self-appointed leaders. In general they performed like a team.

- *Solution of tasks and decision making process*

None of the students got the pedagogical sense of the game. They just thought of getting points in the race, the obvious goal.

In general, there exist two ways of performance: The leader's decisions were not transferred and the other students tried to smooth the situation by making additional suggestions to these of the self appointed male leaders or the leaders' decisions were transferred and the groups reacted like a team, they discussed decisions as well.

Even the Slovakian group transferred the leaders' decisions and the group react like a team by having female visitors or female observers (Female classmates who did not get involved). The female students did not demand their participation. The groups react the same way. They lived a male dominated competition for getting the most points. They did not buy any advice.

None of the students in the female control groups made any decision without consultation with the other students. They did not buy any advice.

It was quite astonishing that the students did not buy advices. They were not interested in the advices at all. None ever asked for the number of advices. Three Groups bought two advices (out of eight possible), but they did not continue the way of buying advices and getting support. Buying all advices leads to the solution of the tasks.

Purpose

The purpose is directly related to the two problems: to increase the number of (female) engineering students and to enable the students to create innovation and sustainability. By implementing serious games as a sustainable part of the curricula more (female) engineering students are attracted, and those students are enabled to create innovation and sustainable solutions. Therefore, the implementation of these games is sustainability and sustainable at the same time.

Results

After finishing the game the students were asked about their experiences and feelings concerning the game. Here are the students' comments:

- All students liked the game and really enjoyed playing it.
- And they underlined that they feel comfortable to play in a girl group and that it offers the possibility to generate creativity without being discriminated.(Female control group)
- The students noticed themselves as a team without any role assignment.
- They enjoyed their team work especially due to the fact that they did not know each other.
- They enjoyed it to play in a female group and they expected a more competitive atmosphere when playing with boys. The female students liked to feel free to develop a solution without getting male comments.(Female control group)
- Only 2 groups were aware of the aim of the game and the management tasks even though they did not know the game before. The group was very empathic and noticed the cultured differences of extroversion.
- When discussing most of the groups reflected their behaviour and noticed grievances. Then they recognized the aim of the game and evaluated that they failed. They were just competition driven without taking any soft skills into consideration even if it would support their competitive position.

This positive attitude of the students towards this serious game drives us to apply more serious games and we noticed a sustainable learning effect: All groups were aware thinking about methodologies to solve tasks, discussing creativity, to co-operate e.g.

The hypothesis that non technical lectures as interdisciplinary study offers attract more (female) engineering students was verified through interviews with the students.

We carried out 25 small qualitative interviews. During the interviews we asked the students about their likes or dislikes of the serious games which had been applied (not just about the LEGO Game). All students liked the games, but the female students (18) underlined that they would recommend this module to their classmates because of the application of serious games. Additionally we carried out 12 focus group discussions with our students being involved in the case studies.

The type of personality characterizes the behaviour of people and it likely overlaps gender and cultural influences, but nevertheless a gender and culture relevance of the behaviour towards serious games turned out very obviously:

- Female students behaved in a different way when being in a mixed group, up to getting into subordinated roles to their male classmates.
- Female students rarely perform leadership competencies in mixed groups.
- A cultural background leads to big differences towards using games up to denying them. A special preparation of the students in advance should be taken into consideration.
- Background of the game is the competition of the race which can only be won by co-operation and team play. In general the female students performed more towards co-operation by building teams and taking common decisions than the male students.
- Due to the fact that the game includes the two sides of a coin 'co-operation as well as competition' it offers the possibility to be aware of and to break gender barriers as well as any diversity barrier /Hoeborn and Bredtmann 2011/.

Research Limitations

At this time the number of case studies is limited, and the development of further steps to improve the serious games themselves as well as their implementation has to be improved.

There is still more research work to do to improve interdisciplinary modules in engineering degree courses on the one hand and on the other hand to improve serious games concerning their consideration of gender and culture differences.

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Performance-based logistics

A literature review

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Key words: Performance-based logistics, Performance contracting, Product service systems, Servitization

Category: Literature review

Introduction

Recently, many manufacturing firms have moved from selling only products towards selling the outcome of their products, i.e. the product performance. The transformation has mainly been made by suppliers of defense and aerospace equipment, providing large scale, capital-intensive products, known as ‘technical systems’ or, as further referred to in this article, exclusively ‘systems’. These manufacturing firms, hereafter called ‘suppliers’, became performance orientated relatively early and seem now to have the most developed approach for selling performance – often referred to as *performance-based logistics* (PBL) (Hypko et al., 2010).

In PBL, the supplier provides a combined offer of both the system and related support services, such as maintenance, repair and logistics. Moreover, instead of paying for the system, the customer pays according to achieved system performance, e.g. the availability of an aircraft. Consequently, the responsibility for the system performance is shifted from the customer to the supplier, forcing the supplier to concentrate on delivering results rather than delivering resources. An extreme form of PBL would be a case where the supplier keeps the ownership of the system during its entire lifecycle, using the system merely as a means to deliver the required performance, see figure 1. The expectation of PBL is that performance will be produced more efficiently, resulting in advantages for both the supplier and the customer.

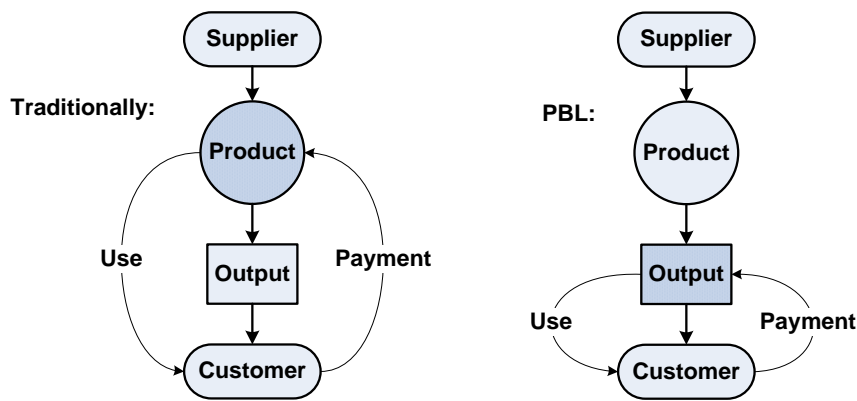


Figure 40: The difference between PBL and the traditional way of making businesses. Adapted from Pawar et al. (2009).

The notion of PBL originated in the United States military in 2001 (Devries, 2004, GAO, 2004, Berkowitz et al., 2005). To date, a limited number of articles on PBL have been published. The limited literature has not yet devoted enough attention to key PBL aspects such as how performance should be measured, what the risks are for the customer and the supplier, and if PBL is profitable?

However, the history of selling and contracting for performance goes back further in time than PBL. Research applicable to PBL can be found under different headings, such as ‘product-service systems’ (PSS) and ‘servitization’.

PSS is described as an integrated product and service offering that delivers value in use (Baines et al., 2007). Similar to PBL, the essence of PSS is selling and buying performance instead of products. PSS originated in industrial ecology as a result of the expectation that reduced consumption of materials could be obtained if the product ownership stayed with the supplier (Tukker, 2004, Baines et al., 2007, Spring and Araujo, 2009). Nonetheless, PSS is also discussed as a means to gain better product performance, and PBL is regarded as a variation of PSS with a large service component, implying that the supplier is relatively free to decide how to produce the performance (Tukker, 2004, Park and Lee, 2009, Neely, 2009, Kuo et al., 2010).

Servitization is the occurrence of adding a service to a product, i.e. moving from selling a product to selling a PSS. Commonly identified as the first article giving attention to servitization is Vandermerwe and Rada (1988), suggesting main motives for servitization and impacts on competitive dynamics. Even so, Schmenner (2009) propose

that the servitization has antecedents going back around 150 years, when some manufacturing companies started bundling goods with services to gain market power.

The interdependence between PBL, PSS and servitization is described in figure 2.

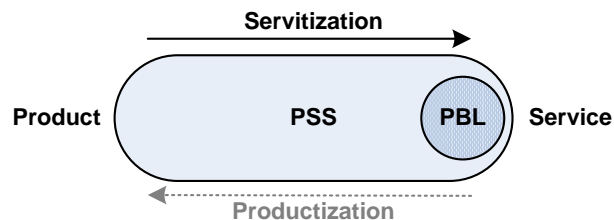


Figure 41: Servitization is the transformation of a product to a PSS by adding a service. Moreover, PBL is a variation of PSS.

In this study PBL is reviewed in the broader context of PSS and servitization, enabling knowledge to be drawn from related research areas. The purpose of this study is to describe how PBL is implemented, explore strengths and weaknesses, and point out areas for future research.

The article begins with a discussion of the methodology used for conducting the literature review. Thereafter the findings are presented, beginning with the benefits of trading performance, followed by considerations when implementing PBL, and the risks for the supplier and the customer. Finally, the conclusions are presented along with a discussion of the findings and suggestions for future research.

Methodology

This article is based on a review of literature concerning PBL, PSS, servitization and performance contracting. The reason for extending the literature review beyond PBL was that few PBL publications had been made, and many of them were conceptual publications containing little empirical evidence. The search was conducted in Web of Science and Scopus. These databases were selected since they usually cover technical and management journals as well as conference proceedings, which is where the research on servitization and related concepts primarily has been published. All articles mentioning “performance-based logistics”, “product-service systems”, “servitization” or “performance contract” in the title, abstract or keywords were initially selected.

A total of 434 articles were identified through the search. I reviewed the abstract of each article and classified the articles as “relevant” or “not relevant” for this study. A relevant article focused on servitization, PSS, PBL, or an aspect closely related, such as contracts in PSS or PBL. When all abstracts had been reviewed, 65 articles were classified as relevant. During the review of these articles, I found some of the references in the articles interesting. These articles were added to this study, which increased the list of articles to 78. All articles are presented in table 1.

Findings

The benefits of selling and buying performance

PBL is commonly regarded as a win-win strategy for the supplier and the customer compared to a more traditional way of buying and supporting capital intensive and complex systems, see e.g. Keating and Huff (2005), Beatum (2007), Sols et al. (2007), Dang et al. (2009) and Hypko et al. (2010). Traditionally, the customer buys a system and is thereafter responsible for all support services. Moreover, the original equipment manufacturer is usually the only actor able to provide support and spare parts to such systems (Keating and Huff, 2005, Nowicki et al., 2010), implying that the customer becomes dependent of the of the system supplier. Meanwhile, there is little motivation for the supplier to improve the reliability of the system, since much of the supplier’s profit comes from selling parts and support services (Sols et al., 2007). However, Nowicki et al. (2010) suggest that even though the traditional way of providing support services seems advantageous for the supplier there are small opportunities to make large profits.

Now follows a discussion on how PBL could address the shortcomings of the traditional model from a supplier, customer and value chain perspective.

The supplier perspective

In PBL, the supplier’s income depends on the performance of the system, e.g. the availability of an aircraft. Consequently, the supplier’s profit is increased if the system and the support processes are improved. Moreover, since the supplier is responsible both for manufacturing and support, the supplier is free to decide how to produce and improve the performance of the product. The supplier could thus e.g. improve the repair processes, logistics processes, and product reliability (Smith, 2004, Kim et al., 2007, Kumar et al., 2007). Such improvements generate profit as the performance increases,

but are also likely to improve the supplier's competitive position as the improvements may lead to enhanced technologies (Baines et al., 2009b, Hypko et al., 2010). Furthermore, PBL is carried out in close cooperation with the customer, which should enable a strong customer relationship and customer loyalty (Hypko et al., 2010). However, despite the possible advantages of PBL it should be recognized that the supplier could be forced to engage in PBL as a consequence of customer demands or fierce competition that increase the need for a differentiated product (Baines et al., 2009b).

Table 14: The reviewed literature in chronological order.

Nr	Author	Year	Origin	Research topic	Number of publications by period				
					1988-1999	2000-2002	2003-2005	2006-2008	2009-2011
1	Vandermerwe and Rada	1988	Switzerland	Servitization					
2	Martin	1997	Netherlands	Performance contract					
3	Frost and Lithgow	1998	Australia	Performance contract	4				
4	Mahoney and Thompson	1998	USA	Performance contract					
5	Maples et al.	2000	USA	Performance contract		1			
6	Cunic	2003	USA	Performance contract					
7	Devries	2004	USA	PBL					
8	Doerr et al.	2004	USA	PBL					
9	GAO	2004	USA	PBL					
10	Howard	2004	USA	PBL					
11	Smith	2004	USA	PBL					
12	Yik and Lee	2004	China	Performance contract					
13	Tukker	2004	Netherlands	PSS			14		
14	Barrie	2005	USA	PBL					
15	Berkowitz et al.	2005	USA	PBL					
16	GAO	2005	USA	PBL					
17	Keating and Huff	2005	USA	PBL					
18	Phillips	2005	USA	PBL					
19	Komoto et al.	2005	Netherlands	PSS					
20	Fino	2006	USA	PBL					
21	Gansler and Lucyshyn	2006	USA	PBL					
22	Richardson and Jacopino	2006	Australia	PBL					
23	Smith et al.	2006	USA	PBL					
24	Zhao et al.	2006	USA	Performance contract					
25	Aurich et al.	2006	Germany	PSS					
26	Beanum	2007	USA	PBL					
27	Giannotti et al.	2007	USA	PBL					
28	Jacopino	2007	Australia	PBL					
29	Kim	2007	USA	PBL					
30	Kumar et al.	2007	India, USA	PBL				21	
31	Lowenstein	2007	UK	PBL					
32	Mahon	2007	USA	PBL					
33	Sols et al.	2007	Spain, USA	PBL					
34	Baines et al.	2007	UK	PSS					
35	Cortez et al.	2008	USA	PBL					
36	GAO	2008	USA	PBL					
37	Nowicki et al.	2008	USA	PBL					
38	Ott	2008	USA	PBL					
39	Sols et al.	2008	Spain, USA	PBL					
40	Johnson and Mena	2008	UK	Servitization					
41	Dang et al.	2009	China	PBL					
42	Hollik	2009	Canada	PBL					
43	Forslund	2009	Sweden	Performance contract					
44	Aurich et al.	2009	Germany	PSS					
45	Bianchi	2009	Italy, UK	PSS					
46	Brad	2009	Romania	PSS					
47	Liu et al.	2009	China	PSS					
48	Pawar et al.	2009	UK	PSS					
49	Yang	2009	China	PSS					
50	Yang and Li	2009	China	PSS					
51	Baines et al.	2009	UK	Servitization					
52	Baines et al.	2009	UK	Servitization					
53	Baines et al.	2009	UK	Servitization					
54	Neely	2009	UK	Servitization					
55	Park and Lee	2009	Korea	Servitization					
56	Schmenger	2009	USA	Servitization					
57	Spring and Araujo	2009	UK	Servitization					
58	Nowicki et al.	2010	USA	PBL					
59	Mao et al.	2010	China	PBL					38
60	Tegtmeier	2010	USA	PBL					
61	Hypko et al.	2010	Germany	Performance contract					
62	Abramovici et al.	2010	Germany	PSS					
63	Aurich et al.	2010	Germany	PSS					
64	Hong and Huo	2010	China	PSS					
65	Kuo et al.	2010	China	PSS					
66	Li and Li	2010	China	PSS					
67	Li and Liu	2010	China	PSS					
68	Yang et al.	2010	Australia	PSS					
69	Yang et al.	2010	Australia	PSS					
70	Baines et al.	2010	UK	Servitization					
71	Lyul and Fu	2010	Taiwan	Servitization					
72	Martinez et al.	2010	UK	Servitization					
73	Wang and Fu	2010	China	Servitization					
74	Lycette and Lowenstein	2011	USA	PBL					
75	Erkoyuncu et al.	2011	UK	PSS					
76	Johansson	2011	Sweden, UK	PSS					
77	Meier et al.	2011	Germany	PSS					
78	Greenough and Grubic	2011	UK	Servitization					

The customer perspective

From the customer's perspective, PBL implies a change from working with support services to concentrating on core activities, such as e.g. maintaining a country's defensive ability or defending a country (Martin, 1997). Buying performance also implies that the customer's financial risks are reduced as the customer no longer is responsible for supporting the system (Dang et al., 2009). The customer acquires better system performance and more efficient support if the supplier manages to improve the system and the support services (Fino, 2006). Altogether, PBL strives for providing the customer with better performance to a fixed cost, or similarly, less cost to a fixed performance (Nowicki et al., 2010)

The value chain perspective

In the value chain perspective of PBL, the intention is to create customer value more efficiently. This is supposedly accomplished by: concentrating manufacturing and support services to one actor, opening up for the supplier to improve system performance, strengthening the supplier's motives for improvements, creating better opportunities to earn profit, and reducing the customer's cost (Howard, 2004, Sols et al., 2007, Nowicki et al., 2010, Baines et al., 2010). For PBL to be a win-win strategy in a financial sense, the customer and the supplier must share the gains of a more efficient value chain to increase the profit and reduce the total cost, as illustrated in figure 3.

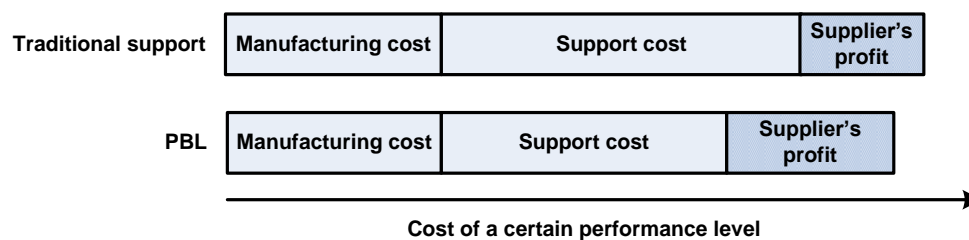


Figure 42: The intention of PBL is to reduce the customer's cost and increase the supplier's profit.

Implementing PBL

This section of the article presents the findings regarding the implementation of PBL. Four topics are discussed: commonly used contracts in PBL, the scope of PBL-contracts

and what PBL-contracts usually include, performance measurements and payment models.

PBL-contracts

PBL-agreements between suppliers and customers are settled in contracts. The literature emphasizes that each PBL-contract has to be highly tailored (Sols et al., 2007, Nowicki et al., 2010), which is perhaps why it seems hard to identify different contract types. In fact, authors do not even agree on how to separate PBL contracts from traditional contracts, see e.g. Kim et al. (2007) and (Nowicki et al., 2010). The same contract type is considered traditional by one author and as a PBL-contract by another. Nevertheless, two contract types are more frequently mentioned in PBL-literature than others: the *firm fixed price* and the *cost plus award fee* (Cunic, 2003, Kim et al., 2007, Sols et al., 2007, Nowicki et al., 2010).

In firm fixed price contracts the supplier agrees to maintain some level of performance (e.g. aircraft availability) based upon some level of use (e.g. the amount of flying hours per month). Moreover, the customer pays the supplier a fixed price according to the level of use, e.g. price per flying hour. An award fee can be added to the price to stimulate performance improvements (Kim et al., 2007, Nowicki et al., 2010). The price of a given service will thus increase if the supplier manages to deliver better performance than the contracted minimum level. The financial risks are concentrated to the suppliers whose incomes are dependent on their abilities of producing performance. The risks are especially high when the supported system is new and future system performance must be predicted with no historical data available (Smith, 2004, Kim et al., 2007, Erkoyuncu et al., 2011, Sols et al., 2008).

In a cost-plus award fee contract, the customer reimburses the supplier's costs for the performed services, adding an award fee to stimulate performance improvements or cost reductions. Here, the financial risks are concentrated to the customer who is forced to pay the supplier regardless of the performance outcome (Cunic, 2003, Sols et al., 2007, Nowicki et al., 2010). Cost-plus award fee contracts are often used in a transition phase when a non-PBL contract is being converted to a firm fixed price with award fee (Kim et al., 2007, Nowicki et al., 2010, Liu et al., 2009).

Scope of PBL-contracts

PBL-contracts can be implemented over complete systems, part of systems, i.e. subsystems and major components, or on certain support services, e.g. providing spare parts (GAO, 2004, Sols et al., 2008, Dang et al., 2009). Moreover, PBL can be applied to a system's whole lifecycle as well as a part of the lifecycle (Sols et al., 2007). A disadvantage of implementing PBL partially, i.e. not to a whole system, may be that opportunities to economies of scale might be lost (Nowicki et al., 2010). Furthermore, performance measurements can be complicated if the supplier only is responsible for the performance of a subsystem, (Fino, 2006).

As any contracts, PBL-contracts vary in length. However, it is commonly suggested that PBL-contracts ought to be long, (Maples et al., 2000, Keating and Huff, 2005) and some authors even suggest that PBL-contracts are long by definition (Berkowitz et al., 2005, Nowicki et al., 2010). There are two main benefits of long term contracting both of them regarding return on investments: First, setting up and implementing PBL is costly and there has to be enough time to harvest the benefits of a PBL-contract to insure that the benefits exceed the costs (Berkowitz et al., 2005) Second, a long contract enables the supplier to get return on large investments in the system that take long time to realize, but might improve system performance significantly. (Nowicki et al., 2010) Such improvements might be mitigating obsolescence and enhancing system reliability (Fino, 2006) that is especially important for systems with long product life cycles (Sols et al., 2007). For these reasons, it is argued that a PBL-contract should extend at least around five years (Sols et al., 2007, Nowicki et al., 2010).

Performance measurements

Performance is a central part of PBL as performance reflects customer value and forms the basis for the supplier's income. Consequently, measuring performance accurately is crucial (Devries, 2004, Sols et al., 2008, Hollick, 2009). The supplier and the customer must agree on: performance variables and metrics, definitions of the variables and metrics, target values and how to perform measurements and analyzes (Forslund, 2009).

The performance variables should be specific, straightforward, measurable and relevant to the customer's requirements (Fino, 2006, Dang et al., 2009). Selecting performance variables that reflect the customer value is challenging, since the customer's needs often are formulated in abstract terms (Tukker, 2004, Spring and Araujo, 2009). Commonly, several performance variables are used in a PBL-contract, for example: availability, reliability, maintainability, supportability, logistics response time, logistic footprint and cost of usage (Fino, 2006, Sols et al., 2007, Dang et al., 2009, Nowicki et al., 2010).

The variables can be used on different system levels and address different aspects. For example, reliability can address a component (component reliability), a system (system reliability) or the system's performance (mission reliability) (Dang et al., 2009). Furthermore, a performance variable must not be an objective variable but can also be subjective, e.g. customer satisfaction (Dang et al., 2009).

Availability of e.g. an aircraft is a highly aggregated performance variable, dependent on many less aggregated variables. It is difficult to track improvements or problems by only observing the aircraft availability. Performance variables at a lower level are therefore required (Fino, 2006, Sols et al., 2008, Hollick, 2009). Moreover, if the supplier is responsible for the availability of some components, the supplier can not be held responsible for the availability on an aggregated level, as the supplier is unable to control all factors affecting the availability (Hollick, 2009). However, it should be noted that achieving performance goals on a lower level does not guarantee good system performance (Hollick, 2009).

Defining performance variables and corresponding metrics can be challenging, e.g. if the definition must respect a certain equipment requirement. For example, if a military aircraft will be considered available or not might depend on what kind of missions it is available for. Such availability is commonly referred to as operational availability or operational readiness (Dang et al., 2009, Hollick, 2009). Agreeing a definition of a metric could also be complicated. For example, the mean time between failures (MTBF) is commonly used to measure reliability, but MTBF requires a definition of a failure and determination of how many failures that are required to get statistical significance (Richardson and Jacopino, 2006).

Performance target values must represent the customer's needs while at the same time constitute a realistic challenge for the supplier. A baseline constituting the "normal" performance of the system must thus be identified to set a target. If the system have been used, the baseline could be drawn from historical performance (Sols et al., 2008). However, identifying a baseline through historical values might be difficult e.g. if the way measurements have been conducted is not in line with the adopted definition of the metric, or if the system have been used differently in the past (Sols et al., 2008). For new systems the baseline must be built on predictions of future performance exclusively (Kim et al., 2007), which is even harder.

Payment models

When performance variables and metrics are set, a payment model must be established to translate achieved performance into payment for the supplier. A good payment model creates incentives for the supplier to produce high performance (Dang et al., 2009), whereas a poor model could impose unwanted supplier actions (Nowicki et al., 2008).

Payment models must often consider many performance variables and this makes them complex (Sols et al., 2007). A conflict appears when the system is over-performing with regard to one variable and under-performing with regard to another. Consequently, the payment model must be designed as a kind of balanced scorecard, with the function to translate several performance variables to a payment (Sols et al., 2008).

Nowicki et al. (2008) propose a payment model consisting of a minimum performance limit, a penalty zone, a dead zone and a reward zone, as showed in figure 4. The minimum performance limit determines the performance that the supplier must reach to receive any compensation. If the supplier delivers performance just above this limit, the supplier enters the penalty zone, receiving payment according to the achieved performance. However, in the penalty zone the payment is smaller than the cost of delivering the performance. If the performance is within the limits of the dead zone, which is around normal system performance (Sols et al., 2007), the payment is comparable to the cost for delivering the performance, i.e. the supplier earns marginal or no profit. If the system performance is above the dead zone, the supplier enters the reward zone and receives payment exceeding the production cost (Nowicki et al., 2008).

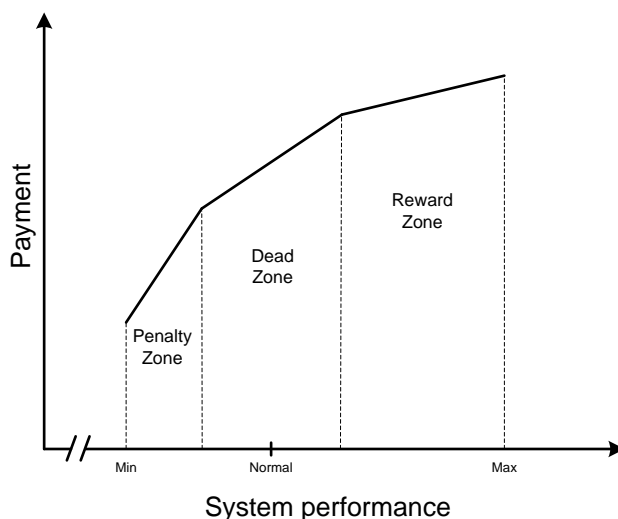


Figure 43: Payment model. The supplier's payment depends on system performance.

Also the frequency of measurements and performance review is discussed in the literature. Sols et al. (2007) suggest that performance should be assessed over relatively short periods, with relatively long periods over which the payments are calculated, to allow some of the small payments to be balanced by some of the large payments earned by the supplier.

Risks and uncertainties

The supplier's risks

PBL moves the responsibility for system performance from the customer to the supplier and the supplier is therefore confronted with higher financial risks as a consequence of bad system performance (Jacopino, 2007, Hypko et al., 2010). Moreover, the risk that delivering system performance will cost more than expected is also shifted from the customer to the supplier (Kim et al., 2007, Nowicki et al., 2010). In the bidding stage of a PBL-contract, the supplier's risk is depending on the supplier's ability to predict costs and performance (Tukker, 2004, Erkoyuncu et al., 2011). Such predictions are difficult to make because the complexity of the systems generates significant costs and performance uncertainties and PBL-contracts often are long term (Smith, 2004).

Furthermore, the supplier faces organizational risks, as going from providing products towards providing performance requires extensive organizational changes, investments in infrastructure and new skills (Baines et al., 2009b, Kuo et al., 2010). The supplier also faces new challenges in understanding customer value, managing close interaction with the customer and long term partnerships (Baines et al., 2009c, Martinez et al., 2010).

The customer's risks

The customer's risks when moving to PBL are also increased in some aspects. One risk is that the supplier will deliver bad performance (Hypko et al., 2010) and the customer is locked to the supplier for the duration of the contract (Nowicki et al., 2010), while being unable to enhance the system performance (Jacopino, 2007). Moreover, if the supplier breaks the contract, the customer will have difficulties to introduce a new supplier to support the system, since the customer could have little access of the technical data of the system (Kim et al., 2007, Dang et al., 2009).

Risks in military PBL-contracts

Applying PBL to military systems introduce operational risks for the civilian supplier which might be forced to support the system in war at unsafe locations (Doerr et al., 2004). Apart from the challenging task of the delivering performance in war, the supplier also risks losing the employees' lives (Gansler and Lucyshyn, 2006). From the customer's perspective, having the supplier responsible for the support services might limit the oversight of military operations (Tegtmeier, 2010).

Conclusions and discussions

The purpose of the literature review has been to describe how PBL is implemented, explore the strengths and weaknesses of PBL and identify future research challenges. PBL is a business concept mainly applied to complex and capital-intensive technical systems in military and aerospace industries. In PBL, the supplier of a system delivers not only the system, but is also responsible for the performance of the system. Consequently, PBL transfers the responsibility for providing support services from the customer to the supplier. The intention of PBL is to enhance the efficiency of the value chain, i.e. reducing the total costs for delivering a certain performance level. The cost reduction aims to increase the supplier's profit while reducing the customer's costs for the system, and thus creating a win-win situation for the supplier and the customer. However, the transfer of responsibilities is not without risk, requiring the customer and supplier to put efforts on designing contracts, conducting performance measurements and structure conditions for payments. Moreover, PBL introduces financial risks for the supplier that require long term predictions of future costs and performance.

An unanswered question is whether the costs for mitigating the risks in PBL and rearrange organizations, equipments and mindsets from a traditional support structure are lower than the cost reductions that PBL might result in. Certainly, there are numerous of reports of successful implementations that have resulted in reduced costs, see for example Phillips (2005), Keating and Huff (2005), Gansler and Lucyshyn (2006), Mahon (2007) and Ott (2008), but these reports do not account for how measurements have been conducted and thus give little empirical evidence of the profitability of PBL. However, there are some profound studies regarding profitability. In two extensive investigations of PBL-contracts in the U.S military, the U.S. Government Accountability Office (GAO) concludes that some PBL-contracts seem to reduce the customer's total costs for the system, while other PBL-contracts seem to increase the costs, see (GAO, 2005) and (GAO, 2008). Moreover, investigating

financial data for more than 10 000 companies, Neely (2009) concludes that large manufacturing firms generates less net profit if they move towards providing PSS, while the opposite holds for small manufacturing firms. These three studies provide some results in the profitability of PSS, but more empirical research is needed for other or specific contexts.

In the bidding stage of a PBL-contract the supplier's risk is depending on the supplier's ability to predict costs and performance. Moreover, as PBL transfers the responsibility for the performance of the system to the supplier, the supplier must assure the performance of the supported system. Even so, the literature gives little advice to how the supplier should make predictions as well as enhance the system's performance. Block (2009) give some suggestions, addressing an aircraft supplier's need for a simulation tool to predict the availability of an aircraft fleet. However, there is a need for more research into the specific challenges of predicting performance and enhancing system's performance that suppliers' must be able to handle under PBL-contracts.

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Evaluating E-service Quality Based on Interdependence Perspective

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Introduction

The concept of electronic service quality (e-SQ), stating that service quality on the Internet is “the extent to which a website facilitates efficient and effective shopping, purchasing, and delivery of products and services” (Zeithaml *et al.*, 2002). Previous research already pointed out that e-SQ is the most important determinant of long-term success for online companies, and also indicated that good e-SQ is prerequisite for companies to operate e-commerce on the Internet (Santos, 2003). Therefore, many studies has developed evaluation scales for e-SQ, including SITEQUAL (Yoo and Donthu, 2001), eTailQ (Wolfenbarger and Gilly, 2003), and E-S-QUAL (Parasuraman *et al.*, 2005). Such researches have mainly used multidimensional and hierarchical structures, but have ignored questions of interdependence and feedback between dimensions and attributes (Parasuraman *et al.*, 2005; Ho and Lee, 2007).

The analytic network process (ANP) is also the most comprehensive decision-making technique used to handle the complex interrelationships and feedback among criteria in

multi-criteria decision-making (MCDM) research. However, using the ANP approach requires $n(n-1)/2$ judgments for n criteria to compute a pairwise comparison matrix, and problems may arise that may seriously affect the evaluation results, including a lack of consistency and complexity and the inability to handle information uncertainty (Lin and Hsu, 2011).

Among the most popular of the wide range of products and services available on the e-commerce are travel services, which include airline and rail tickets, hotel accommodation, travel packages and car rentals. The use of online travel websites has also become the most popular and common way for customers to purchase travel-related services and products (Sanchez-Franco and Rondan-Cataluña, 2010). The major challenge for online travel websites is to retain customers. Customer-oriented service quality is essential to create customers' intention of repurchases and loyalty for online travel service (Sigala and Sakellariadis, 2004). Consistent delivery of high service quality of online travel websites becomes a primary competitive advantage.

Therefore, this study investigates the interdependent relationships among the dimensions and attributes of e-SQ, and proposes a ANP-FPR method to simplify the evaluation process as well as overcome many drawbacks when evaluating e-SQ considered interdependence perspective. Moreover, we also provides the five steps to evaluate systematically quality value of interdependent dimensions and attributes for e-SQ. Utilizing the interdependence perspective of e-SQ and our proposed ANP-FPR method, researchers and practitioners for e-service quality management can find out the true quality value precisely, and further can realize that which dimensions or attributes are really needed to improve in order to achieve total service quality control.

Literature Review

Related Researches for e-SQ

Practitioners of e-service operations must ensure high-quality electronic services for success, as well as e-SQ is rising quickly due to the pace of competition and the ease of duplicating service features within online business (Trabold *et al.*, 2006). With the development of the Internet and the rapid growth of online business-to-customer e-commerce in recent years, service quality delivery through electronic platforms has become one of the most important issues for online companies (Zeithaml *et al.*, 2002; Kim and Lee, 2009). Online companies should pay more attention to the increasing number of dissatisfying experiences that customers including service breakdowns, lost

orders, or inadequate complaint handling (Rust and Lemon, 2001). The service quality is expected to be an important determinant of success not only in traditional environments but also in online environments (Wolfenbarger and Gilly, 2003).

Previous researches have demonstrated that service quality influences customer consumption decisions and these findings have also been applied to e-commerce (Martínez Caro and Martínez García, 2007; Lu *et al.*, 2009). The most important and evident difference between traditional and electronic commerce environments is the replacement of interpersonal interactions with human-machine interactions. In the online environments, there are almost no face-to-face interactions. Instead, online companies often communicate with customers via Internet-based communication tools such as e-mail, chat rooms, and message boards (Zeithaml, 2002). Because of this distinction, it is important to develop e-SQ evaluation for assessing the e-commerce environment. As in other e-services, online travel websites facilitate the interaction between the travel service providers and customers through the Internet, and therefore, online providers should ensure e-SQ as well as outcomes (Surjadjaja *et al.*, 2003; van Riel *et al.*, 2004).

Related Researches for ANP

In recent years, the ANP has been widely used in MCDM research for the business and management sectors, including in business performance measurement (Ren *et al.*, 2004), location selection (Partovi, 2006), logistic service provider selection (Jharkharia and Shankar, 2007), and service quality evaluation (Hsieh *et al.*, 2008). Because of the vagueness, uncertainty and internal inconsistency of decision maker's judgments, crisp pairwise comparison as part of the conventional ANP may be insufficient and imprecise to capture the judgments of decision makers. Therefore, several researchers have used fuzzy theory to tackle the ambiguities involved in the ANP as applied to the decision-making process (Tuzkaya and Önüt, 2008; Lin and Hsu, 2011; Önüt *et al.*, 2009). In addition, pairwise comparison in the ANP context assumes that the decision-maker can compare any two criteria and provide a ratio that indicates their relative importance. It also requires $n(n-1)/2$ judgments for n criteria when establishing pairwise comparison matrices, and the number of comparisons increases as the number of criteria increases. Consequently, decision-makers' judgments will most likely be inconsistent (Wang and Chen, 2007b).

We also found out the ANP has two main drawbacks that should be highlighted based on the literature review, including (1) the judgments of decision-makers are not perfect; they might be considered as approximations of exact but unknown priority ratios that

satisfy the equalities in the ANP judgments for the decision-makers; (2) Decision-makers are generally unsure of their preferences because information is incomplete and uncertain. Some of the decision criteria used in the ANP are subjective and qualitative, so decision makers cannot easily express the strength of his preferences or provide exact pairwise comparisons. Therefore, this study combines the FPP method with the ANP technique to overcome these two drawbacks.

The Related Researches for FPR

Herrera-Viedma *et al.* (2004) propose a FPR method as a way of constructing decision matrices for pairwise comparisons that are supposed to ensure better consistency in preference relations indicated by decision-makers and avoid inconsistent solutions within the decision-making processes. Under this method, only $(n-1)$ repetitions are required to complete the pairwise comparison matrix that have n criteria, and the increase in the number of criteria and sub-criteria reduces the number of comparison required and enhances the efficiency and accuracy of the decisions made. Because FPR method is faster to execute and more efficient at addressing the inconsistencies involved in multiple decision-making problems than are conventional methods, a great many studies related to decision-making have used this strategy in recent years (Wang and Chang, 2007a; Wang and Chang, 2007b; Chao and Chen, 2009). Therefore, we utilize this method proposed by Herrera-Viedma *et al.* (2004) to overcome the consistency problems associated with decision-maker judgments as well as eliminate the computational burden of checking the consistency index (CI) and consistency ratio (CR) in the ANP model. We also aim to increase computing efficiency in this way and to avoid inconsistent estimation in constructing the decision matrices. Furthermore, researchers have used the fuzzy preference relations method in different fields in recent years. Wang and Lin (2009) used consistent fuzzy preference relations to help banks choose merger strategies that will allow decision-makers to improve decision-making consistency and effectiveness. Chao and Chen (2009) also utilized consistent fuzzy preference relations to evaluate the importance of different influence factors related to multimedia digital e-learning materials intended to ensure effective and successful teaching and learning.

The Interdependent dimensions and attributes of e-SQ Model

Earlier researches already identified many dimensions and attributes of e-SQ related to travel websites including navigability, playfulness, information quality, trust, personalization, responsiveness, ease of use, information/content, responsiveness,

fulfillment, security/privacy, and visual appeal. (Park *et al.*, 2007; Nusair and Kandampully, 2008). Some previous studies also indicated that these dimensions and attributes essential to e-SQ evaluation are correlated with one another (Kim and Chang, 2007; Lin and Sun, 2009). Therefore, this study considers the interdependent relationships among the relevant criteria when evaluating e-SQ. Liu *et al.* (2000) found out that information quality, security, playfulness and responsiveness have a positive and significant correlation with website design. Ahn *et al.* (2007) indicated that website design, security, information and responsiveness have a positive effect on user perceptions of enjoyment in online retailing. Ha and Stoel (2009) also claimed that customer relationship management, which aids in business interactions with customers, is correlated with website security. The perception is that beneficial product/service information will positively affect customer relationships and that interactions in online virtual communities will also affect perceived enjoyment (Kim *et al.*, 2004). Thus, based on our literature review, we selected four interdependent dimensions including website style, website security, customer relationships and enjoyment.

The Interdependent Attributes for Website Style

The “website style” includes all elements of the consumer website experience, including navigation, information searching, order processing and product selection (Wolfenbarger and Gilly, 2003). Ho and Lee (2007) focused more on website functionality, whereas eTransQual (Bauer *et al.*, 2006) combines website functionality and visual design into one dimension. The influence of website design on e-service quality has been studied extensively. Cho and Park (2001) found out that customer satisfaction is assessed using the quality of website design during online shopping. Wolfenbarger and Gilly (2003) also found that website design factors are strong predictors of customer quality judgments, satisfaction, and loyalty for Internet retailers. Helpful search functions make it easy for users to find the information that they want and can foster efficient navigation, encouraging users to feel that the site is functioning exactly as it should based on their expectations (Parasuraman *et al.*, 2005). In addition, the site organization and presentation (the visual appeal) are considered to be factors in the helpfulness of search functions and the ease of locating desired information. Thus, website design in this study is measured by considering the search functions, basic functions for website, easy to find information (Ho and Lee, 2007), the efficiency of navigation (Grigoroudis *et al.*, 2008) and the visual appeal (Bauer *et al.*, 2006).

The Interdependent Attributes for Website Security

The “website security” is defined as the degree to which a customer feels safe completing transactions and believes that website purchases do not entail any danger, risk, or uncertainty. Security is related to how a website proves to its customers that it is trustworthy (Ho and Lee, 2007). Security has been perceived as a critical dimension in e-SQ because personal information can potentially be accessed or used over the Internet by third parties (Ranganathan and Ganapathy, 2002; Loiacono *et al.*, 2007). Security can be measured according to the features used to protect information and reputation of the website, as well as to confirm online payments (Ho and Lee, 2007). In addition, customers are more willing to purchase on reputable sites due to their perception that the site always provides more security features and offers payment confirmations to protect their customers (McKnight *et al.*, 2002).

The Interdependent Attributes for Customer Relationships

The “customer relationships” is defined as the development of services/products that allow companies to better understand and serve underlying customers. This dimension involves personalized services provided on the website, online communities centered on experience sharing, and the ease with which users can transfer to other related sites (e.g., hotels, destinations and airlines) or to the BBS (Bulletin Board System) for more information (Ho and Lee, 2007). Personalized service can be addressed via the customization and personalization of services specifically provided on the website to address individuals’ needs (Khalifa and Liu, 2002). The “customer relationships” indicates the service features that a website has designed to make it easier for its users to exchange travel information and experiences with other online users who have similar interests within the online virtual community (Ho and Lee, 2007). The three attributes used to measure the quality of customer relationships are personalized characteristics, a platform for exchanging information and access to the platform.

The Interdependent Attributes for Hedonic

The “hedonic” is defined as the ability of a website to fulfill customer needs for escapism, diversion, aesthetic enjoyment or emotional release in the online context for shopping (Negash *et al.*, 2003). By taking into account what factors cause users to perceive a site as enjoyable, firms can create websites that provide users with opportunities to enjoy site use and that also meet users’ utilitarian and hedonic needs (Huang, 2003). Research investigating that extended enjoyment to the online context, where it can be measured using three attributes including the fun of using the website, the excitement when shopping online and the entertainment provided by the website

(Bauer *et al.*, 2006). Thus, three attributes for measuring the quality of enjoyment in this study are the fun of using the website, the excitement when shopping online and the entertainment provided by the website. These positive emotions are correlated with one another. Accordingly, four dimensions and fourteen attributes for e-SQ evaluation can be culled from the related literature and brief definitions of each are provided in Table I .

Table I A brief explanation of dimensions and attributes for e-SQ evaluation.

Dimensions	Attributes	Definition
Website Style	Basic functions for website	The website basic functions reliably and correctly without errors. It can process transactions and payments without malfunction.
	Search functions	The website search function is useful and easy to use.
	The efficiency of navigation	The ease, convenience and speed of linking and using the website without wasting time.
	Easy to find information	Information is classified clearly and can be acquired without difficulty.
	The visual appeal	The aesthetic aspect of the website, that is, the organization and presentation of a website, is attractive, including the proper use of color, graphics, image, and animations.
Website Security	Online payments security	This website makes confirmations (through e-mail, telephone, and mobile message) after customers make payments online.
	Reputation of the website	The company behind the website has a well-known and trustworthy image.
	Protect customers' information	This website has secured features to protect customers' personal information, credit card numbers, and shopping behaviors.
Customer Relationships	A platform for exchanging information	The website provides an online virtual community for users and customers to exchange travel information and experiences.
	Personalized characteristics	Services or information specifically provided on the website for individual needs.
	Access to the platform	Users can use the chat room, BBS or other websites with ease to gain more travel-related information.

	The fun of using the website	Users feel pleasure when browsing the website.
Hedonic	The entertainment provided by the website	The enjoyable experiences provided for users on the website (through multimedia, such as graphics, visual and sound effects, and 3D pictures).
	The excitement when shopping online	Customers feel excited when shopping on the website.

The ANP-FPR Measurement Model for e-SQ Evaluation

This study proposes a model which called ANP-FPR measurement model to evaluate e-service quality. This model not only allows customers to evaluate e-service quality performance more easily but also handles interaction of quality attributes with interdependence perspective. In the first step, we utilized the consistent fuzzy preference relations method to compute the weight value of the dimensions and attributes for e-SQ evaluation. In the second step, we introduced the ANP technique, which we used to compute the influence value for the dimensions and attributes and to obtain the interdependent influence value. In the third step, we also used the consistent fuzzy preference relations method to obtain the performance value of attributes. In the four and fifth step, the quality value of the dimensions and attributes for e-SQ evaluation taking into account their interdependence perspective were estimated by the multiplication of the performance value and the influence value.

First Step: The weight of dimensions and attributes for e-SQ evaluation

First, this study provides the fuzzy preference linguistic degree set N_k quantified on a scale of $\left[9, \frac{1}{9}\right]$ to express the weight of the criteria and sub-criteria $N_k = \{ \text{equally important, weakly more important, significantly more important, very significantly more important, absolutely more important} \}$ ($k= 1, 3, 5, 7, 9$). Then we construct the decision matrices for pairwise comparisons by using Herrera-Viedma et al. (2004) proposed reciprocal additive consistent fuzzy preference relations.

In this study, \bar{w}_i denotes the weight of e-SQ criteria without considering as the question of interdependence, as in Eq. (1):

$$\bar{w}_i = \frac{\sum_{j=1}^n r_{ij}}{\sum_{i=1}^n \sum_{j=1}^n r_{ij}} \quad (1)$$

where r_{ij} is used to represent the normalized fuzzy preference values for each criterion i and j and is computed using the consistent fuzzy preference relations method proposed by Wang and Chang (2007b).

Second step: *The influence value for dimensions and attributes of e-SQ*

Based on the ANP supermatrix formation and analysis, the ANP supermatrix M is used to determine the influence value of interdependent relationships among e-SQ dimensions and attributes. The elements in the columns of ANP supermatrix M have been imported from t_{ij} , which is used to represent the normalized fuzzy preference values for the influence of each criterion i and j ; we also compute them using the consistent fuzzy preference relations method as proposed by Wang and Chang (2007b).

Then, we transform the unweighted supermatrix (the initial supermatrix) into a weighted supermatrix (the limit supermatrix) with random effects following Saaty (1996; 1999). We make the ANP supermatrix column stochastic to weight the components based on their impact on the column of blocks. To achieve convergence in the influence value of interdependent dimensions and attributes, the weighted supermatrix is raised to the power of $2k+1$ and $\lim_{k \rightarrow \infty} M^{2k+1}$, where k is an arbitrarily

large number (Saaty and Vargas, 1998). The final influence value where \bar{y}_i represents each interdependent criterion can be obtained by normalizing each cluster of the limit supermatrix, such as Eq. (2):

$$\bar{y}_i = \frac{\sum_{j=1}^n \lim_{k \rightarrow \infty} M_{ij}^{2k+1}}{\sum_{i=1}^n \sum_{j=1}^n \lim_{k \rightarrow \infty} M_{ij}^{2k+1}} \quad (2)$$

Third step: *The performance value of dimensions and attributes for e-SQ evaluation*

In this step, we denote \bar{p}_i as the performance value of dimensions and attributes for e-SQ evaluation which showed in Eq. (3):

$$\bar{p}_i = \frac{\sum_{j=1}^n t_{ij}}{\sum_{i=1}^n \sum_{j=1}^n t_{ij}}, \quad (3)$$

where t_{ij} is used to represent the normalized fuzzy preference values for each criterion i and j and is computed using the consistent fuzzy preference relations method proposed by Wang and Chang (2007b).

Fourth step: *The quality value of dimensions and attributes for e-SQ evaluation (without considering the question of interdependence perspective)*

Then, we used q_i to represent the quality value without considering the question of interdependence perspective of dimensions and attributes as indicated in Eq. (4):

$$q_i = \bar{p}_i \times \bar{w}_i \quad (4)$$

Fifth step: *The quality value of dimensions and attributes for e-SQ evaluation (with considering the question of interdependence perspective)*

The quality value taking into account interdependence is calculated through multiplying the performance value by the influence value. Thus, Q_i denotes the quality value of the e-SQ dimensions and attributes as indicated in Eq. (5):

$$Q_i = q_i \times \bar{y}_i \quad (5)$$

Empirical Illustration for e-SQ Evaluation

Travel online website companies are not only informative but also functional, and Internet users can make reservations for transportation and accommodations, book package tours, and carry out other key functions online through websites. The samples of data collection were senior membership customers who had purchasing experiences on a travel website company in Taiwan, ezTravel Co., LTD.. We chose ezTravel travel website company as our research objective because it has the best business revenue and most membership customers in Taiwan. In addition, this study selected senior

membership customers as samples who frequently purchased at least 5 times a year in any one of three online travel companies, as well as minimal 3 months away from the last purchasing experiences. We used snowball sampling method to collect samples, and ensured all samples had purchasing experiences on three travel website companies by questionnaire's design, and the total samples of senior membership customers are 106. This study investigates the performance value and influence value of dimensions and attributes by distributing questionnaires and conducting face-to-face interviews with these senior membership customers. The customers were asked to evaluate the performance value of the various dimensions and attributes for e-SQ in the context of travel websites.

The weight value of dimensions and attributes for e-SQ evaluation

Senior membership customers evaluated the performance value for ezTravel travel website according to their self-evaluation and experiences with usage and purchase. The weight value of dimensions and attributes are obtained by using first step. According to analysis results (see Table II), "Website security" is weighted more heavily than the other dimensions. The results also reveal that the attributes "Search functions" is more important than the other four attributes under the dimension of "Website style." Similarly, the results also show that "Protect customers' information" is the most important within the "Website security" dimension, and "Personalized characteristics" has the greatest weight of those included under "Customer Relationships." The attribute "The fun of using website" has the highest degree of weight of those included under "Hedonic."

The influence value of dimensions and attributes for e-SQ evaluation

The influence value is also obtained by using second step in Section 4. This study utilized 7 experts to identify the influence value of the various dimensions and attributes for e-SQ in the context of travel websites. These experts should be high-level or middle-level managers who have worked at online travel companies for more than 10 years, and they were responsible for travel services at their firms.

According to analysis results (see Table III), the "Website style" has the highest influence value of all the dimensions. The results also revealed that the attributes "Search functions" has the greatest effect on "Easy to find information," "Basic functions for website," "The efficiency of navigation," and "The visual appeal" under "Website style" dimension. Similarly, the results also show that the attribute "Protect

customers' information" has the greatest degree of influence of all the "Website security" attributes, and the "Personalized characteristics" has the greatest influence value of all the "Customer Relationships" attributes. Finally, the attributes "The fun of using website" has the greatest influence value of the attributes under "Hedonic."

Table II The weight value of dimensions and attributes for e-SQ evaluation

Dimensions	The weight value of dimensions (W1)	Attributes	The weight value of attributes(W2)	Global weight value for e-SQ evaluation (W1×W2)
Website style (A)	0.181	Search functions (A ₁)	0.228	0.041
		Basic functions for website (A ₂)	0.220	0.040
		Easy to find information (A ₃)	0.224	0.041
		The efficiency of navigation (A ₄)	0.203	0.037
		The visual appeal (A ₅)	0.124	0.022
Website security (B)	0.332	Protect customers' information (B ₁)	0.412	0.137
		Reputation of the website (B ₂)	0.197	0.065
		Online payments security (B ₃)	0.391	0.130
Customer Relationships (C)	0.275	Personalized characteristics (C ₁)	0.377	0.103
		A platform for exchanging information (C ₂)	0.326	0.089
		Access to the platform (C ₃)	0.297	0.081
Hedonic (D)	0.211	The fun of using website (D ₁)	0.360	0.076
		The excitement when shopping online (D ₂)	0.310	0.065
		The entertainment provided by the website (D ₃)	0.330	0.069

Table III The influence value of dimensions and attributes for e-SQ evaluation

Dimensions	The influence value of dimensions (I1)	Attributes	The influence value of attributes (I2)	Global influence value for e-SQ evaluation (I1×I2)
Website style (A)	0.433	Search functions (A ₁)	0.239	0.103
		Basic Functions for website (A ₂)	0.194	0.084
		Easy to find information (A ₃)	0.238	0.103
		The efficiency of navigation (A ₄)	0.229	0.099
		The visual appeal (A ₅)	0.100	0.043
Website security (B)	0.147	Protect customers' information (B ₁)	0.362	0.053
		Reputation of the website (B ₂)	0.288	0.042
		Online payments security (B ₃)	0.350	0.051
Customer Relationships (C)	0.276	Personalized characteristics (C ₁)	0.345	0.095
		A platform for exchanging information (C ₂)	0.339	0.093
		Access to the platform (C ₃)	0.316	0.087
Hedonic (D)	0.147	The fun of using website (D ₁)	0.355	0.052
		The excitement when shopping online (D ₂)	0.316	0.046
		The entertainment provided by the website (D ₃)	0.330	0.048

(1) The comparison for interdependence perspective

Senior membership customers evaluated the performance value for ezTravel travel website according to their self-evaluation and experiences with usage and purchase. The quality value of dimensions and attributes are obtained by using third and fourth step. Further, the quality value taking into account the question of interdependence perspective are obtained by utilizing fifth step in Section 4. According to analysis results of quality value which showed in the left side (without considering the interdependence perspective) and right side (after considering the interdependence perspective) of Table IV, attributes “search functions,” “basic functions for website,” “the efficiency of navigation,” “the visual appeal,” “protect customers’ information,” “reputation of the website,” “online payments security,” “a platform for exchanging information,” and “access to the platform” are all reversed their ranks (which showed in bold-type of Table IV). However, attributes “the fun of using website,” “the excitement when shopping online,” and “the entertainment provided by the website” within “Hedonic” dimension are not reversed their ranks. Therefore, we can see that the influence values have some effects on our evaluation of the interdependent attributes used in e-SQ evaluation.

(2) The interdependence perspective for e-SQ attributes

According to Figure 1, we can explain why attributes within “website style” dimension are reversed their ranks. The results of Figure 1 revealed that the attributes “search functions” (0.103) and “easy to find information” (0.103) have the greatest effect on “basic functions for website,” “the efficiency of navigation,” and “the visual appeal” within “website style” dimension, therefore, will force these three attributes to reverse their quality value (which showed in Table IV). Similarly, Figure 2 also showed that the attribute “protect customers’ information” (0.053) has the greatest effect on “reputation of the website” and “online payments security” within “website security” dimension, thus will force these two attributes to reverse their quality value (which showed in Table IV). Figure 3 also presents the same situation within “customer relationships” dimension. Nevertheless, although Figure 4 showed the attribute “the fun of using website” (0.052) has the greatest effect on “the excitement when shopping online” and “the entertainment provided by the website” within “Hedonic” dimension, attributes did not reverse their quality value.

Table IV The comparison of interdependence perspective for e-SQ evaluation

Attributes	The quality value (without considering the interdependence perspective)		The quality value (with considering the interdependence perspective)	
	Value	Rank	Value	Rank
Search functions (A ₁)	0.199	④	0.041	②
Basic Functions for website (A ₂)	0.177	⑤	0.029	④
Easy to find information (A ₃)	0.214	①	0.044	①
The efficiency of navigation (A ₄)	0.208	②	0.037	③
The visual appeal (A ₅)	0.203	③	0.009	⑤
Protect customers' information (B ₁)	0.289	③	0.102	②
Reputation of the website (B ₂)	0.357	①	0.047	③
Online payments security (B ₃)	0.354	②	0.114	①
Personalized characteristics (C ₁)	0.361	①	0.172	①
A platform for exchanging information (C ₂)	0.302	③	0.121	②
Access to the platform (C ₃)	0.338	②	0.116	③
The fun of using website (D ₁)	0.379	①	0.073	①
The excitement when shopping online (D ₂)	0.300	③	0.044	③
The entertainment provided by the website (D ₃)	0.320	②	0.051	②

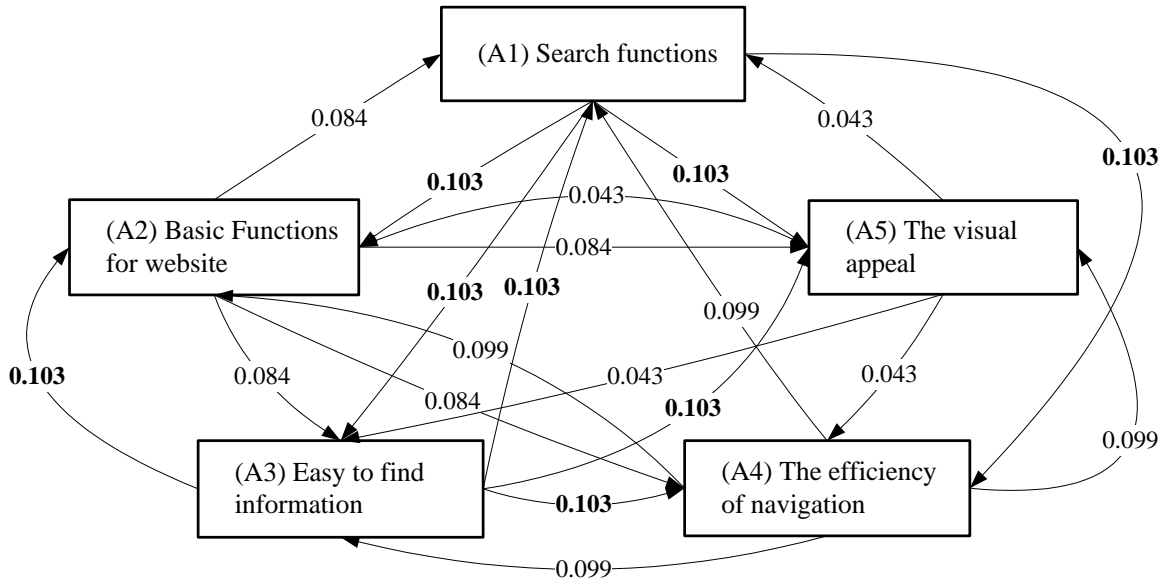


Figure 1. The interdependence perspective for attributes within “website style”

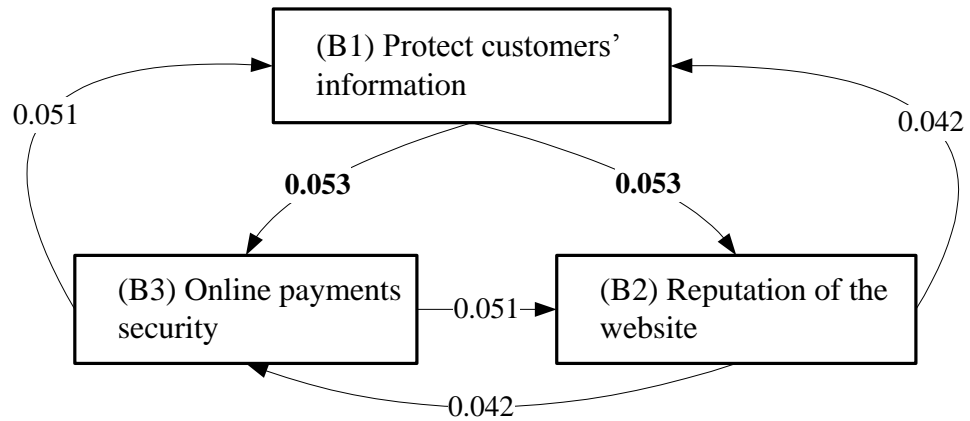


Figure 2. The interdependence perspective for attributes within “website security”

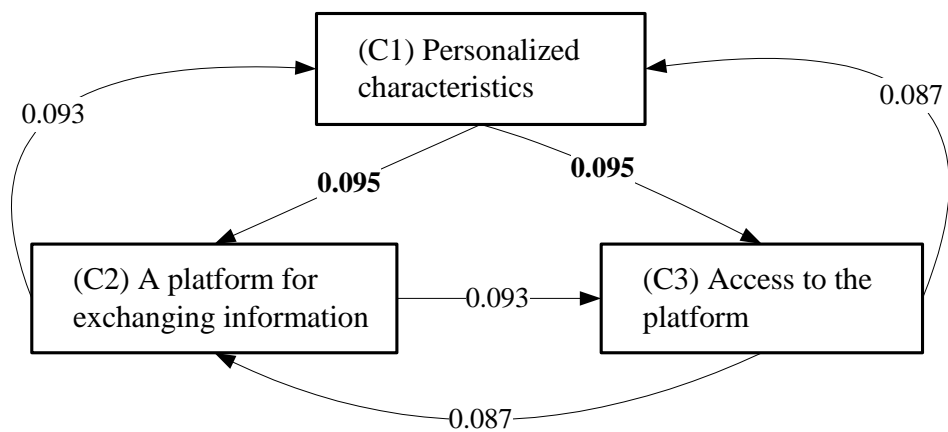


Figure 3. The interdependence perspective for attributes within “customer relationships”

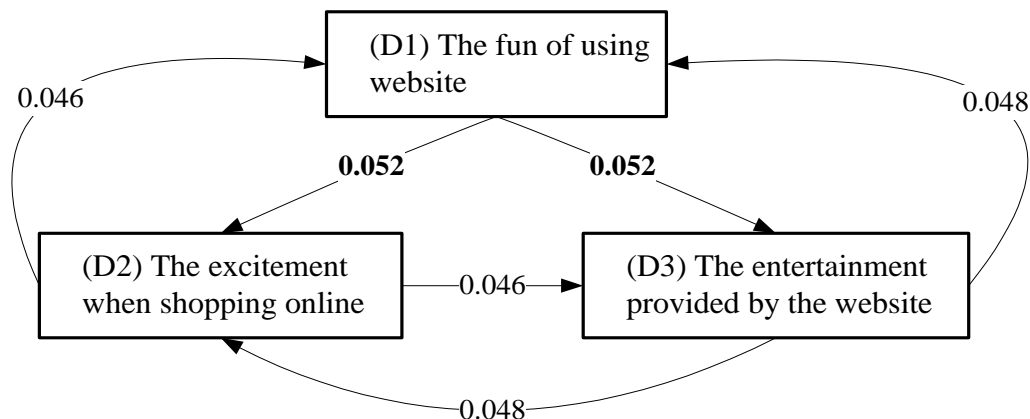


Figure 4. The interdependence perspective for attributes within “hedonic”

Conclusion and Discussion

This study investigates the interdependent relationships among the dimensions and attributes of e-SQ, and proposes a scientific method (ANP-FPR method) to simplify the evaluation process as well as overcome many drawbacks when evaluating e-SQ considered interdependence perspective including inconsistency problem and available information is usually uncertain, vague, or imprecise in a complicated multi-criteria decision-making process. Moreover, we also provides the five steps to evaluate systematically quality value of interdependent dimensions and attributes for e-SQ. Utilizing the interdependence perspective of e-SQ and our proposed ANP-FPR method, researchers and practitioners for e-service quality management can find out the true quality value precisely, and further can realize that which dimensions or attributes are really needed to improve in order to achieve total service quality control.

According to analysis results, after considering the interdependence perspective, attributes “search functions,” “basic functions for website,” “the efficiency of navigation,” “the visual appeal,” “protect customers’ information,” “reputation of the website,” “online payments security,” “a platform for exchanging information,” and “access to the platform” are all reversed their ranks. However, although the attribute “the fun of using website” has the greatest effect on “the excitement when shopping online” and “the entertainment provided by the website” within “Hedonic” dimension, attributes did not reverse their quality value. In our opinion, it is because “Hedonic” dimension was not affected by other three dimensions directly, attributes did not change their quality value. Accordingly, the results of this study indicated that the influence value indeed has an effect on how we evaluate e-SQ dimensions and attributes when taking into account the question of interdependence perspective. It seems that considering influence based on the concept of interdependent dimensions for e-SQ evaluation allows us a more precise method of determining the truly important dimensions for companies looking to improve their overall e-service quality. Based on the results of this study, we also understand that a good online business website should contain useful information, helpful website design, excellent security features, excellent customer relationships, prompt service, and attractive features, as these elements will turn browsers into customers, and further bring profits to companies.

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Implementation of TQM approach in the university environment

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Key words: Quality Management System, Total Quality Management, Self-assessment, EFQM Excellence Model.

Introduction

Currently the universities are situated at competitive environment. It is the principal reason why they have to identify as the organisations providing the services that satisfy their customers.

The quality of services provided by university is the result of quality of processes that are used to secure it. The quality of processes is determined by the quality of management of university. If we want to improve the quality of services provided by university, we have to start with improving the quality of the university management. To lead and operate an organization successfully, it is necessary to manage it in a systematic and visible manner.

Implementation of Quality Management System at University Environment.

There are two basic concepts of QMS:

- **Prescriptive concept** based on International standards ISO 9000 series.
- **Non prescriptive concept** sometimes marked as TQM. TQM is more or less a philosophy. It is applied according to different models that enable to evaluate the maturity of management system in the organisation. EFQM Model Excellence is used in Europe.

After revision of ISO 9000 family standards at 2000 we can observe the convergence of both concepts. The both are based on eight principles. They are very similar as you can see from comparison – table I.

ISO 9000:2000 Quality Management Principles	TQM - the EFQM Fundamental Concepts of Excellence
Customer focus	Results orientations
Leadership	Customer focus
Involvement of people	Leadership & Constancy of purpose
Process approach	Management by processes & facts
System approach to management	People development & involvement
Continual improvement	Continuous learning, improvement & innovations
Factual approach to decision making	Partnership development
Mutually beneficial supplier relationship	Corporate Social Responsibility

Table 1 – The comparison of principles of ISO 9000:2000 and TQM

The existence of explicit defined guidance, which has been successfully verified many times in the industry, led to the decision to implement QMS according to the ISO 9000

concept at VŠB-Technical University of Ostrava (VŠB-TUO). There are no significant reasons why the benefits of implementation of QMS in industry would differ in the case of the university. The decision to implement QMS according to ISO 9001 (ISO 9001, 2008) was supported by the existence of ISO 9001 registration. The ISO 9001 certificate is evidence to the fact that the university is being properly managed, the needs of their customers are identified, and the environment to satisfy them is established.

Implementation of Quality Management System at VŠB – Technical University of Ostrava

VŠB-TUO with more than 160 years history is a modern polytechnical university. VŠB-TUO currently consists of seven faculties:

- Faculty of Mining and Geology (from 1849)
- Faculty of Metallurgy and Material Engineering (from 1849)
- Faculty of Mechanical Engineering (from 1951)
- Faculty of Economics (from 1977)
- Faculty of Electrical Engineering and Computer Science (from 1991)
- Faculty of Civil Engineering (from 1997)
- Faculty of Safety Engineering (from 2002)

There are more than 23 000 students in bachelor degree, master degree and doctoral degree programmes in daytime, distance and combined studies; about 2000 staff (1000 of them are teachers and R&D personnel). VŠB-TUO is the third largest university in Czech Republic.

To utilize the good practices from industry, the management of VŠB-TUO has employed a quality manager that had the long-term experiences with QMS implementation and maintenance at a first class manufacturing company that was awarded by the Czech Republic National Quality Award 2001.

The implementation of QMS in whole university simultaneously we recognised to be risky. The experiences from the implementation of QMS in industry are not fully transmitted into the university environment. There are at least two important differences:

- the cycle time of product realisation is significantly longer than in industry
- the members of university staff and academic freedom.

It was the reason why we split the implementation of QMS into several stages. As each faculty is a relative autonomous part of the university, the first stage (2004) was the implementation of QMS at a selected faculty as a pilot project. The experiences from pilot project were used during second stage (2005-2006), implementation of QMS at next faculties with utilisation of the experiences from first stage. Final third stage (2007) was the implementation of QMS at the administration and executive part of whole university.

Each stage of implementation of QMS consisted of two phases:

- Preparation phase
- Implementation phase

The preparation phase included 5 steps:

1. Decision of faculty/university management about implementation of QMS
2. Declaration of mission , vision and strategy (quality policy)
3. Definition of project team for implementation of QMS
4. Definition of terms
5. Allocation of resources (financial, HR, ...)

The declarations of vision, mission and quality policy was a fundamental step. They were formulated by faculty/university management and communicated throughout. To attain the commitment of staff, the informational and discussion meetings took place. The commitment to quality policy was the base for definition of quality goals on the Faculty or University level. The quality goals were subsequently disseminated to the departmental level and linked with personnel goals.

The implementation phase consisted of 7 steps:

1. Training the staff on QMS
2. Implementation of “process” approach, consisting of :
 - a. *Identification of processes and definition of the process map*
 - b. *Definition and documentation of processes*
 - c. *Definition of process performance criteria*
3. Comparison of existing status with ISO 9001 requirements
4. Implementation heretofore missing procedures (control of documents and records, internal audits, correctives action, preventive actions)
5. Assessments of process performance and quality system review
6. Implementation of actions to improve system performance
7. Certification of QMS.

Processes at the faculty level were divided into three basic groups:

- Customer related processes (education – bachelor, master and doctoral level, R&D activities, and cooperation with business and public sector)
- Managing processes (strategy management of faculty, operational management of faculty)
- Supporting processes (support of education process, support of R&D, purchasing, control of information systems.)

There are different **processes at the university level**. The faculties are looked as the internal customers of university. It means the university supports the faculties. The main, customer orientated processes from the point of view of university, are processes of resource management:

- finance management
- facility management
- HR management
- IT management

These resource management processes are executed and controlled by force of strategic management and operational management processes at the university level.

Based on the successful certification audit in July 2007 **VŠB–TUO was as the first public university in Czech Republic awarded by ISO 9001 certificate.**



Figure 1 – ISO 9001 certificate for VSB-TU Ostrava

The Path to Excellence

The ISO 9001 approach is focused to the satisfaction of customers' needs and expectations. **The university management system has to be oriented not only to customers but also to stakeholders (interested parties) – TQM approach.** The ISO 9004 (ISO 9004, 2009) offers the guidance for managing for the sustained success of an organisation. It addresses the needs and expectations of all relevant interested parties – Fig.2.

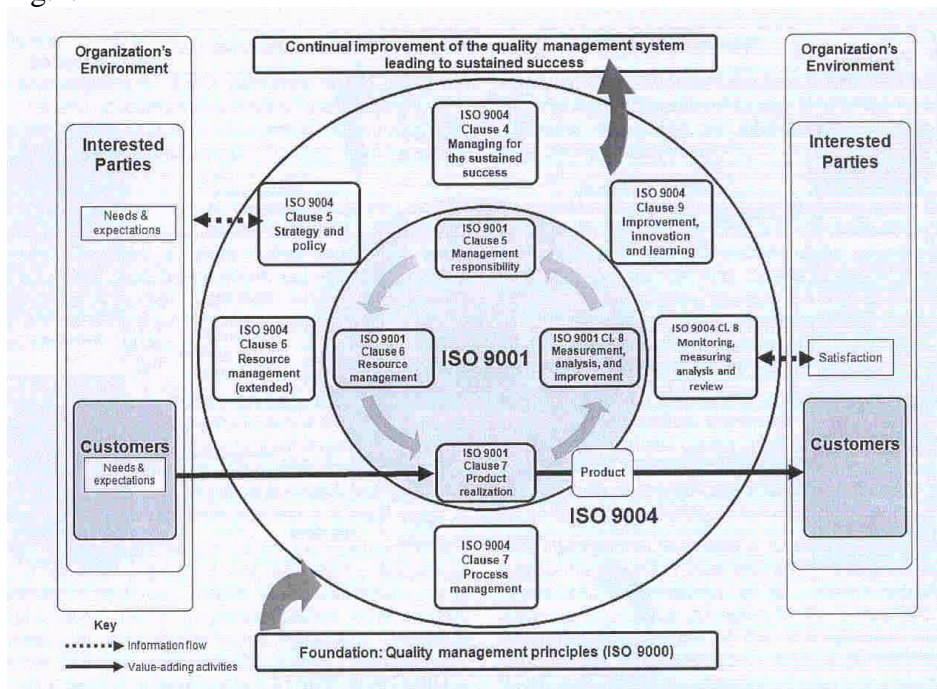


Fig.2. Extended model of process-based quality management system (ISO 9004:2009)

The products of university and their customer and stakeholders can be expressed in process model, see Fig.3. The requirements and expectations are the inputs and are transferred into products – outputs, which are delivered to university customers and stakeholders.

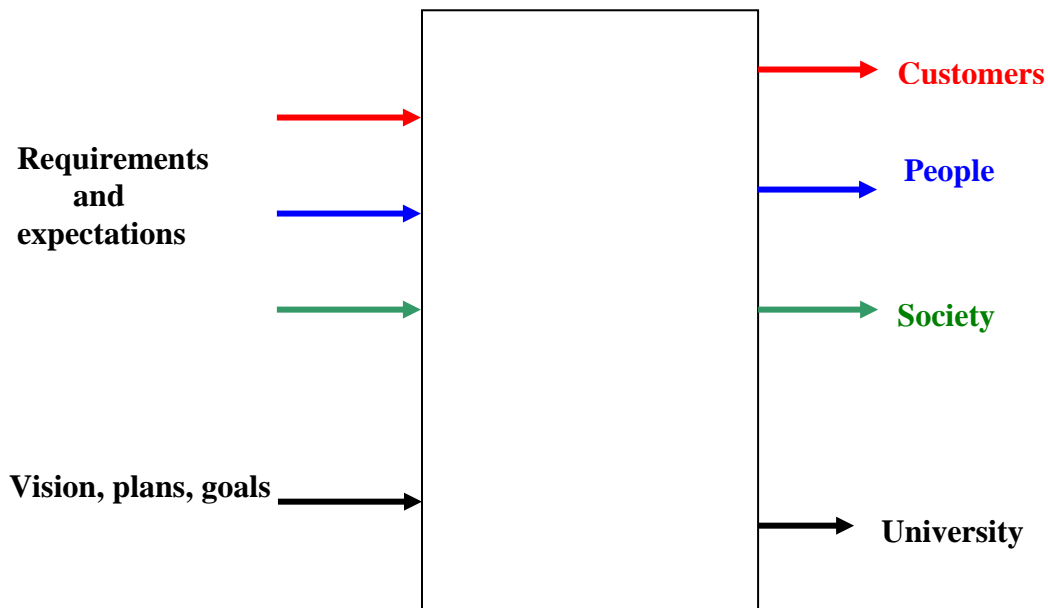


Fig. 3. Process model of university

The customers of university are expressed by red. The main products of university and their customers are in Tab. II. Beside of the customers there are the next groups that receive other university products.

Product	Characteristic	Customer	Customer expectations
Bachelor, master and doctoral university education	Obtained qualification	Students	Readiness in practice
		Employers	Performance capability
		Society	Conformance with development strategy
Life long education	Deepen knowledge, change of qualifications	Participants	Possibility to grow, change of career
		Employers	Planned fulfillment
R&D projects	Looking for new principles	Society (enterprises)	New principles, feasibility
Cooperation with public and business sector	Solving real problems	Enterprises	Applicable solution, effectiveness

Tab. II. The main products of university and their customers

People (academic and non-academic staffs) are one of them. It is expressed in fig. 3 by blue colour. People receive from university the salary and so called “internal university culture” (behaviour and communication with them, taking authority and responsibility ...).

The society receives from university so called “external university culture” (environmental behaviour, communication, support of some society's activities by university ...). It is expressed in fig. 3 by green.

The university itself is also the recipient of university products (financial and nonfinancial results of university). It is expressed in fig. 3 by black

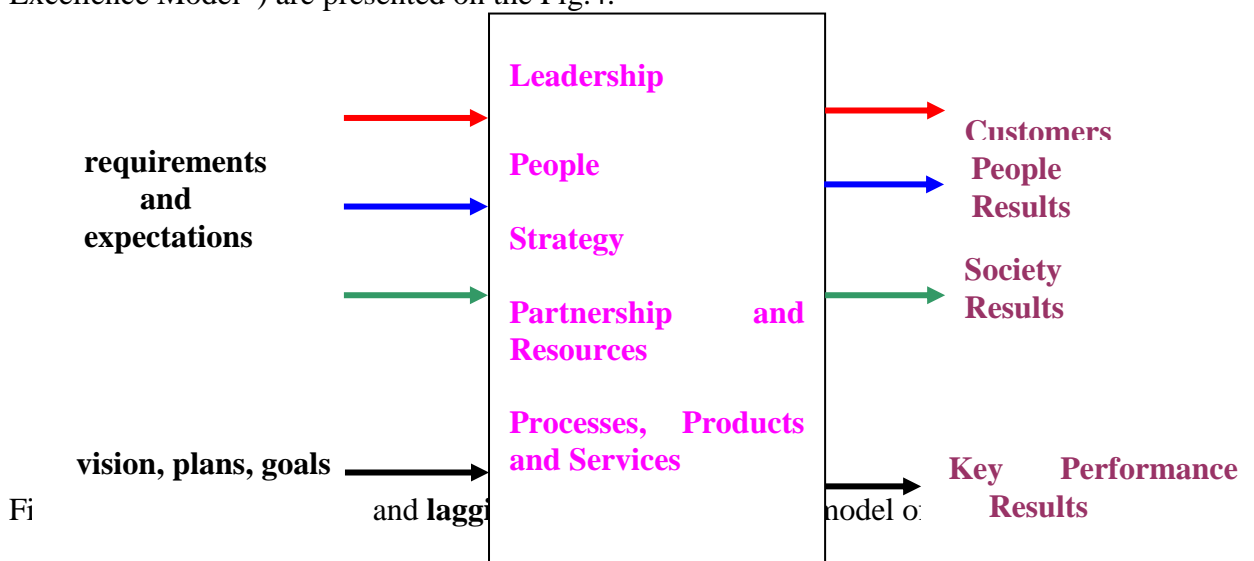
Evaluation of Complex Quality

The quality of any institution, university included, is recognised through quality of their products, the degree to which they fulfil the requirements and expectations of customers. It is evaluated through so called lagging indicator.

The lagging indicators (results) evaluate what organisation reached in the past. The holistic approaches evaluate not only results in the past, but also the capability and potential for future development through so called **leading indicator (enablers)**.

The enabling criteria cover what organisation does, and the results criteria cover what organisation achieved. The time lag between the enablers and the results reinforces the connection that whatever action is taken, will ultimately impact of the performance and results of the organisation.

Lagging and leading indicators at the process model of organisation (inspired by EFQM Excellence Model[®]) are presented on the Fig.4.



EFQM Excellence Model[®] as the Framework for Evaluation of Universities

The European Foundation for Quality Management (EFQM) was created in 1988 by 14 leading European businesses. The EFQM was formed to recognise and promote sustainable success and provide the guidance to those seeking to achieve it.

This is realised through a set of three integrated components:

- The Fundamental Concepts of Excellence.
- The EFQM Excellence Model[®]: A framework to help the organisation to convert the Fundamental Concept and RADAR logic into practice
- RADAR logic: A dynamic assessment framework consists of following elements:
 - Results
 - Approach
 - Deployment
 - Assessment and Review

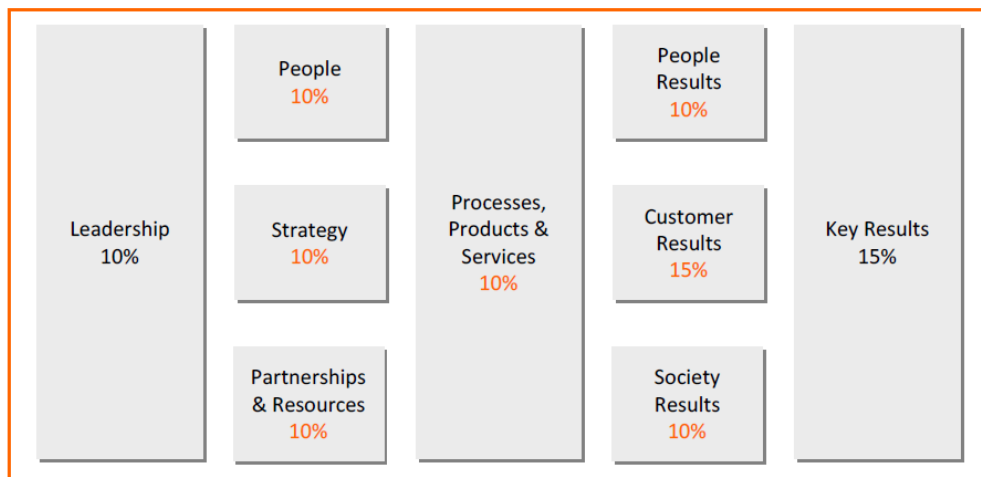
The EFQM Excellence Model[®] was formally launched in 1991 as an assessment framework for European Quality Award. The EFQM Excellence Model[®] was revised in 1999, and updated slightly in 2003 (EFQM, 2003). The model was also rearranged for education institutions (TRIS-EFQM, 2003), (Centre for Integral Excellence Sheffield Hallam University, 2003).

The last version of Fundamental Concepts of Excellence and EFQM Excellence Model (EFQM, 2010) builds on years of experience and takes into the account the current and future challenges of an organisation.

Fundamental Concepts of Excellence (2010 version)

1. Achieving Balanced Results
2. Adding Value for Customer
3. Leading with Vision, Inspiration & Integrity
4. Managing by Processes
5. Succeeding through People
6. Nurturing Creativity & Innovation
7. Building Partnership
8. Taking Responsibility for a Sustainable Future

Revised Weighting between Criteria



The Mc
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Excellence

a series of questions that should be considered during the self-assessment process. Within each criterion part is a list that contains possible areas to address.

Implementation of Self Assessment based on EFQM Excellence Model at VŠB-TUO

Significant motivation for orientation VŠB-TUO to the complex quality comprehension was the Program of the Czech Republic National Quality Award, which was in year 2006 opened for non-profit organizations and extended by two categories – based on the CAF Model and based on the EFQM Excellence Model[©].

The Faculty of Mechanical Engineering was the pilot faculty where we started implementation of TQM philosophy. This faculty applied to the Program of the Czech Republic National Quality Award 2006 - part assessment based on EFQM Excellence Model[©].

Many analyses were done during the self-assessment process. The most significant weaknesses and threads were selected, analysed and activities towards their removal was quickly run. Many uncertainties were eliminated by new analyses by questionnaires for graduates, new students and unsuccessful students. The next important area which was omitted in the past was collaboration with suppliers; particularly collaboration with the high schools. The project called “Partnership with High Schools” was started at the end of year 2006 by the concrete offers for study support, such as special excursions to the faculty labs, university teacher lectures focused on actual technical problems and current events, and other real collaboration support.

Based on evaluation of the self-assessment report, followed by site visit of assessors from Program of the Czech Republic National Quality Award, the Faculty of Mechanical Engineering was awarded by - “Recognised for Excellence-2006” level. The feedback from the site visit was considered very useful. Other possibilities for improvement were identified.

The next step was the dissemination of TQM approach at next faculties. Some of them applied and took a part in the Program of the Czech Republic National Quality Award. The survey of achievements can be seen in Tab.III.

Year	Faculty	Award
2006	FME	Recognized for Excellence
2007	FME	Award winner
	FMG	Recognized for Excellence
2008	FMG	Prize winner
	FMME	Recognized for Excellence
2009	The whole VŠB-TU Ostrava	Recognized for Excellence

Tab.III – The achievements of VSB-TUO in the Program of the Czech Republic National Quality Award.

Faculty of Mechanical Engineering of VSB-TUO became „Czech Republic National Quality Award Winner 2007 – category public sector”. It was the first time the University was given this prestigious award.

Summary

The results of implementation TQM approach followed self assessment based on EFQM Excellence Model[®] at the VSB-TUO and participation in the Program of the Czech Republic National Quality Award are very positive. The orientation to the complex quality improved the university life, its processes and efficiency.

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The importance of quality improvement activities based on long-term relationships with customers: Research on the continuous growth of companies in the land transport service industry

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Key words: Quality improvement activity, a long-term relationship with the customer, a continuous growth company, organisational capability, the land transport services industry, an empirical study

Category: Research Paper

The objective of this research

This research analyses the land transport service industry to determine the importance of quality control and improvement activities and to illustrate the importance of building long-term relationships with customers and increasing organisational capability for continuous growth. In the land transport service industry, the market has contracted because the long-term depression of the Japanese economy has caused the elimination of many land transport service companies. However, in this severe economic environment, some companies are expanding their business. In this research, the factors contributing to continuous success were identified by analysing the activities of these growing companies from various perspectives, such as quality control.

A Review of the Literature

Various factors, such as the importance of quality control, have been cited by previous research as success factors for land transport service companies. Other examples include investments in special vehicles, improvements in the communication capabilities between supply chain management and IT investments, and reinforcement of the sales forces.

Special Assets

Kasuga et al. (1999) present their results as follows. The various types of assets that are necessary for processing distributions with shipping companies and distribution companies can easily serve as special resources for those companies. An example includes the development of a special vehicle used only for a specific situation. Investment in these special resources increases distribution efficiency. When special investments exist between specific companies, the switching costs for both the shipping and distribution companies increase, and it becomes difficult to exit the business relationship.

When a shipping company uses the facilities for distribution processing that are suggested by a distribution company, a closer business relationship becomes likely.

IT

According to Ashida (2004), supply chain management, which was defined as cooperation among a supplier (a raw materials or component supplier), a shipping

company, a distributor and a distribution company, attracted attention in the 1990s. In addition, a concept known as third-party logistics and the demand chain management to take control of the operations of supply chain management also attracted the attention of researchers. Supply chain management is a business approach in which the supply chain is managed transversely to obtain the desired level of production and sales from the supply of raw materials by information technology. Thus, optimisation and a cost decrease of the entire distribution channel and the improvement of customer satisfaction are planned. The role of each related player is clarified, an overlap and the part that must be rationalised are discovered, and the total optimisation is pursued by the supply chain management.

According to Sato (2006), approximately 50% of the companies which introduce supply chain management has already reached the implementation phase of supply chain management. The ratios of the company that reached the implementation phase increased compared with the investigation of 2002. For example, some types of industries, such as the apparel company that used a quick response system or the automotive industry for which production was divided into specialised areas of labour, particularly advanced. Japanese companies demanded improvement in the effectiveness by supply chain management. In the contract choice of the distribution company, the shipping company attached substantial importance to cost competitiveness regarding the IT investment.

Sales Force

Uno (2003) defines logistics in the wide sense as the collaboration of the entire supply chain, including the account executive, the production personnel, and the distribution manager. Uno cites the particular importance of the account executive as follows. A services proposition to satisfy customer needs is an important method to ensure that a distribution company expands its sales. The services proposition improves the temporal efficiency and efficiency of transportation and lowers the total cost. Sales activity of the positive demand creation type is necessary for order acquisition. Therefore, the reinforcement of marketing strategies, the establishment of customer strategies and the offer of customer satisfaction through the use of teamwork with forwarding agents become important. The superior account executive must adequately analyse the dissatisfaction of customers. Speaking with customers on the telephone, ensuring the rapid reporting of information to customers, and maintaining a thorough knowledge of operations are demanded. Reliable action, salesmanship, a wide knowledge of duties, and high presentation capabilities provide satisfaction for the shipping company. In addition, real services relating to the presentation of services are demanded. Therefore, collaboration with other sections within a company (including customer courtesy counters, operation departments, safe administration and finance divisions) becomes important.

Quality Improvement

Ishida (1999) emphasises the importance of the software side, such as the temporal quality (speed, accuracy, and time appointment) and safety (accident compensation capability and freight chase services), in addition to the hardware side, such as the area of the route network, the placement of a terminal or a collection and delivery foothold, the collection and delivery system, to differentiate the distribution supplier.

According to Wakisaka (2008), enhancing the quality of the management of the distribution supplier is required to gain the reclamation of a good shipping company. The starting point of good shipping company reclamation is the creation of credit for the existing shipping company. A rate of accident and carrying expenses are reduced by personnel training and successive workplace improvement to increase transportation quality. In addition, trust can be created with shipping companies. The decline of a distribution company begins with internal management. For example, based on the fixation rate and the number of employee accidents, the level of a distribution company can be estimated. The stagnation of a company begins with the stage in which the fixation rate of the employees is under 75% between years. During the stage in which the fixation rate is under 60%, a company is in a critical situation. In addition, the stagnation of a company begins when accident costs exceed 2.5% of the sales. When accident costs are above 3%, a distribution company faces a dangerous situation. The security, the low costs, and the foundation of the trust with the shipping company are produced entirely in the distribution field. When management is enhanced, the consciousness of the employees changes from a passive consciousness to an active, autonomous consciousness. When corporate culture is transformed from a passive culture to an autonomous culture, employees autonomously ensure higher quality. Eventually, these actions lead to changes in the relationship with the shipping company. For example, the objections from a shipping company may decrease, and an existing shipping company may introduce a new shipping company. This process involves the creation of credit from customers.

Investigation Hypotheses and Methodology

The objective of this research is to determine the relevance of quality improvement activities for distribution supplier to the corporate earnings. Therefore, the fieldwork in this study examined the achievements of distribution suppliers, service content, service quality and improvement activities. A survey questionnaire was distributed and oral interviews were conducted with twenty-eight companies that participated in a workshop for the land transport service industry, which the author also attended.

In this research, each index of SERVQUAL (Parasuraman, et.al, 1988) is referred as a performance index of the service quality to design the investigation items. The characteristics of the distribution company were adapted to each category of SERVQUAL. The etymology of SERVQUAL is an abbreviation of service quality. SERVQUAL is a substantial method to measure the quality of a service after experience is compared with expectations. These qualities are classified into five categories as follows:

Tangibles

This term refers to the appeal of the facilities and the tools used by a service company.

Responsiveness

For example, an employee of a service company may respond to the demands of a customer positively. The customer is notified about the situation of offered services appropriately. Services are offered to a customer promptly.

Empathy

For example, a service company understands the problem of a customer, and the customer's needs are met. Customers receive individual attention, and business is performed at a time that is convenient for customers.

Reliability

For example, a service company offers perfect services for a customer without failure. The services are accomplished in accordance with each agreement that is made.

Assurance

For example, the action of an employee ensures that a customer trusts a company. A services company guarantees safety to a customer.

Each category of SERVQUAL can be connected with various types of success factors that have been cited in previous studies as follows.

- Special Assets: Tangibles
- IT Investment: Responsiveness
- Sales Activity: Empathy
- Quality of Service: Reliability and Assurance

In addition, the activities designed to raise the quality of service was measured by the questionnaire survey. This research was concerned with the measurement of how particular types of quality improvement activities were performed with customers. In addition, the degree and the effect of quality improvement activities were measured. The statistics were processed using SPSS software.

Findings

1) The increase and decrease in the number of the customers and service quality relations

The results of this investigation showed a strong correlation between the increase and decrease in the number of the customers and the quality improvement activities. The group of enterprises that conducted meetings to discuss the improvement of distribution quality for customers regularly experienced increases in their number of customers (the coefficient of correlation was 0.433). These companies recognised the utility of quality improvement meetings with customers (the coefficient of correlation was 0.392), and the frequency of the meetings increased (the coefficient of correlation was 0.54). However, a significant level of correlation was not observed between long-term growth and the other items (e.g., special assets, IT investment, sales activity).

2) Results of the quality improvement efforts involving cooperation with customers

The results of the investigation suggest that the construction of long-term relations with customers and organised communications were important to increasing service quality.

In addition, the importance of organisational capabilities that utilised knowledge through such communications was verified.

The group of enterprises that performed periodical quality improvement activities with customers experienced more prolonged business with its customers (the coefficient of correlation was 0.426). The group of enterprises that continued to conduct quality improvement meetings with customers for years showed enhanced quality improvement results (the coefficient of correlation was 0.494).

In addition, the group of enterprises that performed such quality improvement activities with customers for an extended period of time possessed high organisational abilities. Communications with customers are enhanced (the coefficient of correlation was 0.376), and the quality objectives of customers were understood (the coefficient of correlation was 0.414). Furthermore, the communications within the companies were also enhanced (the coefficient of correlation was 0.575). In terms of organised activities, employee education was enhanced (the coefficient of correlation was 0.561), and the operation improvement activities were enhanced (the coefficient of correlation was 0.443). These activities are related to improvements in the quality of the following operations: improvement in the intelligence capability of the account executives (the coefficient of correlation was 0.517); improvement in the services proposition capability (the coefficient of correlation was 0.450); the improved quality of the crew (the coefficient of correlation was 0.415); the decrease in traffic accidents (the coefficient of correlation was 0.488); and the decrease in load accidents (the coefficient of correlation was 0.406). As a result, these activities led to improvement in the productivity of the operation (the coefficient of correlation was 0.403) and increased economic efficiency (the coefficient of correlation was 0.394).

Conclusions and Discussion

The results of this research are summarised as follows:

- 1) The performance indices of the service efficiencies that contribute to the long-term success of land transport service companies are substantively described.
- 2) In addition to integrated quality control and improvement, the importance of organised communication inside and outside of a company and continuous organisational capability improvements are substantively indicated.

Furthermore, the following facts are considered. The life cycle of the distribution industry in Japan experienced a period of high economic growth in the latter half of the 20th century, but growth is currently slowing. During the period of market growth, orders were increased by investments in hardware, such as special vehicle and information-processing equipment and positive sale offensives in the short term. However, when the life cycle of the market approaches a period of maturity, the company begins to experience higher levels of competition, and differentiation through the use of such short-term investments becomes difficult. Long-term investment becomes necessary for differentiation. The greatest improvements in service quality are the results of a long-term accumulation of activities. Companies that engage in such activities for an extended period of time can survive during periods of maturity. This research considers the long-term success factors in a developed market. Future research may, for example, compare these success factors with those of the growth markets of emerging nations.

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Change Management from a Stakeholder Perspective

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Introduction

With the ever increasing rate of change the pressure continues to increase, for quicker and more effective organizational change. For society at large, and organizations in particular, the magnitude, speed, impact, and especially the unpredictability of change, are greater than ever before (Burnes, 2009, Foley and Zahner, 2009, Helms Mills et al., 2009, By Todnem, 2005). But, there seems to be a general consensus between practitioners and scholars that few are successful when trying to implement change (Hallencreutz and Turner, 2011). There is a plethora of information, advice and assistance that organizations can and do call upon in planning and executing change, and yet, they still fail (Burnes, 2009). Better Change Management is in great need (Senior and Swailes, 2010). What is better could be discussed. One way of assessing the success of change would be to look at its effects on all stakeholders.

Companies of today face multiple requirements that have caused a shift from shareholder focus to a more balanced stakeholder focus. Foley (2005) proposes that the contemporary business enterprise can be better understood and managed by the use of a business model that has a stakeholder rather than a competitor perspective. Stakeholders to be considered could be customers, employees, shareholders, suppliers, government, local community and the bio-physical environment (Foley and Zahner, 2009). It might therefore be argued that the level of Change Management success is measured by looking at the outcomes for all stakeholders.

The Japan orientated quality movement has a long and complex history. Its evolution from the industrial revolution to present day has been interpreted in many different ways and stages, from Quality Control over Company Wide Quality Control to Total Quality Management (TQM). Different aspects of quality management have been thoroughly covered in the literature, see for instance Feigenbaum (1951), Deming (1986, 1993), Juran (1993), Oakland (1999), Foley (2005), Bergman and Klefsjö (2010), Bergquist et al. (2008) and Foley and Zahner (2009). In the 80s and 90s the quality movement, with its focus on customer satisfaction, was largely seen as the solution for effective change. Over the last decade, change programs have shifted from TQM and Business Excellence models to Six Sigma improvement and Lean Management in parallel with behaviourally oriented change approaches with focus on

“the people side of change” such as leadership and culture. Two major approaches for organizational change can be seen in the literature, the planned and the organic approach to change (Hallencreutz, 2009). One could ask if in the development of change management competence old knowledge becomes obsolete or if old truths resurface under other names. The Toyota Production System (TPS) started in the 1950s and was then made known as Lean Production by Womack et al (1990) in their book based on a five year MIT study on the global automotive industry. Since then, there has been Lean Thinking, Lean Management and now mostly Lean. Since the ingredients of TPS have been used as input for TQM, and vice versa, we could suspect that some of the old truths are reused and presented in a new packaging.

Findings from previous studies (Turner et al, 2009, Hallencreutz and Turner, 2011) found no coherent models and definitions of evidence based change management practices to be found in the literature. There does not appear to be one agreed best way to implement concepts such as TQM, Six Sigma or Lean. Additionally, there does not seem to be any clear taxonomy that relates different improvement approaches within the larger context of change management. There does not even seem to be an agreement if the quality movement really is part of change management. As a first step for better understanding how to describe the theory of change it would be of interest to create a taxonomy of change in which different approaches may be related. In order to better understand organisational change and change management we need models that identify critical elements in an organisation that affect the result of a change initiative. According to Andersen (1998) a model is a set of relating concepts, describing a phenomenon in a simplified manner. As such, an organizational change model may aid in the understanding why change occurs, how it will occur and what will occur (Kezar, 2001). In our view, such a model might be able to facilitate the analysis of organisations as a means to identify elements that need to be changed or considered when change is carried out. This would be of help in adapting the change initiative to the needs. With a starting point in stakeholder needs for change it should be possible to organise, categorise and assess the relevance of different improvement approaches. In this paper we carry out a first iteration to see how a change management taxonomy could be created that includes elements from both general change management and Total Quality Management. The purpose is also to define further areas of research.

Methodology

Input to our study includes scientific evidence as well as practitioner knowledge and skills.

Results presented in this study constitute a first iteration with limitations in the depth of different types of information collected.

The information collection is planned to be from the following sources:

- Journals with focus on Organizational Development and Change Management
- Books used as main literature in change management courses,
- Syllabi for university courses in change management
- Web site presentations of change programs from change management consultants.
- Theory and practice of current change management based on literature studies
- Web searches

All sources mentioned above have been used to an extent allowing a first assessment of the approach and results.

We have also used our own pre-understanding and experience as change management practitioners and theoreticians. This pre-understanding has been reviewed, developed and aligned in regular Skype-meetings.

The chosen unit of study is the organization, or a major part of it, being subjected to change. Change could be continuous and incremental as well as intermittent and dramatic, or something in between. We view change management as an approach for improving organisational performance. Approach is here interpreted as something that describes core values and principal change methodologies as well as the sequence of change. Furthermore, we apply a process view where the process subjected to change is part of an organization. We also view change management as a process starting from a perceived need for change to realised change. We recognize that there are an infinite number of elements which could be critical in some particular change situation. However, an assumption in our study is that it is possible to use a limited number of change elements to describe an organisation and its environment in such a way that the main critical areas for successful change are included. The term successful is here interpreted as “the fulfilment of perceived stakeholder value”.

For analyzing and categorizing the information we have used a few assumptions. We have assumed that organizations can be described as process based systems and that change also can be viewed as a process. Change management elements have been categorized based on a breakdown of the data using a typical process model presented in Figure 1.

Additionally, main stakeholders in the change initiatives are identified. Elements are also categorised using the thinking of Bergman and Klefsjö (2010) who define a management system as consisting of values, methodologies and tools. Shared values are generally seen as an important starting point for successful change. These are then supported by methodologies (how things are done) and tools (nouns describing structures, check lists, models etc.). A change approach consists in addition to the values, methodologies and tools of a roll out sequence – the order of carrying out change.

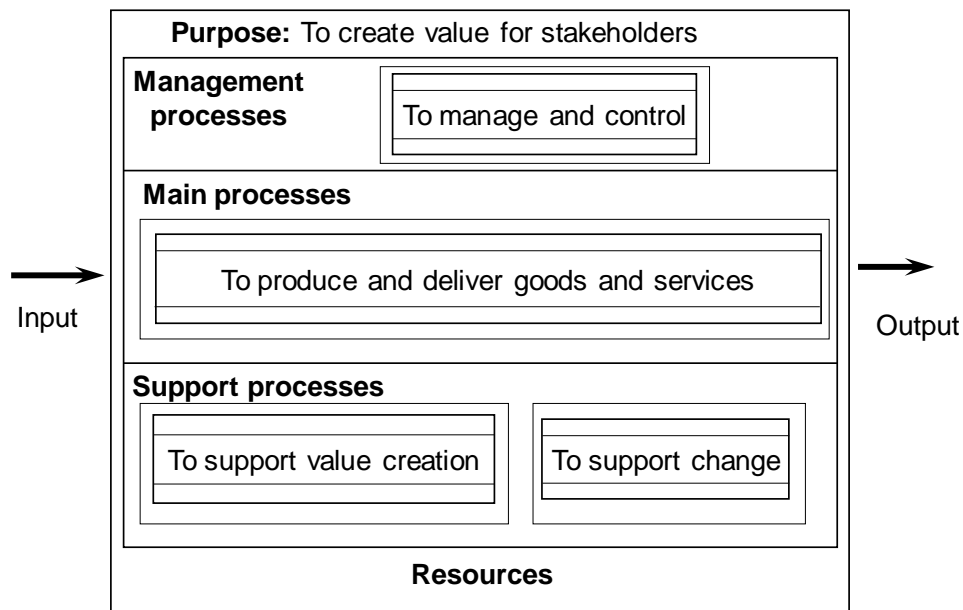


Figure 1. A proposed generic model that is used in this study to describe organizations. The model is based on a classification in management processes, main processes and support processes. Resources are identified as a separate entity. Adapted from Isaksson (2006).

A Brief History on Change Management Theory

The majority of studies from both the US and European countries indicate that over 70 per cent of all major change initiatives fail to reach intended objectives (Haines et al., 2005, Mills et al., 2009, Burnes, 2009). Contemporary theory on organizational change shares the same pedigree as other general management theories, such as quality management. In the theoretical DNA we find references to Taylor, Weber, Fayol and other classics. The rise of capitalism in Britain and other European countries created new problems that could not be accommodated under the old order (Burnes, 2009). A need for coping with change emerged.

The mechanistic, hard systems approach to organizational change, seeing change as episodic with discrete beginning and end points, was grounded in this classic approach to managing and changing organizations (Oswick et al., 2005). For the classical school, change management was relatively straightforward; it tells the organization where it should be and that rational beings within the organization accept that. The first generation of quality management emerged from this theoretical heritage (Foley and Zahner, 2009). Despite being dominant from the 1930s this classic approach to change management has encountered both intellectual and practical opposition, and newer perspectives on organizational life have become increasingly influential in the last decades (Burnes, 2009). According to the human relations movement, in its prime in the 1930s, change cannot be seen as a rational process. Therefore, persuasion and leadership play a key role in change efforts. Later theories, such as the cultural-excellence approach (Peters, 1993), advocated a "big bang approach" to change. Handy (1986), on the other hand, seems to have adopted a more gradualist approach to change. Kanter et al (1992) advocated a combination of both; major cultural changes take time, dramatic interventions are needed to improve short term performance.

The school of organizational learning is directed at enabling organizations to change, but have been criticized for not clarifying how change initiatives generated by learning will lead to effective and coordinated organizational change (Easterby-Smith, 1997, Tsang, 1997). The Japanese approach to long term change – captured in different quality concepts – has undoubtedly been successful in Japan, but it is debatable whether this approach actually worked in many Western countries (Burnes, 2009). Thus, it can be concluded that all these approaches to organizational change have their strong points and drawbacks. But their relevance for the contemporary organization should be discussed. Alongside these developments runs the view that contemporary organizations have moved from the modern to the postmodern world (Boje, 2006). Postmodernism, with its denial of an absolute reality and promotion of competing and socially constructed, multiple realities, offers a scope for alternative organizational strategies. It also offers different choices, and stresses the importance of culture, power and politics (Burnes, 2009). A battle between chaos and order seems to emerge. All these perspectives have important but different implications for organizational life and point to the reality that there seems to be no “One best way” or magic bullet for organizational change. Instead they provide the contemporary organization with a wide range of options and choices as to how they lead change.

Change Management and Total Quality Management (TQM)

To date there is no well-established, widely used and agreed upon definition on TQM (Foley and Zahner, 2009). Bergman and Klefsjö (2010) define TQM as:

“A management system in continuous development consisting of values, methodologies and tools. The aim is to increase external and internal customer satisfaction with a reduced amount of resources. It is based on a continuous improvement work in all process of the organization, in which all employees are allowed and stimulated to participate.”

The definition involves both management and change and would therefore logically seem to qualify as being part of change management. Bergman & Klefsjö (2010) describe the scope of the change in their book title: “From Customer Needs to Customer Satisfaction”. The customer definition they use is very broad and includes what normally could be seen as stakeholders and interested parties. Typical of the literature within TQM, Bergman & Klefsjö (2010) do not advocate any particular change sequence. Instead values, methodologies and tools that should be present are highlighted. TQM is strongly criticized by Foley and Zahner (2009) for its lack of a theoretical foundation and for not being linked to main stream management research. TQM peaked internationally at the beginning of the 1990s and left a clear impact in how the ISO 9001 standards for quality management systems were formulated, starting with the ISO 9001:2000 (Foley and Zahner, 2009).

The research results for impacts from the use of TQM are somewhat contradictory. Some studies indicate that TQM improves economic performance, see for instance Hendricks and Singhal (1997, 1999), Eriksson and Hansson (2003) and Wrolstad and Krueger (2001), but other studies on TQM are less positive, see for instance Hansson (2003), Helms Mills et al (2009) and Alvesson and Svenningsson (2008).

As a management approach for change TQM has declined, but its values, methodologies and tools are being used within approaches such as 6Sigma improvement

and Lean Management. Foley (2005) states that it is unclear whether TQM is simply a collection of essentially independent techniques, a management philosophy, a coherent change management method, a strategy, a theory for managing only the quality and service process, or a master theory for managing the entire enterprise – or all of the above. TQM is sometimes referred to as a planned approach to organizational change, see for instance Mills et al (2009) and Oakland and Tanner (2007). On the other hand since TQM as described by Bergman & Klefsjö (2010) lacks a clear change sequence and sees TQM as a management system consisting of values, methodologies and tools it could be seen as an example of soft systems methodology as described for example by Senior and Swailes (2010). TQM is also accused of being programmatic and technical (Alvesson and Svenningsson 2008, Helms Mills et al., 2009). According to Bergquist et al. (2008) some scholars even call it a management fad.

Customers, Stakeholders and Interested Parties

Much could be said about the categorisation of those that benefit from the results or the outcome of a process. This discussion is outside of the scope of this paper and we limit our contribution to defining our interpretation of stakeholders. Broadly speaking Foley and Zahner (2009) identify stakeholders as those that wield some power over the organisation and whose strategic imperatives therefore must be considered by it. Others that only have an interest or that are affected but cannot really influence the organization are called interested parties, see also Garvare and Johansson (2010). Generally, customers are regarded as being part of the larger group of stakeholders. Bergman and Klefsjö (2010) state: “Those we want to create value for are our customers”. This very wide definition expands the perspective to include several stakeholder groups and even interested parties. It could be argued that all those affected by change should be considered when the success of a change initiative is assessed. There will often be both winners and losers in change initiatives, but seen from an ethical perspective all those affected, within reason, should form part of a change element assessment. In this paper we therefore include in our operational stakeholder definition all those for whom value is created, also considering harm or negative value and even including those who cannot speak for themselves, such as forthcoming generations and nature.

Change Management, 6Sigma and Lean

Toyota Motor Corporation is widely recognized for having created a management system that top leaders of many manufacturing and service businesses throughout the world now seek to emulate (Emiliani, 2006). In the literature this management system is referred to as “Toyota Production System” (Ohno, 1988), “Toyota Management System” (Monden, 1993), “Lean Production,” (Womack et al., 1990), “Lean manufacturing” due to its origins in production and operations management (Shingo, 1981; Ohno, 1988) , “Lean Management” (Emiliani et al., 2003) or just “Lean thinking” (Womack and Jones, 2003). The Japanese commitment to quality and continuous improvement is legendary, but despite a seemingly widespread acceptance of the need for improved quality in the West, the Japanese still appear to be the only nation capable of diffusing and disseminating these ideas and practices throughout the majority of its industry (Dale and Cooper, 1992, Hannam, 1993, Womack and Jones, 2003). So far Lean is probably the most popular concept of the Japanese approaches to management. But not all organizations succeed when embracing Lean. Typical obstacles include:

- Lack of underestimating the cultural and managerial impacts,
- The illusion of progress,
- Conflicting measures, in attention to the principles of Lean
- The use of Lean as a set of tools rather than a way of doing business (Boyer and Sovilla, 2003).

Six Sigma, on the other hand, has been described as an American response, wrapping classic quality management in a new package (Klefsjö et al., 2006). There have been numerous presentations of cases, comprehensive discussions, books and websites addressing Six Sigma. However, little scholarly research has been done on Six Sigma's influence on management theory and application (Goffnett, 2004, Schroeder et al, 2005). Similarly, even though considerable and important works have been carried out within change management there are still many questions remaining.

Six Sigma includes many of the values, methodologies and tools mentioned within TQM, but unlike TQM it comes with a clear recipe for change in the DMAIC-process. Change goes from identified needs over Define-Measure-Analyze-Improve-Control to a desire state secured by some new controls.

The Process View and Change Management

In very simple terms the ideal process is effective, efficient and flexible. Effective could be defined as reaching the objectives, which are set seen from a stakeholder perspective. Efficient could be seen as minimising resource use and harm done to stakeholders and the timely execution of change. The flexible change process would be the one that can adapt to changing system conditions, such as varying needs, without losing effectiveness or efficiency.

In Figure 1 a generic change process “to support change” is identified as a support process. Quite often when major change is attempted a part or all of this change process is outsourced to actors external to the organization, i.e. consultants. The decision regarding to what extent change management should be internal or external is decided in a management process, which also could be seen as a support process. Management processes are present at different levels and the change process has its own management, main and support processes as well as dedicated resources. These are presented schematically with the lines and boxes in Figure 1. The model in Figure 1 is used both for identifying elements in the process which is undergoing change and the change process itself, see Figure 2.

The structure in Figure 2 bears resemblances with the Lewin process of unfreeze, change and re-freeze, (Lewin 1951). However, the descriptions of actual and future states are not static – they are not truly frozen, which also corresponds to the original intention of Lewin's process. Even when frozen in a descriptive model the interpretation should be that of a snapshot of ongoing change. The change process model template could be used to describe the internal work of continuous change as well as a change process managed by an external consultant. In any change there are factors that cannot be controlled, which in Figure 2 have been described as external factors. The model structure can be used to detail change elements at different levels. For example the sub-process of unfreezing could be described using the same model structure of management, main, and support processes supported by resources.

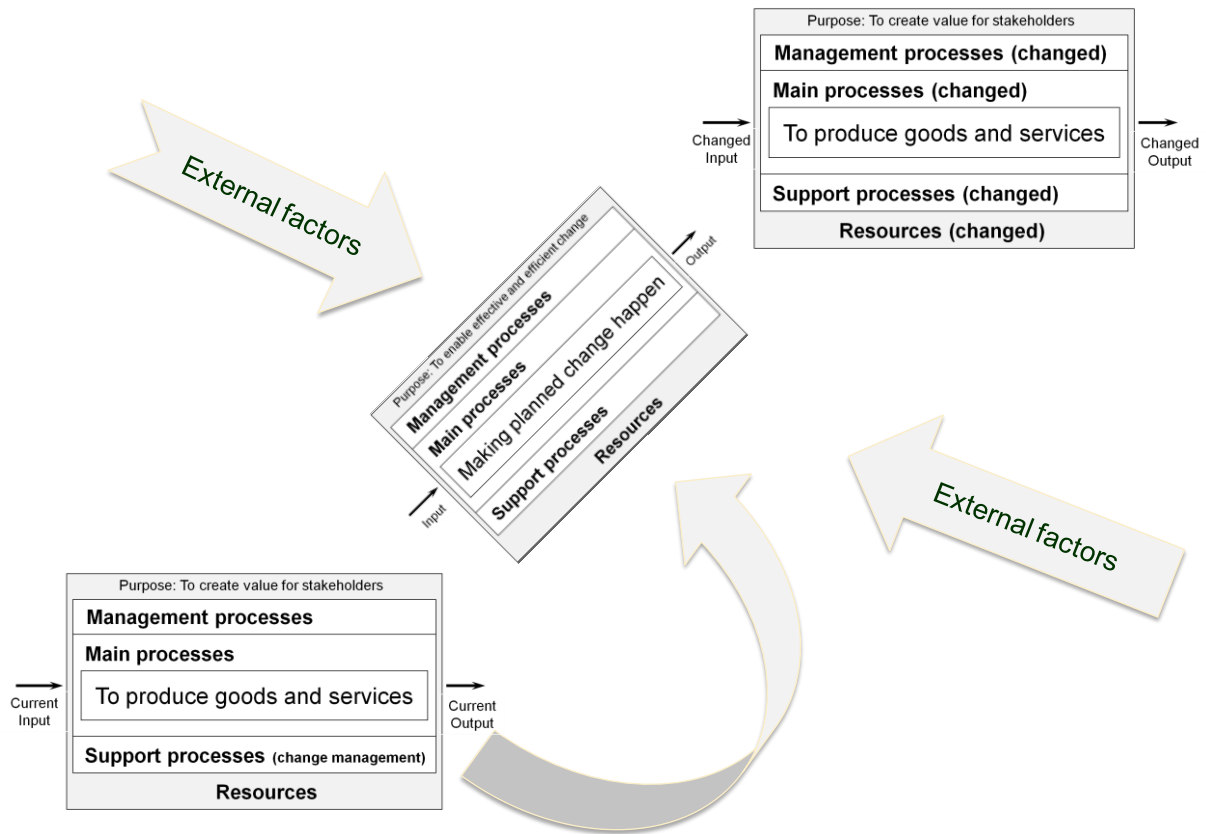


Figure 2. The proposed process model used for describing actual state, future state and change process. Note that the change process can be seen as a support process in the organization that works with both continuous and intermittent change.

Identifying Change Elements

Organizational change can be defined as an alteration of a core aspect of an organization’s operation (Helms Mills et al., 2009). Compiling the information from studied journals, books and websites, the term change management is used to describe both the actual process of managing organizational change as well as an area of professional practice. In essence a body of knowledge and models, describing requirements, standards, processes and procedures. According to Hallencreutz & Turner (2011) there is no consensus on a definition of the term change management. In our view, a large part of contemporary consensus regarding the definition of change management can be summarized in the following definitions:

“Change management is the coordination of a structured period of transition from situation A to situation B in order to achieve lasting change within an organization.” (BNET Business Dictionary)

“Organizational change management is the process needed to enable the people in an organization to transition from their current environment and adopt the new work environment or desired state”. (Turner (2007))

“Organizational change management can be seen as a structured, proactive approach to relocate individuals, groups and organizations from a current state to a desired future state” (Hallencreutz, 2009 and Implement MP AB

Turner (2007) identifies the people in an organization as the main stakeholders. The change process starts with a current state which is not up to the desired state and points out the working environment as the area for change. This would, in the context of the process model, be focused on changing the state of resources of manpower and environment. The Implement MP definition points to individuals, groups and organizations as change elements. Not only do people need to change on an individual level, but also as team members and as employees of the organization. This indicates changes in how work is done in the organization which could be seen as a resource called working methods. When changing how people behave we need to change the resource of working culture. The process starts with a known current state which needs to be changed to reach a desired future state. Both in Turner and Implement it is unclear who has defined what is desirable. In many cases this would be management that has defined a desirable state, which then has to be communicated to employees, which in turn need to accept and sometimes even adopt this definition. Management could be seen as acting mainly in the interest of shareholders. This could be a slight difference from TQM, which at least formally advocates for focus on the customer.

Most change programs, such as Lean transformations, Six Sigma deployment, Business Process Reengineering programs and behavioral change initiatives, start with a perception of a need for change. There is the risk that management has not considered all required stakeholders or all key elements when defining the need for change. Arguably, the success of change is at least partly a function of how correct the means for handling the perceived need for change has been analyzed. For any process it is important to correctly assess the interface. In this case the question is what the input for the change process is. Right or wrong, the identified need for change in any system is the result of a planned or unplanned analysis. Such analysis for the need of change is ongoing all the time – is it worth the time to change this? The studied system is subjected to a multitude of drivers for change. Based on this discussion the input could be seen as a driver for change. The first sub-process would then be to analyze the change need with the result being a decision to stop there, to analyze further or to start a change activity. Isaksson (2006) has divided change into two broad categories, creating interest for change and changing processes. Kotter (1996) has as the first stage in his change process: “Creating a sense of urgency”. This process is probably not linear, but involves several iterations to reach a critical mass favorable to change. The actual trigger for change is sometimes a result of a thorough analysis based on facts and sometimes the result of a social construction, a management hunch or just a wink of the eye of an executive.

The interface on the output side also needs to be defined. It is obvious that we somehow need to include stakeholders as an element into our process model. Our generic model produces output which is received by different stakeholders in the studied system. We could extend our model with an outcome that is a result of the output, (Isaksson et al., 2008). The output of the process is judged by the stakeholder and leads to a certain level of stakeholder satisfaction or value (positive or negative). Process output could for example be usability of products, level of profit and tons of carbon dioxide emitted. The

outcomes for this would be levels of customer and shareholder satisfaction and effects on global heat capture.

The first step of unfreezing described by Lewin starts with changes in a force field which has been in balance (Lewin, 1951). The force field consists of forces that push for change and others resisting change. One interpretation to this is that unfreezing could be seen as the first step after an input consisting of a driver for change. It could also be argued that in order to start unfreezing a decision of doing this is needed, which would indicate an earlier process of analysing a change driver, something that then leads to an imbalance. A change driver which changes the force field in such a way that change actions are needed could be seen as the input for the change process in Figure 2. The end result of this is with the system having the force field in balance. The time for balance could be a question of milliseconds or years depending of the stability of the studied organisation and the level of difference qualifying as change.

Kotter (1996) claims that change can be described with eight steps with the first being creating a sense of urgency. This implies that there already is a decision for starting change among some key persons. Therefore Kotter’s first step could be seen as a sub-process in unfreezing. The last of Kotter’s eight steps is: Anchoring new approaches in the culture”, and could be interpreted as the last sub-process of refreezing.

According to our review of change management consultancies the dominant discourse among US and Swedish change management consultancies seems to be a holistic systems approach, addressing both “hard” and “soft” aspects of change management, such as structural change and people change. The most widespread approach seems to be a planned approach to change, consisting of step models and change processes addressing process, structure and people, see example in Figure 3.

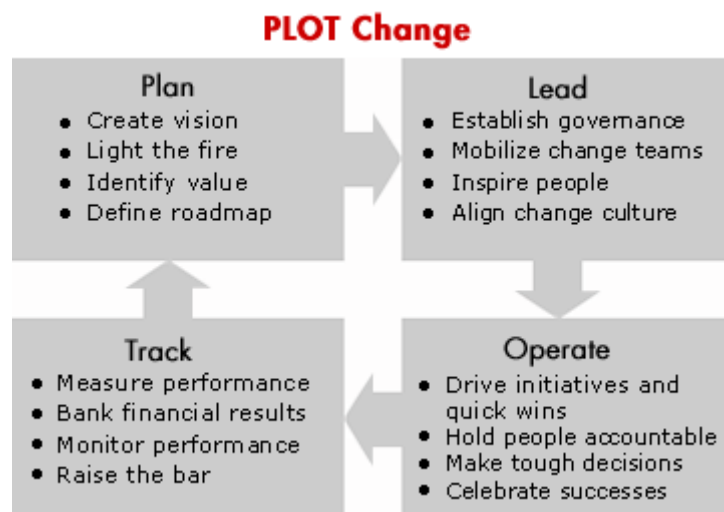


Figure 3. An example of a commercial model for change management deployment based on a planned approach to change, focusing on both structure and people (Bain, 2011).

Important stakeholders that are identified when analysing the model are: Shareholders, customers, “people” within the organisation and leadership/management. There are some values that can be identified as elements but which are not explicitly mentioned.

The model structure indicates that continual improvement is a value. Some methodologies surface such as: Inspire people, mobilise change teams, measure and monitor performance, align change culture, use management by visions and objectives with clear accountabilities. Methodologies that are less evident but could be suspected to be part of the proposed change are using brainstorming, carrying out workshops and training. There is no explicit mention of tools but measuring, monitoring and making tough decisions require good measurements in the form of a list of Key Performance Indicators that relate to all relevant stakeholders. It is not clear if the identified value is for shareholders only or all stakeholders. The model indicates that the sequence of change is Plan-Lead-Operate-Track. The circularity of the model indicates that the change could start at any point. This resembles the Plan-Do-Study-Act improvement wheel with the difference that Lead is similar to Plan, Operate with Do and so on.

Values, methodologies and tools could all be categorised as resources and are embedded in the resource categories of Management (espoused and enacted values), Manpower (values and competence), Method (methodologies and tools identified by the organisation).

The change elements identified so far are: Input, output, outcome, stakeholders, processes and resources (both internal and external). Input for a change process could be defined as a driver for change which causes an imbalance in the force field and starts a process of unfreezing. The output of change could consist of measured and assessed change in the system subjected to change. This output is then interpreted by the collective of stakeholders and could be summarised as the sum of perceived value change. Stakeholders could be seen as all those that perceive a value change because of the change carried out. Processes are activities at different levels in the system. Resources are both tangible and intangible resources that enable the processes to work. External resources could include country and branch factors.

A Proposed Change Management Taxonomy

In Figure 4 our first proposed interpretation of a generic process model for change with some preliminary elements.

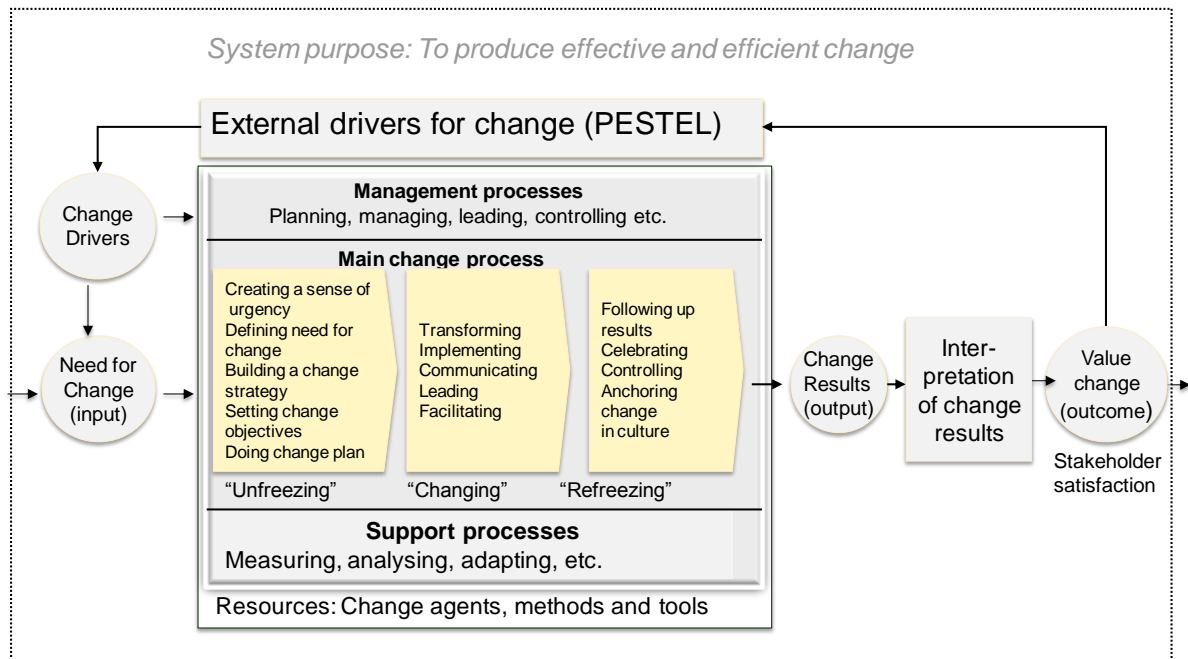


Figure 4. Proposed elements in a generic change process. Adapted from Isaksson et al. (2008).

The main elements are complemented with sub-elements in the three steps of the change process. These should be seen as examples and are the result of a first iteration. Some are probably redundant and others could be missing. However, the indication is that the structure could be of use. The PESTEL refers to an abbreviation of different change driver categories and are Political, Economic, Social, Technological, Environmental and Legal (Senior and Swailes, 2010).

Conclusion

We find that organizational change can be visualised as a process and that the proposed structure in Figure 4 can be used for further research. The change process describes change from stakeholder needs to a level of stakeholder satisfaction. Since stakeholders are those that decide a change process, one can never guarantee that all stakeholders are satisfied. It remains an objective. Based on Figure 4 it can be stated that TQM forms part of generic change management. Customers form part of the group of stakeholders and working with fulfilling their needs based on defined values, methodologies and tools can be seen as change management.

Discussion

Within the group of stakeholders it seems fair to say that TQM would be more focused on the stakeholder customer where as general change management might be more geared towards the stakeholder shareholder.

In most change processes there seems to be an initial phase of orientation before the actual change takes place. Kurt Lewin (1951) labelled it the stage of unfreezing and it consists of different actions to set the need for change and create a sense of urgency within the organization. This phase is followed by a phase of preparation where

planning and sense-making take place. The phase of activity then executes the actual change events and enables the transformation. Finally, there is a fourth phase of securing and sustaining the desired outcome of the change events.

We have so far retained the three phases of Lewin, but will have a closer look at the input interface in future work. All these phases can be visualised in a process model which can facilitate the organizational understanding of the context, purpose and meaning of the change process as a whole. The world is complex and dynamic and constructed, interpreted and experienced by people in their interactions with each other and with wider social systems. Thus, reality is subjective and can only be imperfectly grasped. A process model can only partially explain the complex reality of organizational change but it might help us along.

Implement MP uses three perspectives of change – human, strategic and structural. This is a quite typical categorization for change management consultants. If we used the three steps identified by Lewin (1951) as a starting point it could be discussed if we need to look separately at each step in the three perspectives. Is there a value in looking at unfreezing in a human, strategic and structural perspective? This remains an issue for further research.

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Sustainable Development in Universities – The power and role of visions and goals

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Introduction

Sustainable Development (SD) is a concern for everybody and major changes concerning technology, behaviour and politics are required. Highly educated labour is expected to contribute solving many of the pending SD problems. Global heating (instead of the cosier sounding warming) is an example of an urgent problem. There is a common understanding that drastic reductions of carbon emissions need to start within the next 10-15 years to achieve a global reduction of some 80% until 2050 compared to 1990 figures. This reduction should take place while simultaneously increasing the GNP. Johnson & Isaksson (2010) estimate that value produced per ton of carbon oxide emitted has to go from about 2000 Euro/t to 50 000 Euro/t in order comply with a 80% reduction in emissions while having a 4% annual growth required to solve poverty problems. This requires major changes in multiple areas. Technological innovations need to be complemented with economic and political changes.

This indicates that major changes are also needed in university education. Global Heating might be one of the most serious problems, but there are a number of other similar issues: world poverty; starvation; depletion of the world's fisheries; water scarcity; and loss of biodiversity. Rockström & al (2009) identify nine planetary boundaries that need to be respected to assure that humanity can operate safely. Climate change is mentioned as the first of these. To sum up there are multiple signals that *Business as Usual* is not being an option. The World Business Council of Sustainable Development (WBCSD) depicts in "Vision 2050 – The New Agenda for Business" a few scenarios why *Business as Usual* is bad for everybody including business, (WBCSD, 2010). Drastic changes require innovative rethinking which logically should also apply to universities. It could even be expected that universities would be in the lead in terms of supporting innovative thinking. Higher education, and thus universities, has an essential role in advancing the understanding of SD requirements, and providing society and industries with competent SD employees (Fien, 2002). Agenda 21 and the Johannesburg summit in 2002 identified a global need for more equal dissemination of the knowledge about sustainability. Shifting environmental education practice towards TBL education about and for SD is a major national and global challenge (Tilbury, 2004).

A Swedish government decree states that SD is an overall objective of all Swedish Government policies (Comm. 2005/06:126), declaring a Triple Bottom Line (TBL) (Elkington, 1998) vision of SD. The vision stems from a global long-term vision of SD and is related to international decrees and initiatives (c.f. United Nations and European Union). The environmental, social and economic dimensions of SD are expected to be

pursued in a coherent manner by all Swedish public authorities and actively influence and shape all policy areas (Comm. 2005/06:126, page 9), including the universities. This, of course, also is reflected in the university decree (chapter 1 § 5 Högskolelagen 1992:1434), stating that Swedish universities, through their activities shall promote a SD that ensures that both the present and coming generations are guaranteed a sound environment, economic as well as social well-being and justice. Thus, the apparent interpretation is that Universities in Sweden should play a central role by providing competence and research which is relevant for SD.

Changing universities from current non sustainable practices to the sustainable university is a huge change management task. To create the appropriate strategy both the current situation and the vision and goals should be known. For the vision to work it needs to comply with common requirements for a vision and it must also be translated to goals which can be understood and worked with. This papers aims at defining how the visions and goals for Sustainable Development have been defined by universities and to what extent they act as drivers for change. The research questions in this paper are:

- How could university work with sustainable development be characterized in education and research?
- How are visions and goals for Sustainable Development described by universities?
- How could visions and goals be improved in order to better support change towards Sustainable Development?

Methodology

Sweden is taking pride of being one of the few countries where carbon emissions have been reduced while GNP has continued to increase – this could be a sign that decoupling economic development from carbon dioxide emissions is possible. With SD being a prioritized issue in Sweden it could be expected that Swedish universities would set good examples within different areas related to SD and that they would work with the TBL.

We use common definitions for Sustainable Development and compare them with university missions and directives from the Swedish state to answer the question how university work for Sustainable Development could be characterised.

We identify typical definitions for what is required for a vision and for goals. These definitions are compared with the university interpretations as described in official documents and as defined by persons closely related to the sustainability work in universities. The components of the proposed vision and goals structure are organised using the structure in the draft assessment instrument for Sustainable Development in Higher Education, (AISHE 2.0, 2009). This provides a clear and logical division in campus and the activities related to the university mission of education, research and support and co-operation with society. With additionally apply the structure of SMART goals to review the goal quality, for SMART see for example Bergman & Klefsjö (2010).

We have interviewed six persons active with Sustainable Development in Sweden for their ideas on how a sustainable university should look like. These persons have been chosen from those active within Sustainable Development and university work. Most persons have been identified through HU2-network (www.hu2.se) working for Sustainable Development in universities. We have also posted a web-questionnaire using the HU2-network. Six replies on the question of how the university vision for Sustainable Development should look like have been received. The structure of the interview as well as of the web survey was as follows:

1. How does your vision of a sustainable university look like?
2. And, more specifically how do you see this in relation to education, research and co-operation with society?
3. How could this vision be exemplified when viewing your university and the region it is situated in?

Manual notes were taken during the interviews and notes were then sent to the interviewee for a check. Five out of the six interviewees responded with some minor modifications. The time for the interviews was 1 to 1.5 hours. This is a first iteration and we believe that in spite of the low number of answers we have enough information for a first indication of a vision seen from a practitioner's point of view. Qualitative analyses of the answers have been carried out and compared with what could be expected of a vision for Sustainable Development.

We have also studied visions and goals from benchmark universities. The identification of benchmark universities in Sweden has been carried out in connection with the interviews and work within the HU2 network. For Sweden Gothenburg University is chosen as the benchmark. They have a long tradition of work with environmental and sustainability issues. The university is one out of three having an ISO 14001 certificate and the only one doing a report based on the Global Reporting Initiative guidelines. The international benchmarks are chosen based on those that Gothenburg University has chosen. They have the intention to compare themselves with the best in the world. Additionally Mälardalen University and Blekinge Institute of Technology have been reviewed as good examples that have been mentioned in discussions with people active within the HU2-network. The answers are categorised using the previously defined structure for visions and long range goals. This provides the proposed answer for how universities describe visions and long range goals for Sustainable Development.

The review of benchmarks and data collected in comparison with how visions and goals should be expressed reveals a number of gaps which are analysed. These analyses form a basis for proposed improvements.

Sustainable Development in Universities

The Brundtland commission definition from 1987 states that: *Sustainable development is development that meets the needs of the present without compromising the ability of future generations to meet their own needs* (WCED, 1987:43). This definition is the one also used by the universities studied and is the foundation for the university law. Swedish universities have the missions of carrying out education based upon scientific knowledge and carrying out research. The earlier so called third task requiring co-operation with society is now integrated in both education and research. Chapter 1 § 5

in the Swedish University Law (Högskolelagen 1992:1434), states that Swedish universities, through their activities shall promote SD that ensures that both the present and coming generations are guaranteed a sound environment, economic as well as social well-being and justice. The interpretation is that universities should have education and research of what Sustainable Development is but also carry out education and research for Sustainable Development. This differs from the teaching of many topics where no action and not taking any position are required. The interpretation here is that universities should be change agents for SD.

A sustainable university should relate to the main sustainability aspects both globally and regionally. We would expect that vision indicates how work for reducing carbon emissions and reducing world poverty is carried out and also how regional sustainable development is supported. Goals based on the vision should be such that major change is achieved within the next 10-20 years. Many problems, such as the curbing of carbon emissions, need to be solved within the next 10-15 years to avoid the risk of uncontrolled heating. The “safe” temperature increase is set at 1.5-2C above the historical average. This means that the sustainable university should have challenging visions and bold objectives for drastic change to provide the competence for all the challenges humanity is confronting. After all, it is the generation receiving their education now that will have the responsibility for major change towards sustainability.

The AISHE2-instrument suggests dividing the assessment of sustainability in five parts which are operations, education, research, society and identity. See Figure 1.

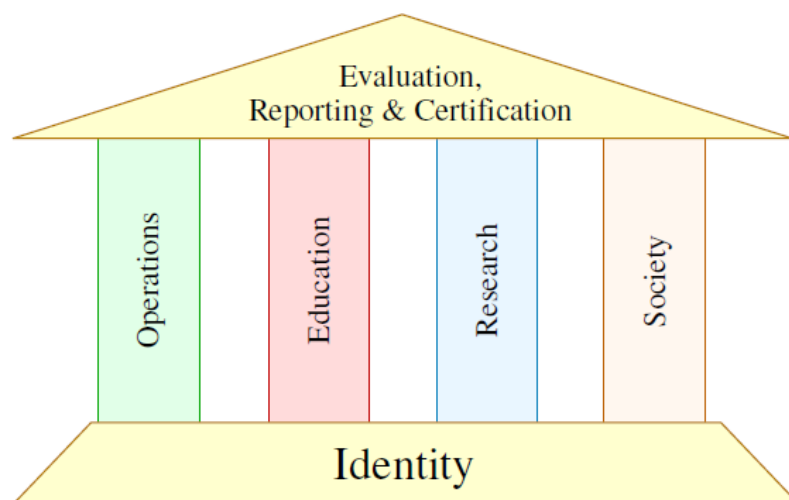


Figure 1. The evaluation structure from the draft AISHE 2 assessment instrument (AISHE 2, 2009).

The Identity module contains the elements vision & policy, leadership, communication, expertise, coherence and transparency & accountability. These could be seen as core values (expressed by vision & policy) and other enablers. The elements of Identity support the different activities within operations, education, research and society (co-operation with). With a clear and well communicated vision and with SMART goals a university gets the required support for the different operative areas.

Combining this with what was previously said about visions and goals the interpretation is that the university working with Sustainable Development would have visions and

goals for operations, education, research and co-operation with society (relating both to education and research).

The vision & policy criterion from AISHE 2 states: *“The organization has a vision on sustainable development and on corporate social responsibility in general, on aspects within the own fields of expertise and on the consequences of this for the organization policy. The vision is expressed in the policy. This policy translates the vision in concrete plans for action. Goals are formulated, and activities are designed aiming to realize these goals.”*

Additionally the vision should be as described by Bergman & Klefsjö (2010) below.

Vision, mission long range goals and strategy

A vision should according to Bergman & Klefsjö (2010) be:

- Able to inspire and create a visionary picture of future
- Desirable
- Clear (*which means that it should be easy to break down into objectives - authors' comment*)
- Flexible
- Easy to communicate
- Stable

A vision requires a mission. The Swedish university mission is defined as carrying out basic education based on an academic foundation, carrying out research and co-operating with society within both education and research. A vision should specifically be backed up by objectives, goals and strategies for education, research and co-operation with society. There should also be action plans and there should be practical results that motivate people to continue change work. A good vision without any clear goals is not a good vision, but most likely an effort of marketing only; indicating a gap between espoused and enacted views (Argyris, 1990). Here, we will focus on how the vision is clarified with goals, defined as SMART-goals (Specific-Measurable-Accepted-Reasonable-Time set) (Bergman & Klefsjö, 2010). Good change management requires that the current state is well assessed and that the vision is clear enough for defining goals. In the ideal situation the vision can be broken down into SMART goals down to the level where they make sense to everybody.

Using the AISHE2-classification in Figure 1 the vision should relate to the building and premises and the three parts of the mission. Additionally there should be a set of guiding values and principles that underpin the SMART-goals. Schematically this could look like in Table I.

Table I. Proposed schematic structure of SMART-goals for Sustainable Development with focus on global heating and the university. The Content of the table should be seen as an example only.

Area of vision	Specific	Measurable	Accepted	Realisable	Time-set
University building and	Carbon neutral	yes	?	yes, provided	Within ten years

premises				funding	
	Recycling all waste	yes	yes	yes	Within two years
Education	SD included in all education	Could be minor or major part	?	yes	Within five years
Research	SD included in all education	Could be minor or major part	?	?	?
Co-operation with society	Co-operation to include SD and carbon emissions when relevant	?	?	?	?

How visions and goals are defined in benchmark universities

Gothenburg University has been studied as the main Swedish benchmark. The 2010 sustainability report has been used as main source (Hållbarhetsredovisning, 2010). There is no explicit policy for sustainable development but instead one for environment.

Gothenburg University will be one of the leading universities in Europe in education and research within sustainable development and environmental sciences

There is no explicit vision of the sustainable university. The University vision 2020 is under work and some preliminary documents are presented. There is no clear indication of the role of Sustainable Development in this. The university is ISO 14001 certified and is part of Global Compact and reports according to the Global Reporting Initiative guidelines (world leading system on sustainability reporting). Courses are also marked with a sign if they include SD. Goals are given for education, research and co-operation with society and there are also goals for climate effects, use of resources, chemicals and competence development:

- Education - Gothenburg University (GU) shall integrate SD in education
- Research – GU shall increase research within SD
- Co-operation-GU shall offer the surrounding society with at least one public activity per day
- Climate effect – GU shall reduce its emissions of gases affecting the climate and reduce energy consumption in university buildings
- Resource use – The purchasing of GU shall be an example for other universities for the dimensions of economy, environment and social responsibility; All waste from university shall be sorted based on the existing plan
- Chemicals – GU shall reduce the use of dangerous chemicals and products
- Competence development – All personnel must know how they can contribute to SD in their area of responsibility

The explicit goals constitute a clear commitment. On the other hand they are not fully SMART since they are not Specific (integrate, increase, reduce) and not Time set.

Blekinge Institute of Technology (BTH) has a vision that states:

BTH is a globally attractive community of knowledge within applied IT and innovation for sustainable growth.

There is no sustainability policy but instead an environmental policy. Sustainable development is described in another document with reference to Brundtland and the Triple Bottom Line. However, it was not possible from the overview to see how sustainable growth is defined. There was no obvious links to goals.

Mälardalen University has a policy for SD referring to Agenda 21 and the Triple Bottom Line (excerpts translated from Swedish).

...this is interpreted as a responsibility in giving employees, students and other partners increased knowledge in order to enable them to analyse and prioritize actions that take into consideration several of the sustainability dimensions. Actions are carried through education, research, running the campus and in contacts with society. The university shall work for local, regional and global networks that promote education and research for SD. Co-operation shall take place with business and other sectors.

Specific goals are not visibly mentioned. The University is certified for ISO 14001.

Harvard and Stanford have by Gothenburg University been mentioned as international benchmarks.

A brief search on the Harvard web-site gave no hits for policy in SD. The search for an environmental policy only leads to a description of the organisation for environment and health. There is a mention of campus sustainability:

University Operations Services (UOS) is a leader in sustainability. The nature of our programs and services allows us a unique opportunity to improve the environment, and it's something we are deeply committed to doing.

Student involvement in the UOS is mentioned. It is unclear based on the web-site to what extent SD is part of education and research.

Stanford has like Harvard a commitment to a sustainable campus:

Sustainable Stanford is a university-wide effort to reduce our environmental impact, preserve resources and show sustainability in action. We're determined to lead in researching, teaching and practicing environmental sustainability. Our vision: create a healthier environment now and richer possibilities for generations to come.

A brief search for environmental and SD policies gave no hits. A more extensive search might change this. However, with a similar effort the documents were found in the Swedish universities.

From the brief review of proposed benchmark universities it seems that Gothenburg University is the one providing the best guidance for visions and goals. However, compared to the previous theoretical review with requirements on a good vision in the

different areas of operations with links to SMART goals, even the benchmark is still far from ideal.

How visions and goals are defined by key persons

Generally it has not been easy for the respondents to comprehend what a vision is. Answers from interviews very often relate to strategies, goals, what is done and what is planned. The interviewees often start by defining university sustainable development in what is related to campus activities and then to the education and research instead of expressing a vision statement or contents of one.

Out of the six interviews two statements qualifying as vision statements for the sustainable university emerge:

Own knowledge as part of a larger field for problem solving towards Sustainable Development

A university that educates students for a sustainable lifestyle in a sustainable world – it equips them for creating it and for living in it

Ulf Andersson from Gothenburg University mentions the official policy on sustainable development embedded in the environmental policy. In practical terms there also exists an internal vision and goals for promoting Sustainable Development in all education and research.

The pro vice-chancellor from Malmo University presents the vision as having four parts (translated from Swedish):

Cross-functional (border crossing) action competence and citizen education mean that a student leaves Malmö University with several perspectives to be able to act in the society in a sustainable way. Partnership and shared knowledge mean that the different courses and programs co-operate with the surrounding society. The focus on internalisation means that everybody shall have a multi-cultural competence and be global citizens.

A response from the web survey proposes the vision:

An organisation that makes a difference for Sustainable Development through its research, education and innovation and which also acts as a good example with its own environmental work.

A policy is to show the intentions of the organisation and it should be expressed in the vision as mentioned in the AISHE2-document.

The interviewees had much more to say when it came to the specific issues of education, research and co-operation with society. For the educational vision and objectives the following issues were raised:

- Should SD be part of all education or be given as a separate topic?
- Is SD more relevant in some topics than in others?

- Should education be of SD or for SD (in other words should education promote activism)?
- How can universities support (or control) that SD forms part of different topics?

Nobody advocated SD to be dealt with as a separate topic and the general understanding was that SD can be included in all topics. The question of relevance was harder to answer. Several interviewees mentioned that relevance could be seen as higher in for example humanities and social sciences, but nobody had a proposal of how to define relevance. With reference to the earlier question it was mentioned by a few that it should be up to the lecturer to decide the relevance.

“Everybody should find the relevance by working together with others and doing their part of the whole”.

Education on SD should be both of SD and for SD. Several interviewees stressed the importance of activism. One of the interviewees claims that education should be for SD and should include that the lecturer is clear with his or her values.

“Education should include problem solving and be based on an interdisciplinary approach and a holistic view. The education should prepare the student for life.”

“We learn in what we do what is sustainable. The more applications we have the better the understanding.”

Proposals from the web questionnaires for the educational vision (several respondents emphasise actions):

Students taking their examination should have developed a competency for action that is grounded in basic broad knowledge of all the dimensions of SD. The students should also have the competency required to act for SD in their future working role.

All education shall include a stream of SD both as separate and integrated contributions. It is important that students at an early stage understand how they can contribute to SD in their future profession.

How to support and in some cases control that SD is included is not easy. There should be both carrots and sticks while retaining the university lecturer freedom. Several interviewees pointed out the importance of recruiting lecturers interested in SD. One interviewee made the point that credibility comes only from within the profession. For convincing an economist an economist is needed and for convincing a medical doctor another medical doctor is needed and so on. A problem with both education and research is that when SD is made to a requirement there will be lip service. One interviewee pointed out that the Swedish National Agency for Higher Education (HSV) does not do any follow up of how the decree on including SD in all education is carried out. When HSV has been directly confronted with this their answer has been that measuring this is too difficult.

For research that works with SD the following things were reviewed:

- Type of research

- How to guide research towards SD

Research could be within a discipline, multi-, inter- or trans-disciplinary (with trans-disciplinary research being the most suitable for SD).

Research should be able to solve real problem in society locally, nationally and globally. Focus should be on issues of strong sustainability and should be cutting edge (weak sustainability is handled by business).

Several interviewees advocate research for action and some specifically mention action research. Working with real life problems often requires a system view which indicates a multi- or trans-disciplinary approach. Here, there are some problems with the fact that research often is valued within a single discipline context. That is the merit system does not always acknowledge the applied and trans-disciplinary research. One proposal was to try to influence the state and those institutions providing research funds to be more focused on research on SD.

University management should try to employ professors that are doing research within SD and see that the combined skills of those employed provide interesting options. With professors working with SD their students are bound to choose related topics.

Web-questionnaire: To have leading edge research contributing to practical solutions and basic research contributing to system change.

Control of researchers is difficult since the basic right to independent research. One way of changing this that was proposed is to be explicit on the need for Sustainable Development and to focus on younger researchers who hopefully are not too stuck in old ways of thinking.

In the vision for co-operation with society the importance of practical work was mentioned several times.

Students should be able to function out in the reality having a balance of knowledge and skills.

The relevance of education and research of a university should be validated by society

This could be interpreted as a requirement of more customer focus from universities analyzing in more detail if the right type of education is offered in addition to measuring if what is provided is done in the right way (for example input from student's course assessments). Another interpretation is that with focus on sustainability it would be the societal sustainability which would guide the university in education and research.

Finally to the question how the visionary sustainable university would work in its region. Several persons propose a more active role for the university in the local debate and participation in the regional vision work. It is also important to apply special knowledge relevant for the region as for example Wind Power competence from Gotland University on the island of Gotland that has a high number of wind turbines. One proposal is to work more with schools to support their efforts with SD.

Web-questionnaire: *To co-operate with business and the public sector to solve regional problems (can be used both within research and education).*

Gaps in university visions and goals when working for SD

A review of the benchmark universities and comparing their visions and goals with what could be expected from a good vision indicates that there is quite a lot to do. Most visions do not identify the areas of focus but speak generally about SD and the Triple Bottom Line. Since there seems to be a common understanding that universities should provide help to making development more sustainable the logic would be to start from the main problems, like the nine planetary system boundaries and world poverty. Gothenburg University mentions carbon emission, but generally visions deal with the reasonably ambiguous Triple Bottom Line. It seems that a basic risk analysis is missing. Global risks should be related to regional and local aspects and then to university work. The indication is that universities seem not fully to have grasped the task of change agents for sustainable development.

The description of visions coming from people active within the field presents a variety of relevant comments. In the same time the impression is that the structure of the ongoing work is far from optimal. It might not even be relevant looking at the quality of the visions from the perspective of how they should be written when it is not even clear what they should contain.

Before it is relevant to look at the criteria of a good vision as described by Bergman & Klefsjö (2010) we need to know that we are speaking about the right things. See comments below in italic.

- Able to inspire and create a visionary picture of future – *which relates to the main global threats*
- Desirable – *The required changes might not always be desirable at first sight and the first criteria might be instead “Necessary”*
- Clear – *Clear enough for education, research, co-operation with society and campus to enable the definition of SMART-goals*
- Flexible
- Easy to communicate
- Stable – *Global challenges are there to stay, which means the vision should be flexible to be relevant over some time*

Universities could to a certain extent be viewed as change agents for sustainable development. As such they play an important part in the change process from current “Business as Usual”, which according to most research is clearly risking the safety at a global level, to a level of sustainability. For the change agent the task is to see what needs to be changed and which part of this change concerns the change agent. This analysis should affect the mission, the vision, the strategies, objectives and goals of universities.

The interviews and web-questionnaires give better examples of practical ways forward than the official documents found. However, many contributions presented as visions are more often actions. This is understandable. It is difficult to make sense of the entire

area of SD. Somebody who wants to act does what seems meaningful and this then becomes SD for the person. The risk with this is not doing the right things.

The preliminary indication is that there could be more grass root activity than there is real managerial commitment. One of the reasons for university management not focusing fully on SD could be that in spite of the existing law requiring this there is little or no follow-up from the state.

Conclusions and Discussion

From a business management point of view the situation for vision and goals on SD seems to be poor. Even if one problem for universities could be the fact that the concepts of mission, vision, policy and strategy are not always fully understood by employees the main problem could be lack of management commitment for change towards sustainability. That is, even if the vision and goal documents would be well prepared technically the effects could still be limited due to lack of management commitment. The perceived drivers for change in the university world seem weak in spite of the apparent urgency when looking at how we already now are crossing safe operating limits for humanity. Roxström & al. (2009) note that three limits have been transgressed. These are climate change, loss of biodiversity and the global nitrogen cycle. The reasons for not taking note even if severe problems could be around the corner could be the human difficulty to focus on things which are far in time and space. Referring back to Figure 1 the problem could be that the Identity module hosting values is generally too weak, which is indicated by the not so clear structure for visions and goals.

Focus on Sustainable Regional Development is an area of interest to look further into. It is in the region that co-operation with society in terms of education and research can be carried out quite readily, providing options for actions within SD. This requires the same type of change agent approach as mentioned above, studying main regional aspects and relating them to university competencies and capabilities. Basically this is introducing more of customer focus to universities with focus on the customer society. Universities at occasions tend to mainly view students as customers where as another important customer is the employer. Results of the education can only be judged when students enter working life.

The results are only indicative, but support earlier findings indicating that there are no major changes in how universities are working with Sustainable Development, not at least to the level required when viewing the global challenges. It can be discussed if these results can be generalised outside of Sweden. If the assumption of weak governmental drivers is correct then the situation is probably worse in most other countries. Universities are conservative organisations where changing content in the topics taught takes time and which often requires strong drivers. Our assessment is that the indications from our work in Sweden most likely can be generalised. That is, universities generally are not living up to their change agent requirements.

Future research with the purpose of finding out to what extent universities are living up to their expected roles as change agents should be of interest. One way of doing this research is to base it on case studies looking in depth at what is done and what could be done for example in the regional context.

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Value stream mapping as a tool to improve the service delivery processes – a case study

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Introduction

The definition of value is of special importance, since it creates the fundamentals on which lean management strategies are built. It has been widely discussed that the two most fundamental objectives in lean management thinking are – to create value and remove waste (Womack and Jones, 1996; Drew et al., 2004). Contrary to traditional mass production model, the value is delineated from the customer's perspective. To meet this objective, it is aimed to reduce all sources of waste in the company in order to unify actual operational performance with the needs of customers.

Simply stated, value is perceived as the worth of something – product or service, according to the given indicators. The worth can be conveyed in terms of money, quality or satisfaction. However, what is more significant to managers, is rather what the indicators are and who determines value (Nash and Poling, 2008; Rich et al., 2006). As Womack and Jones recommend, the purpose of every lean organization should be generating and delivering value to the end users, not the company itself. Contrary to the traditional manufacture view, in lean management, value is always perceived from the vantage point of the customer. It might be defined as a capability defined by the customers and provided to them at the right time and cost (Womack and Jones, 1996).

Moreover, value is never isolated from other production or management factors. It constantly depends on such aspects as time, resources, market, etc. The role of value creation and implementation in the organization is also substantial, as it constitutes the approach of creating value through the constant continuous improvement without any waste.

In every business, large or small, the variety of activities and steps needs to be taken to meet final client's value may vary significantly. What is more, such value must be easily noticed and eagerly exchanged for the product or service presented. The company is obliged not only to convey the good or service according to the customer's expectation, but also obtain a rational exchange of value for it. Reducing waste and generating a practical, value-adding customer experience will increase every company's competitive edge. As Sayer and Williams emphasized: "The consumer is the ultimate customer. What the consumer values is ultimately what counts. Although you may have intermediary customers who have their own set of values, it is important to not lose sight of the consumer's wants and needs.", (Sayer and Williams, 2007).

Since the concept of lean organization goes beyond the process of manufacture, emphasis of value creation should be put on all parties in the company like employees, partners and suppliers as well as non-manufacturing procedures, regarding e.g. information flow or service provision.

The importance of value

As Liker suggested, the answer for the question “What does the customer want from this process?”, indicates value (Liker, 2004). The customer is the only one who determines value of the outcome of a process. The definition of value takes us to the two of the essential concepts of lean management, *value-added* and *non-value-added* (Carreira, 2005). The first term in question refers to every activity in organization that transforms the product or deliverable, in the view of the customer, to a more complete state. The product has been physically changed, and its value to the customer has increased. It is exactly what the buyer is willing to pay for – every product, service that is valuable for him or her (Rich et al., 2006). Conversely, non-value-added states an activity that consumes time (people expense), material, and/or space (facilities expense), yet does not physically advance the product or increase its value.

Practically, according to lean management principles, if an activity does not fulfill just one of the following criteria:

- the customer must be willing to pay for the activity,
- the activity must transform the product or service in some way,
- the activity must be done correctly the first time,

then it might be perceived as non-value-added (Sayer and Williams, 2007).

However it has to be emphasized that non-value-added activities might be divided into two kinds (Monden, 1993):

- Necessary non-value-added activity – applies to an activity that from the final customer’s point of view does not enhance the product but seems to be essential under the given business circumstances. Such activity is a waste and needs to be eliminated; however, it cannot be done immediately. It should be planned carefully and performed as a long term transformational change.
- Unnecessary non-value-added activity – describes an activity that adds no value to the final customer and seems not necessary under the current conditions. These activities are considered to be pure waste and ought to be removed as soon as possible. An example of such activities is: waiting time or defective products.

Value stream and value stream mapping

The presented concept and explanation of value take us to another fundamental principle of lean management – the value stream. This is a significant difference from the attention of an every traditional – “non-lean” business. The value stream is the total cycle of activity, from initial customer contact through receiving payment for a product that has been delivered (Chan and Yim, 2010). However, the development of a product or service under lean management philosophy means more than just a direct flow of information or materials. It includes also the flow of value. A value-stream approach to exploring and improving an organization provides a totally alternative interpretation of where the opportunities for a business origin and what the priorities for fulfilling these opportunities should be. Therefore, the value stream needs to be visualized. It enables the depiction and analysis of all business activities and process in a company. Moreover, a value stream map can control the activities of an organization and increase process visibility and is also a way to find process improvements (Locher, 2008).

Value stream mapping (VSM) is a simple “pencil and paper” technique that helps to identify and understand the flow of material together with the flow of information that signal and control the business process. VSM is mainly an organizational improvement tool which enables visualization and analysis of business processes, however it can also be used as a communication tool, a business planning tool and a tool to manage the process of organizational change (Rother and Shook, 1999).

As it has been already stated, two most fundamental principles in lean management thinking are: to create value and reduce waste. In order to accomplish them, Womack and Jones (Womack and Jones, 1996), suggested five basic steps, mentioned below.

Specify Value

It is crucial to know what the value of the product or service is, and whether it is shared by the company’s customers. Managers in this stage should realize and also ask themselves: What do customers want? What combination of characteristics, abilities and price would be preferred by them?

Prepare Value Stream Analysis

It is the collection of methods and activities required to convey a product’s value to the customer, from beginning of the production or service provision process to the end. It is the stage in which the manager needs to make a draft of the process of implementing and distributing the value to the client. It can help to comprehend the material and information flow in the organization. At this stage the analysis of the three basic types of VSM activities is made (adding value; not adding value but cannot be avoided at this time; not adding value and should therefore be immediately eliminated).

Continuous Flow

Organizations should be able to make value flow continuously and effectively in time. In the ideal state, flow simply indicates a unified sequence of activities throughout the whole process, without disruptions and if there are any, immediate reduction of them.

Customer Pull

This principle belongs to the just-in-time concept. According to it, companies are not allowed to “push” their products to customers (Feld, 2001); they would rather let the clients to “pull” – create the demand for products and services. The practical implication of this approach results in a situation, where the final customer pulls the product (or service, transaction, etc.) at the end of the value stream and subsequently each step of the process pulls the product when needed from the preceding one. What is actually crucial, only the amount required is processed and no action is taken until a clear signal is provided. The method of pulling means that the particular processes are done when they are required to be done, not before. It indicates a consumption-driven or in other words, a customer demand-driven system.

Continuous Improvement

It indicates that products and process can be improved without any limitations. To do this it is necessary to go beyond products or services and develop processes that are fundamental to them. It is the conviction that improvement efforts are never finished, and it is the consistency to keep the discipline for improvement in place through different supporting techniques, such as e.g. Kaizen (Womack and Jones, 1996).

It is essential that the value stream is always analyzed from the end customer's standpoint. In practice, the beginning of the analysis of the value stream is in the point where it ends – with the final buyer's view, and then following it, all the way up to the source of resources and production or service provision stage. With this data, the analyst is able to grasp the entire process as a static image (the current state value stream map). From the current state, the future state map can be created. It will allow emphasizing and specifying the possible areas of improvement for the system. After the identification and evaluation of the benefits of the future state map, then generally, the new improvements might be applied in the process. In pursuit of mapping the value stream, the organization must have a scheme with priorities regarding time and waste limitation efforts. In the chase of competitive advantage, the company sets the criterion of customer-focused quality to prioritize waste reduction process. Efforts to limit cost need to be balanced with retaining or increasing product's quality to sustain product's value.

The Visualization of Value Stream in Fujitsu Company

The presented case study is based on author's own research at the Global Delivery Centre in Lodz and analysis of information on Fujitsu available at the Fujitsu's webpage.

General overview of the company

Fujitsu is one of the world's leading information technology products and services company. Its headquarter is located in Japan, however its departments are spread all over the world and one of the is also situated in Lodz (Fujitsu Global Delivery Centre Lodz). It provides a range of products from electronic components as well as services including IT consulting, systems integration, outsourcing, networking, and system support. The company operates in the Americas, Asia-Pacific, and Europe and it employs total amount of about 176,000 people.

Overview of Fujitsu Global Delivery Centre in Lodz

Fujitsu's Global Delivery Centre (GDC, named also Service Centre) in Lodz was opened in February 2009. Lodz was chosen for its excellent infrastructure, high-quality labour market and active university centers. The Service Center in Lodz mirrors Service Center in Lisbon. The Main objectives of Fujitsu's Service Centres are to help the customers learn about the value of information technologies (IT) through consulting and contract management system. This aim reflects in specialization on designing, developing and providing customers with information technologies service systems dealing with financial, telecommunications and retailing sectors as well as for governmental administration. Other minor services focus on delivering systems for IT

infrastructure management, data center networking, technical consultations, application integration, deployment and management to service desk supplies and operations, etc.

Lodz Service Centre is the latest Fujitsu’s GDC for Service Desks. There have been €4.2 million invested in the development of the centre, of which about 80% in human resources. The team capacity is about 480 employees and is predicted to be reached by the end of 2011. The size of the team changed from 150 employees in 2009 to 325 currently. The recruitment of employees is based on language and analytical skills as well as customer focus and ability to deliver world-class service.

The key services that are offered in Lodz’s GDC focus mainly on providing service desk, such as:

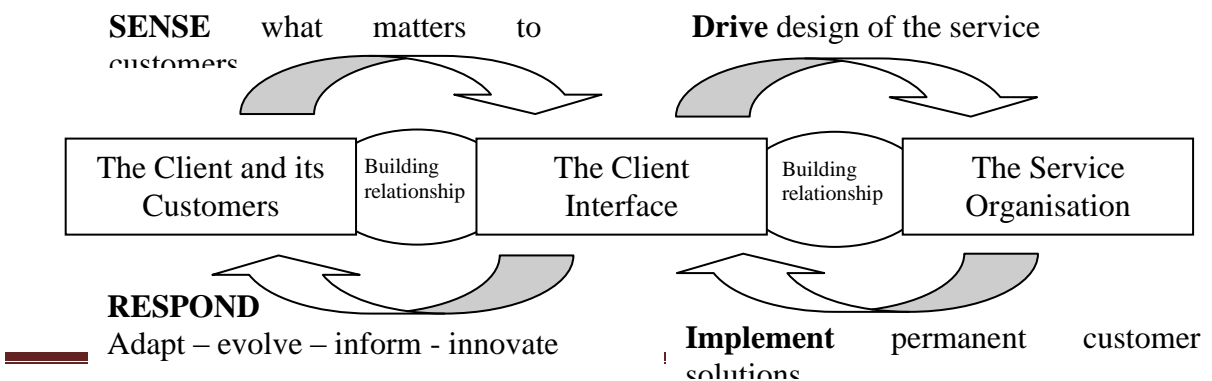
- Incident and problem management;
- End to end incident management;
- Continuous service improvements.

In the near future the department in Lodz will also support their customers with additional services, such as e.g: desktop outsourcing, application services and project management.

Fujitsu’s approach to Lean Management

Nowadays, as many international and globally operating organizations, Fujitsu also employs the philosophy of lean management. Fujitsu defines lean management as understanding what really matters to the customers and the customers’ customers so that to be able to continually find better ways to deliver it. lean enables the workers to focus on compelling user experience and creating business value.

The lean concept precisely defines the practices of the company in everyday activities, such as eliminating the operations involved in manufacturing products or providing services that do not add value to the final good or service. Putting the lean philosophy into practice, Fujitsu’s GDC in Lodz is comprised of simple and clear structures. The process stages and work resources are made meaningful so that they can be used to their highest potential. Fujitsu’s strong commitment to the continuous service improvement is reflected and simultaneously supported by an original company methodology called Sense and Respond, which is Fujitsu’s method for implementation of lean principles in the service environment. It creates a unique value proposal for the customers by implementing the new rules of business organization to the whole company. Therefore the policy in serving the customers becomes an operational design, rather than a plan or company’s strategy. The concept of the Sense and Respond philosophy is shown on the following picture.



Picture 1 Fujitsu's Sense and Respond approach

Source: Based on Barlow et al., 2005, p. 184 and own research

Sense and Respond creates intelligence at the customer interface which drives a continuous improvement culture in Fujitsu (Reynolds, 2009). This implies implementing a service organisation which processes, roles, responsibilities and measures are aligned to the purpose of lean philosophy and customers' expectations. The mentioned philosophy is based on several principles, among which the most important is "Understanding the customer value". First and foremost, it is significant to understand what matters to the customers by assessing the service that is delivered regarding the clients' language and expectations as well as visualizing the value stream in the company. **Additionally, in order to fulfill the process and organizational aims, Fujitsu's employees are empowered to drive continuous improvement and continually find ways to exceed customers' expectations by giving priority to their business objectives.**

Other principles that are present in the Sense and Respond philosophy are:

- *Involve everyone* – prepare a framework that allows everybody to involve through every day work improvements, providing long-term changes in the way people think, behave and work;
- *Manage Visually* –make the invisible visible and draw attention to what is important to the customers;
- *Measure what matters* – measure what contributes to value as seen by the customer; align the IT service with the customer's business and create intelligence at the client interface;
- *Remove waste* - remove wasted time and effort from the process in order to devote it to new improvements;
- *Standardise* - drive standardisation and re-use through sharing best practices, industrialising the service management processes (Triole) as well as enabling re-use and knowledge share.

As it was said before the organizational priorities concentrate on the ability to adapt and respond to customer's needs through focusing on operational design and analysis of the customer value. Fujitsu's philosophy represents a customer centric approach and puts the client at the core of operational processes.

According to Fujitsu's approach, the implementation of the lean strategy starts at the very beginning of the operational process – at the service desk, where there is as well the strongest company – customer relationship. The service desk is crucial to deliver sound services according to the company.

The organizational structure of Lodz's GDC is depicted as a functional, modular network instead of vertical hierarchy. It allows to use the synergic effect of employees capabilities and constant coordination among workers.

As it was marked before, Sense and Respond empowers individuals from service desk to harmonize their actions with customer's needs in order to achieve mutually identified goals. Moreover, a word 'sense' represents the employees' ability to recognize the customer's value and possibility to improvise so as to achieve the desired effect. The practical implications show, that e.g. first-time fixed incidents are of high importance in the service delivery company as it is Fujitsu GDC in Lodz. The employees are

authorized to identify the best system solutions on their own and demonstrate ability to respond to the current customer preferences and values as soon as possible. They also listen to what clients are demanding, identify repeating patterns and create standardized solutions. The whole approach is also supported by other organizational processes and resources like: enterprise management, visualization of value stream, organizational innovation system, voice and data networking, etc.

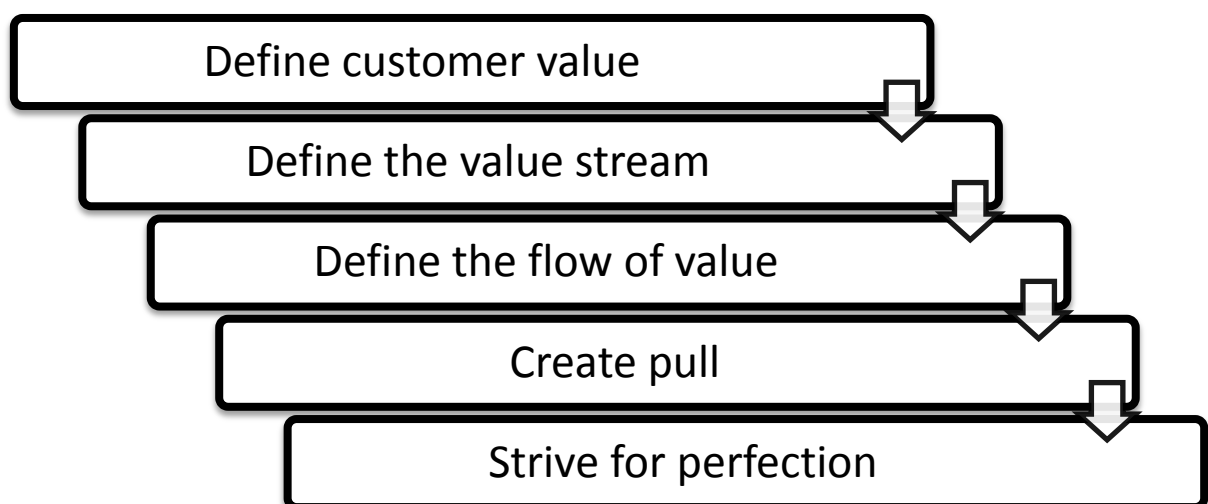
The use of Value Stream Mapping for process improvement

Sense and Respond involves permanent and continuous adjustments to the target set by the customers. Being aware of the customer needs helps to identify the expected requirements and understand what creates value for the customer. Consistently optimized use of resources enables continuity and efficiency of sustainable process stages – described in Fujitsu as the value stream. This is possible by introducing and using value stream mapping (VSM). It allows to recognize process bottlenecks (flaws that cause workflow disruptions) and determining the takt times (needed to produce a given good or deliver service in order to meet customer requirements).

According to Fujitsu managers VSM is a perfect tool for managing performance visually and is the starting point for understanding and creating a continuous improvement environment in the company. Teams that manage their performance visually by implementing value stream maps find it easier to communicate, identify important issues, meet targets and deliver real improvements in performance for their customers and for the whole business.

Drawing a current state value stream is a team activity in Fujitsu GDC in Lodz, with the objective of developing a common picture of how work is done at present. The task is performed with the members of the teams who are involved in the value stream (process realization) and ideally in or near the location where the work takes place.

The steps taken during the identification and analysis of the value stream are as follows:



Picture 2 The development of VSM - fundamental principles of VSM adapted for Fujitsu
Source: Fujitsu

The first step is to define what service is being delivered and how and where the value to the customer is created. Value stream mapping enables to achieve the second step and move forward to a future state which seeks establishing steps 3 to 5. Moreover, products (or services and process results as the “product” can be seen here extensively) that the customers value, need to be grouped into similar value streams such as e.g.:

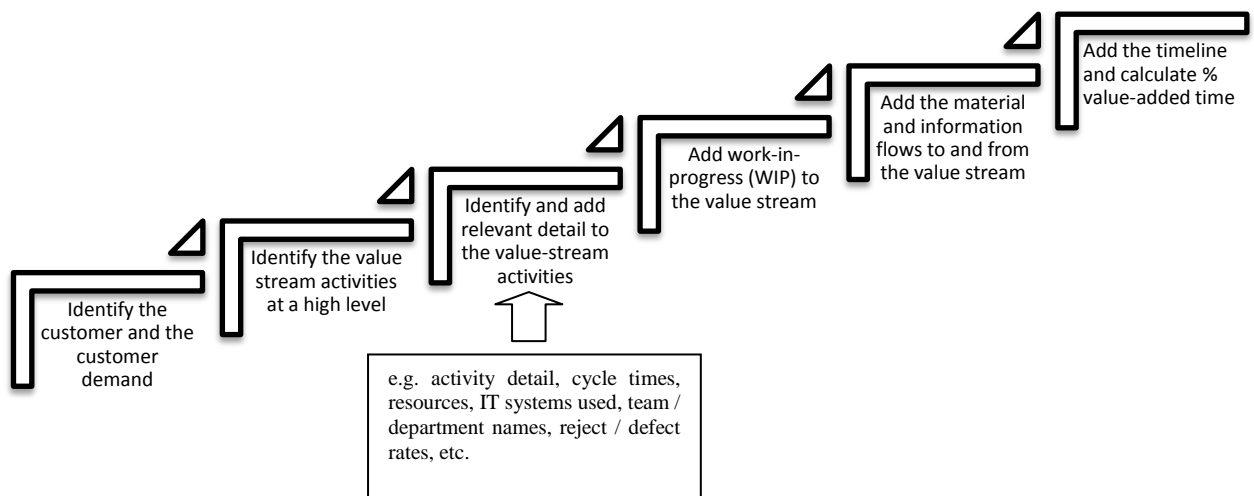
- flow through a similar sequence of operations;
- flow following a similar timescale.

Another criteria for value stream identification can be the type of the product (physical or virtual output) delivered by the process such as e.g.:

- calls that are resolved first-time compared with those that get referred elsewhere;
- simple and complicated customer requests.

In the Global Delivery Centre in Lodz it is crucial to gather all employees involved in identifying the value stream in the meeting room and together identify customer requirements as well as the final customers of the process (internal or external). The employees map the value flow by describing the major value adding steps. Then they continue at the workplace and observe the process, verify the steps described previously, estimate cycle and waiting times and iteratively improve the value stream map. Usually it takes 2 to 4 hours to prepare a high-level value stream map, whereas a detailed one may take even up to a day.

The steps usually taken to create a value stream map are:



Picture 3 Steps taken to create a value stream map
Source: Fujitsu

One of the main benefits of using the approach described in the above picture identified at Service Centre in Lodz is depicting process steps at highly detailed level. It is also used to show processes of various types and form different perspectives e.g. focusing on the actions undertaken by employees or analysing the information flows in the processes.

The value stream maps prepared at the service centre follow the item of ‘value’ for the customer and are fairly strategic in its level of detail. In fact it often happens that the maps do not have an end-to-end focus, with the customer always being the final step. The maps do not stop at departmental boundaries, but follow the ‘value’ wherever it

goes and is continuously adjusted depending on the changes in customer needs and expectations.

In the opinion of GDC managers the value stream map is a way of thinking about the end-to-end flow, from its origin through to delivery of activities that are required to bring value to the customer. Delays can often arise when work is passed between teams and/or locations. Fujitsu can reduce them by eliminating waste, improving quality, reducing processing time in the process and also reducing the overall time taken to respond to customer demands.

Conclusions

As Taylor and Brunt (Taylor and Brunt, 2001) noticed value stream mapping is a tool that allows to look at the current state of operation, and develop their future state and also to see where the waste lies, and how it can be limited. It also identifies which activities create value for the customer, and which ones add costs but no value.

Furthermore the presented case study of practical VSM use presents the process and benefits from the managerial point of view, considering the specific services provided by Fujitsu at the service centre in Lodz in terms of the end-to-end stream of customer value. The main advantages of using the VSM as a lean management technique identified by GDC managers as the ability to recognize the improvement opportunities of two kinds: continuous – being identified systematically and breakthrough – often being the result of the continuous improvements.

Sayer and Williams mentioned other VSM advantages (Sayer and Williams, 2007). According to them the tool allows to:

- always take the customer's perspective and focus on fulfilling to the customer's expectations and needs;
- provide a complete, fact-based, time-series representation of the stream of activities - from beginning to end (required to deliver a product or service to the customer);
- provide a common language and common view to analyze the value stream;
- demonstrate how the information flow to trigger and support those activities;
- show, where the performed activities add value and where they don't, enabling to see the means to supply and satisfy the customer.

Value Stream Mapping can serve as a starting point for the management and every employee to understand and further also analyze value, as well as recognize waste and its reasons. VSM allows workers to observe taken actions from the wider, operative perception - it does not concentrate on the particular product or activity, but on the entire operational process. The result is locating all the information in one place, allowing to capture the "big picture", which is a one of the key factors to the value generation process and continuous improvement of the company.

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The Use of EFQM model in performance assessment of suggestions system

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Introduction

In today's crowded communities in which increasing reduction of natural resources adds to their problems, technology development and advancement of knowledge and information has made rapid changes and complexities in the communities and organizations. So, it is impossible to manage organizations without the participation of staff and using new and diverse ideas in decision-making. Therefore, organizations try to utilize their employees' ideas, opinions and initiatives, using participative management. To implement participative management in an organization, different methods are used, among them the suggestions system is the most important (Habibnia, 2003). As the time passes, the number of organizations that have applied the system is on the rise. For the sake of continuing and completing this trend, it is necessity to evaluate the performance of the suggestions system in various organizations (Fathollahi, Nejabat, 2007). EFQM Excellence Model can be a helpful tool for organizations to ensure the realization of this issue (Dashtizade, 2004). In general, EFQM has two very important goals; First, to guide and support improvement activities, and second, to support managers in achieving comprehensive quality management (Dashtizadeh, 2004).

A review of related literature

In designing any system, especially a management system in which some people constitute an integrated and united human set, attention should be paid to the basic concept of participation and its spirit and essence. Participation is a set of measures that increases influence and responsibility of the personnel in decision-making process through the conferment on various levels. It creates a sense of ownership and belonging to the organization in the people associated with it (Feshalenj, 2006). Participation includes all the processes and techniques which need some initiatives and techniques (Thurston, 2005) and causes the conditions to achieve satisfaction and consensus in effective management of resources. Tendency towards participation is the prerequisite for successful participation (Alpizar, 2006). Among the most important advantages of suggestions system is the creation of trust among employees and promotion of transparency in accountability and decisions making. (Nadeem, Fischer, 2011).

Suggestions System:

Suggestions system, also known as participation system, is one of the participative management programs. In suggestions system, the management provides space and

facilities in the organization in order that the employees present their criticism and suggestions for solving the problems and shortcomings and continuous improvement of the organization's activities. In fact, suggestions system is a regularized system for activating people's minds and applying their ideas and supervision for solving the problems and shortcomings and improving the organization's activities (Khaza'i, 2007).

Historical Background of Suggestions System

In 1867 Alfred Krupp used for the first time suggestion-based management system in Krupp steelmaker factory in Germany. Employees were encouraged to put forward suggestions regarding their work and were paid a little amount of cash as a reward in exchange for them (Roshandel Arbatani, 2003).

In 1960s, growing international competition in global markets and the need to export products, forced Japan to devote special attention to the quality of its products. In this regard, the production companies' managers, in addition to using suggestions system, tried to improve it by extensive training of supervisors and staff. They also created quality control groups.

In the early twentieth century, the suggestions system was used in America, in some industrial companies, including "NRC" and "Bill" factory and some other industries (Habibnia, 2003).

History of Suggestions System in Iran:

In 1986 Iran's Research and Self-Sufficiency Services Center studied two important plans named "management system" and "research system" which were the main causes of rapid growth and industrial revolution in some countries, particularly countries destroyed in World War II, such as Japan and Germany. The result of the study was an executive plan modeled based on an advanced system. In 1987, based on this, a directive from the Minister of Heavy Industries was created for all projects under implementation in the system, called the "suggestions system" (Habibnia, 2003).

Following the issuance of the said directive, the suggestion system was applied in a number of associated companies with consultation and guidance from the Research Center. It needs mentioning that the project was first implemented as a pilot test in four companies (Iran Radiator, Production of Rolled Steel Joist, Akam Felez and Soliran) in 1988. After proving successful in practice, the project was implemented more seriously in other associated companies and thus seven other companies joined the group of performers of employees' participation system through the suggestion system (Habibnia, 2003).

In summary it can be said that the American system focuses on economic benefits of the suggestions and provides financial incentives, while the Japanese style emphasizes on psychological privileges of positive participation of the staff. In other words, Western suggestion system can be different from Kaizen system based on two aspects: means and goals (Recht, Wilderom, 1998). According to the performed studies, the suggestions system in Iran emphasizes both on economic benefits of the suggestions and psychological effects resulting from employees' participation.

Objectives of Suggestions System:

In suggestions system bylaw, the following items have been mentioned as the objectives of implementing the system:

- 1- Moving towards organizational excellence and improving business processes of the organization by implementing useful suggestions of the staff and other beneficiaries.
 - 2- Improving productivity and providing quality products and services in order to achieve organization goals.
 - 3- Promoting individual and group participation spirit of the staff and increasing sense of responsibility for improving the organization.
 - 4- Preparing the basis for employees' effort to increase their work knowledge and awareness through the presenting suggestions on small improvements in their jobs.
 - 5- Identifying creative people and preparing the basis for realization of the staff's creativity and talents.
 - 6- Creating a valuable database of improvement activities that increase improvement opportunities in the organization due to public access.
- Therefore, believing in the necessity of systematic utilizing of mental abilities and creativity of human resources in managing the organization, Agricultural Jihad Organization of Fars province has established suggestions system.

Introducing Agricultural Jihad Organization of Fars Province

Ministry of Agricultural Jihad was established under Act 405, dated 2/1/2000 passed by Islamic consultative Assembly out of the merger of two former ministries of Jihad Sazandegi and Agriculture. Following this, provincial organizations associated with these ministries were also merged and Agricultural Jihad organizations were formed in each province. The organization's duties description was ratified at the ninety-eighth session of the Administrative Council dated 28/12/2001. The most important of these are as follows:

- Studying and identifying potential and actual facilities and opportunities of resources and production factors of agriculture sector.
- Preparing and regulating strategies, objectives, programs and developmental policies of agriculture sector.
- Studying, regulating and implementing programs, plans and instructions related to the patterns of growing agricultural crops.
- Livestock and animal husbandry systems and natural resources of the province.
- Planning for the establishment of promotive operation network.
- Studying and taking action to preserve, reform, restore and increase soil fertility.
- Providing prerequisites for the development of agriculture-related industries.

Suggestions System and Organizational Excellence Model

Agricultural Jihad Organization of Fars province, as an organization that is implementing the suggestions system, for development, growth and sustainability in today's competitive arena requires a kind of performance evaluation system that could assess the efficiency and effectiveness of the programs of the organization, process and human resources. In an efficient organization, it is not enough to collect and analyze data, but the data are used to improve the organization and achieve its missions and

strategy. (beikzad, Alizade, 2009). Targeted planning can be done by assessing the performance of an organization in different dimensions (including assessment of resources and facilities, staff, goals, strategies and ...). By the same token, organizational excellence models, as a powerful tool in response to the organization's need has been very successful and could largely be used in finding the organization's shortcomings and determining the direction for access to excellence in human resources (Rahmati, 2007).

EFQM Model:

European Foundation for Quality Management was founded in 1998 by fourteen European reputable companies with the support of Europe Union. The purpose of this foundation was to "stimulate, encourage and assist management in selecting and applying the principles of comprehensive quality management and to improve competitiveness of European industries". EFQM model is a self-assessment tool for determining the organization's well-being (Sayyadi, Farid, Mirfakhraddini, 2009). This model has nine criteria. Five enabler criteria: leadership, policy and strategy, people, partnership and resources, processes. Four results criteria: customer results, people results, society results and key performance results. Enabling criteria cover what the organization does. They are the factors that enable an organization to achieve excellent results. Results are achieved by the implementation of enablers and enablers are improved by getting feedback from the results (Eghbal, Siadat, Mohammadian, Hc

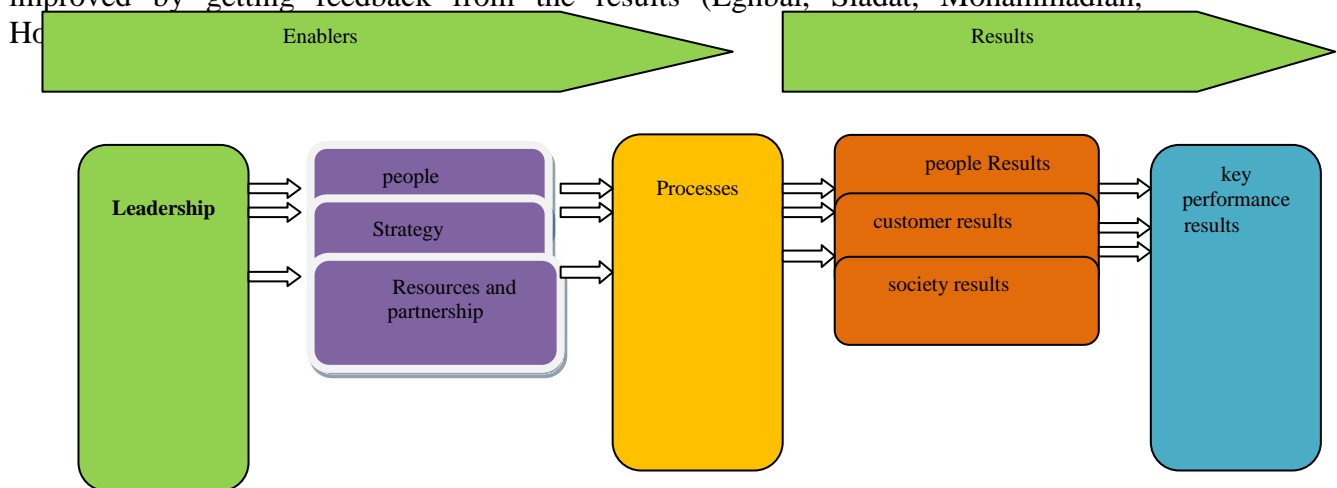


Figure (1): Distribution of scores between the two criteria of enablers and results in EFQM Organizational Excellence Model (Bondet, Zentner, 2007)

The definitions of all the criteria of the model and their components are as follows:
 Leadership Criterion: Excellent leaders determine the mission and outlook and facilitate the conditions to access them (Liusar et al, 2009).

Policy and strategy criterion: Excellent organizations achieve their mission and outlook through developing a proper strategy that focuses on the beneficiaries' interests (Liusar et al, 2009).

People criterion: Excellent organizations manage, develop and use all potential abilities of their employees in individual, group and organizational level (Liusar et al, 2009).

Resources and partnership criterion: Excellent organizations plan and manage their external partnerships, suppliers and internal resources (Eghbal, Siadat, Yarmohammadian, 2009).

Process criterion: Excellent organizations plan, manage and improve their processes in order to protect and support the organization's policy and strategy and fully implement it. They seek to create added value for customers and other beneficiaries (Liusar et al, 2009).

Customer results criterion: Excellent organizations measure and achieve comprehensively the important results related to their customers (Salehi, 2005).

People results criterion: Excellent organizations measure and achieve comprehensively the important results related to their people (Eghbal, Siadat, Yarmohammadian, 2009).

Society results criterion: Excellent organizations measure and achieve comprehensively the results related to society (Javidi, 2006).

Key performance results criterion: Excellent organization measure and achieve comprehensively the important results related to key elements of policy and strategy (Salehi, 2005).

Reasons for Choosing Organizational Excellence Model of EFQM in Iran:

- 1- It has been chosen as the National Award Model in the world more than any other model.
- 2- Iran's good relations with European countries make it possible for Iranian organizations to transfer knowledge and use this model's experts.
- 3- Strong systematic viewpoint and close attention to management based on organizational processes and being result-oriented are important and informative features of EFQM model especially for Iranian organizations which are faced with serious problems in these areas.
- 4 - The model which is used for assessing organizations and granting "National Award of Excellence and Productivity" is based on EFQM model (Beikzad, Alizadeh, 2009).

Research Questions

Main question:

Is assessment of the suggestions system of Agricultural Jihad of Fars province, using EFQM model, successful?

Secondary research questions:

- 1 - Is assessment of the suggestions system of Agricultural Jihad of Fars province, using leadership criterion of EFQM model, successful?
- 2 - Is assessment of the suggestions system of Agricultural Jihad of Fars province, using policy and strategy criterion of EFQM model, successful?
- 3 - Is assessment of the suggestions system of Agricultural Jihad of Fars province, using partnership and resources criterion of EFQM model, successful?
- 4 - Is assessment of the suggestions system of Agricultural Jihad of Fars province, using human resources criterion of EFQM model, successful?

- 5 - Is assessment of the suggestions system of Agricultural Jihad of Fars province, using processes criterion of EFQM model, successful?
- 6 - Is assessment of the suggestions system of Agricultural Jihad of Fars province, using key performance results criterion of EFQM model, successful?
- 7 - Is assessment of the suggestions system of Agricultural Jihad of Fars province, using customer results criterion of EFQM model, successful?
- 8 - Is assessment of the suggestions system of Agricultural Jihad of Fars province, using society results criterion of EFQM model, successful?
- 9 - Is assessment of the suggestions system of Agricultural Jihad of Fars province, using people results criterion of EFQM model, successful?

Research Methodology:

The present research has been done by survey-descriptive methods and it has applied objectives. The most important method used in this study is survey method. In order to investigate research questions and evaluate the performance of suggestions system, a questionnaire was designed that in fact combines three questionnaires (1- Sabco company's Questionnaire designed for assessing and granting national awards to suggestions system, 2 – Questionnaire of a thesis titled "Designing Employees' Performance Evaluation based on Organizational Performance Management Models" by Asieh Saghapoor. It is designed to evaluate employees' performance, 3 – Questionnaire of a thesis titled" Feasibility Study for the Establishment of Performance Evaluation System of Agricultural Jihad Organization of Fars Province Based on EFQM Model", written by Rezvan Abdoli Dashtestani. It has been designed to evaluate the performance of Agricultural Jihad Organization of Fars province).

To assess the validity of the questionnaire of the study, Cronbach's alpha coefficient was used, the figure 0/9113 came out and its validity was accepted by the suggestions system committee officials and the thesis supervisor. For answers to the questions, Likert scale of values (completely agree, agree, no comment, disagree, completely disagree) was used. The statistical populations of the research are 2222 staff of Agriculture Jihad of Fars province. Sample size was determined as 238 after calculating by using the Cochran formula.

Data analysis:

After the questionnaires were collected, information was analyzed by SPSS software. The quantitative analysis was used in the study. Quantitative analysis can be done in two forms: descriptive and inferential. In the descriptive statistics, Indicators of descriptive statistics such as mean, variance and standard deviation, cumulative percentage and statistical charts for each of the demographic variables and major variables are shown. In inferential statistics, single-sample t test is used.

Table I: Demographic data of the studied sample

gender	frequency	employment status	frequency	position	frequency	education level	frequency	marital status	frequency
male	186	permanent	158	secretary for suggestions	13	under high school diploma	8	married	202

				system committee		ma			
female	52	contractual	19	member of suggestions system committee	46	high school diploma	29	single	36
total	238	Other	61	staff	179	associate degree	32	total	238
		Total	238	total	238	BA	146		
						MA	23		
						Total	238		

Test of Secondary Questions:

Assessment of suggestions system of Agricultural Jihad of Fars province, using EFQM model in its nine dimensions has been successful.

Table II: T- Test

	T	Df	Sig. (2-tailed)	Mean Difference	Test value = 3		Mean
					95% confidence Interval of the Difference		
					Lower	upper	
Secondary Questions 1	14.420	237	0	0.6486	0.5600	0.7337	3.6486
Secondary Questions 2	13.180	237	0	0.6639	0.5646	0.7631	3.6639
Secondary Questions 3	4.439	237	0	0.2332	0.1297	0.3367	3.2332
Secondary Questions 4	10.323	237	0	0.4924	0.3986	0.5864	3.4924
Secondary Questions 5	11.106	237	0	0.5070	0.4117	0.5969	3.5070
Secondary Questions 6	5.777	237	0	0.3036	0.2001	0.4071	3.3036
Secondary Questions 7	11.200	237	0	0.5706	0.4702	0.6710	3.5706
Secondary Questions 8	13.240	237	0	0.6361	0.5415	0.7308	3.6361
Secondary Questions 9	5.511	237	0	0.2840	0.1825	0.3856	3.2840

In all the questions of the above table, due to the fact that the amount of “sig” is considered less than 0/05, zero hypothesis is rejected and statistical hypothesis is verified with 0/95 confidence. Therefore, evaluation of suggestions system of Agricultural Jihad of Fars province using EFQM model has been successful in nine

criteria. According to the above table, the average amount of policy and strategy has the highest amount and is the most successful area in EFQM approach.

Variables Rating: Friedman test is applied for checking whether the prioritization of the variables is the same or not:

Zero assumption: The prioritization of all the variables is the same.

First Assumption: At least two priorities are different.

Table III: Ranks of variables

	Mean rank
Policy and Strategy	6.05
Leadership	5.87
Society results	5.70
Customer Results	5.52
Processes	5.09
Employees	5.10
Key Performance Results	4.00
People Results	3.90
Partnerships and Resources	3.77

The above table is descriptive statistics indicating the rating of each variable. We see that the policy and the strategy variables have the highest ratings. The following table shows the number of data for each variable besides the K-score statistical amounts and the degrees of freedom.

Table IV: Test statics, friedman Test

N	238
Chi-square	207.519
Df	8
Asymp.sig.	0

Since the certainty percentage is below 0.05, the zero assumption is rejected and the assumption of having the same ratings is not accepted.

Investigating the effect of demographical variables on the success of suggestions system

Gender

Has the gender variable been effective in the success of suggestions system?

Table V: Independent samples Test

		Levene s Test for Equality of variance		t-test for equality of Means						
		F	Sig.	T	Df	Sig(2-tailed)	Mean Difference	Std.Error Difference	95% confidence	
									lower	upper
EFQM	Equal variance assumed	2.47	0.11	0.53	236	0.59	0.53	0.98	-0.14	0.24
	Equal variance not assumed			0.57	90.9	0.56	0.53	0.91	-0.12	0.23

We deduce from the above tables that the certainty percentage has not been less than 0.05 and therefore, the zero assumption is not rejected, and gender variable has no effect on the success of suggestions system.

Marital Status

Has the variable of marital status been effective in the success of suggestions system?

Table VI: Independent samples Test

		Levene s Test for Equality of variance		t-test for equality of Means						
		F	Sig.	t	Df	Sig(2-tailed)	Mean Difference	Std.Error Difference	95% confidence	
									lower	upper
EFQM	Equal variance assumed	0	0.99	0.44	236	0.65	0.05	0.113	-0.17	0.27
	Equal variance not assumed			0.43	47	0.66	0.05	0.177	-0.18	0.28

Based on the above tables, we infer that the certainty percentage has not been below 0.05 and the zero assumption is not rejected, and thus, variable of marital status has no effect on the success of suggestions system.

Educational Degree

Has the variable of educational degree been effective in the success of suggestions system?

Table VII: Test of Homogeneity of Variances

Levene statics	Df1	Df2	Sig.
0.37	4	233	0.82

The variances are homogeneous in the variable of educational degree.

Table VIII: Anova

	Sum of squares	Df	Mean squares	f	Sig.
Between Groups	5.5	4	1.3	3.6	0.007
Within Groups	90	233	0.38		
Total	95.6	237			

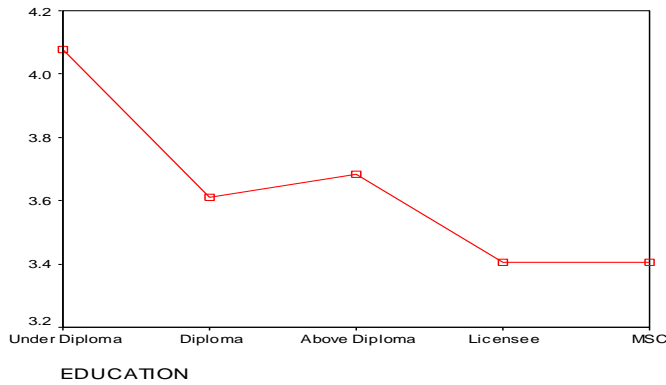


Diagram 1: Effective of Education on success of EFQM

Based on the above tables, it is concluded that there is a significant difference between groups and the variable of educational degree has an impact on the success of suggestions system, and the under-diploma degree have the greatest impact on the success of suggestions system.

Employment Condition

Has the variable of employment condition been effective in the success of suggestions system?

Table IX: Test of Homogeneity of Variances

Levene statics	Df1	Df2	Sig.
3.4	2	235	0.064

The variances are homogeneous in the variable of employment condition.

Table X: Anova

	Sum of squares	Df	Mean squares	F	Sig.
Between Groups	3.5	2	1.70	4.40	0.013
Within Groups	94.5	235	0.04		
Total	98.1	237			

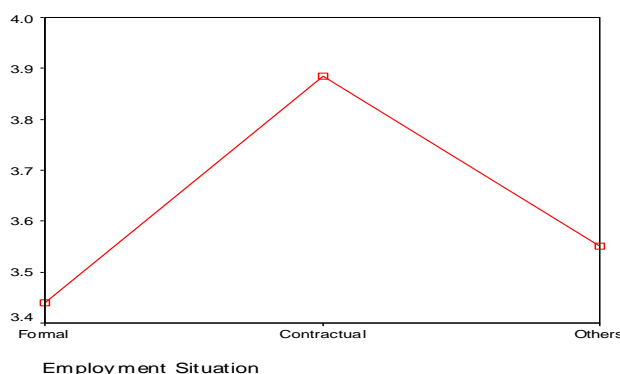


Diagram 2: Effective of Employment Situation on success of EFQM

Using the above tables, we conclude that there is a significant difference between groups and the variable of educational degree has an impact on the success of suggestions system, and considering the diagram (2), the contractual condition has the greatest impact on the success of suggestions system.

Organizational Position

Has the variable of organizational position been effective in the success of suggestions system?

Table XI: Test of Homogeneity of Variances

Levene statics	Df1	Df2	Sig.
0.239	2	235	0.788

Table XII: ANOVA

	Sum of squares	Df	Mean squares	F	Sig.
Between Groups	4.5	2	2.2	5.4	0.005
Within Groups	98.1	235	0.418		
Total	102.63	237			

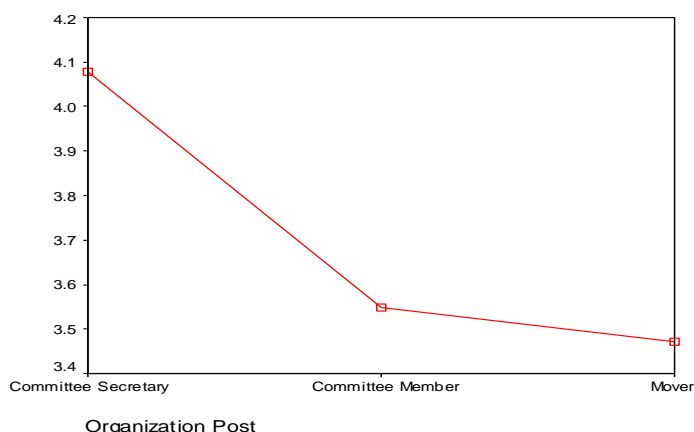


Diagram 3: Effective of Organization Post on success of EFQM

Based on the above tables, it is inferred that there is a significant difference between groups and the variable of organizational position has effect on the success of suggestions system, and considering the diagram (3), the committee head of the suggestions system is the most influential one on the success of suggestions system.

Research Results and Findings:

Hypothesis test results: According to the study tests, results of the research questions are as follows:

Main question: Based on the answers to the questions ,it is clear that the evaluation of suggestions system has been successful.

First question: Leadership: Based on the answers to the questions in this field, it is clear that the evaluation of suggestions system has been successful regarding leadership dimension. The results of direct participation of senior managers in designing and establishment of suggestions system are positive attitude of managers concerning the potential abilities of employees, ensuring of the correct implementation of suggestions system, symbolic and spiritual support from senior managers, expressing the necessity

of participation of staff in gatherings and meetings, reminding managers about the necessity of participation of the employees in management meetings, assigning specific time by senior management to support employees and listen to their views.

Success in this area is the result of participation and practical action of senior managers. It needs mentioning that according to a research by Asive Asar and his colleagues in 2005, leadership is the most effective activity to maintain quality in UK higher education in terms of EFQM model.

Second question: Policy and Strategy: Based on the answers to the questions in this field, it is clear that the evaluation of suggestions system has been successful regarding policy and strategy dimension. The most important factor for success in this area is similarity of suggestions system goals with organizational objectives. Among other factors for success in this area are employees' efforts for providing suggestions related to their jobs and for developing organizational goals, clarifying the way for separation between duty and suggestion and promoting it between managers and suggestion reviewers, identifying active committees and individuals and rewarding them. During his research in 2008, John Davis found that the coherence and integration between strategy and goals, are important factors in effective implementation of EFQM model and more coherence makes its implementation more successful; hence, enhances quality in the organization.

Third Question: Partnerships and Resources: Based on the answers to the questions in this field, it is clear that the evaluation of suggestions system has been successful regarding partnership and resources dimension. It shows the confidence of the staff about the existence of suggestion system software with secured information. The software is available to all beneficiaries in the organization and the competence of suggestions system secretaries has been proved in a mechanized way. This makes sure those who suggest participate actively in the partnership system, organizational structure of suggestions system is defined clearly and employees ensure the dynamic performance of suggestions system through the introduction of the best parts, reporting, culture-building, monitoring, planning and budgeting.

Fourth Question: Employees: Based on the answers to the questions in this field, it is clear that the evaluation of suggestions system has been successful regarding employees dimension. This shows positive and effective results of professional training before and after the establishment of suggestions system, employees' awareness of provisions of suggestions system bylaw and its purposes and creating optimism and enthusiasm in the staff towards new management systems, particularly suggestions systems. Most important of all is employees' tendency towards changing and improving their conditions which is one of the main causes of success of suggestions system. By creating empathy and cooperation between employees and managers, desirable conditions can be achieved and granting power of senior managers to employees has been effective in this success. Hence, Carroll and his colleagues have mentioned employees' resistance as the main reason for organization's failure in implementing the management systems. They have expressed participation of the staff as the best solution to this problem.

Fifth Question: processes: Based on the answers to the questions in this field, it is clear that the evaluation of suggestions system has been successful regarding processes dimension. This is the result of the existence of updated and enacted bylaw for

suggestions system which is proportionate to organizational features. The staff can easily present their suggestions and there are various ways to do this. Diversity in rewarding the staff provides incentives for them to give suggestions and most important of all is the support and supervision team that provides incentives for those who suggest by giving feedback and information concerning the implementation of suggestions.

Sixth Question: Key Performance Results: Based on the answers to the questions in this field, it is clear that the evaluation of suggestions system has been successful regarding key performance results dimension. It shows increasing rate of studied, accepted and implemented suggestions and also increasing quantitative suggestions. To use EFQM model as a pattern for performance evaluation more attention should be paid to this criterion. According to a research by Boalivsar and his colleagues which suggest the relation and interaction between the enablers and results, advancement of the enablers makes possible the maximum development of results.

Seventh Questions: Customer Results: Based on the answers to the questions in this field, it is clear that the evaluation of suggestions system has been successful regarding customer results dimension. Suggestions system has been successful to create a positive image of the organization for the customers, improve customer services, consult and counsel employees with customers, respond better to customers' needs and complaints. This is in line with the results of Hakbz and his colleagues' research that expressed EFQM model as an effective method to assess and identify various types of services affecting customers. Michael Haidz and his colleagues have mentioned EFQM in their study as an effective factor for creating the more customer-oriented culture.

Eighth Question: Society results: Based on the answers to the questions in this field, it is clear that the evaluation of suggestions system has been successful regarding society results dimension. Suggestions system has been successful on reducing the costs and the wastes, maintenance and effective use of organizational facilities and has improved organization's performance in people's views. This could represent active participation of secretary for the suggestions system committee in his/her programs, humanitarian activities and other cultural activities.

Ninth Question: People Results: Based on the answers to the questions in this field, it is clear that the evaluation of suggestions system has been successful regarding people results dimension. This shows increasing participation rate of employees and beneficiaries in the organization which rises per capita bonus payment to employees and satisfy them. Another important result of this dimension is per capita increase in savings resulting from implementation of specific suggestions that is satisfactory. Another factor in the success of suggestions system regarding this criterion is to study the causes for success of leading organizations in this system in order to use the results of their work.

Conclusion and Suggestions:

Results obtained from performance assessment indicate that the highest score, according to Table above and the average amount, is related to the field of policy and strategy. This shows that the suggestions system has reflected significant improvements in this area. The most important success factor in this area is similarity of suggestions system goals with organizational objectives; while employees' efforts for providing suggestions

related to their jobs and development of organizational goals as well as identifying active committees and individuals and rewarding them are other major factors of success in this area. The lowest score is related to partnership and resources criterion where suggestions system represents a very small progress. It is better to take continuous actions to ensure all employees of the presence of suggestions system software with appropriate information security and to mechanize the approach for proving the competence of secretaries of suggestions system. All the staff should be informed of the dynamic performance of suggestions system.

In general, the most important success factor of suggestions system in Agricultural Jihad of Fars Province is the serious support from senior management that motivates employees to make continuous improvement in the organization. Another reason is having a full-time, enthusiastic, active and efficient executive secretary in the suggestions system secretariat. The officials motivate employees by examining suggestions in relevant committees in due time, implementing approved suggestions and paying fair and timely rewards to the bidders. Another important factor for success of the suggestions system is establishment of appropriate and direct relations between managers and employees, which has consequently established a precise and logical flow of information exchange and dialogue among the staff.

Suggestions:

According to the results of this study, the following suggestions is presented to organizations that are trying to establish suggestions system:

- Considering the role and place of participatory system in the country and with reference to Articles VII, and one hundred and fourth of Islamic Republic of Iran's Constitution, importance and place of participation should be distinguished in the country's administrative system.
 - In order to create a cultural context for participation in administrative system, it is suggested to familiarize the staff with the philosophy and methods of participation, through providing necessary training to them.
 - This should be noted that implementing participatory programs in organizations, without principled studies and planning, might lead to failure. Therefore it is necessary to consult qualified people before implementing participatory system.
 - Senior management of the organization's belief in and support of suggestions system is one of the most important prerequisites for its success, so before anything, belief in performance of the system should be created in higher management of the organization.
 - Structural and behavioral measures should be taken to reduce the formality and focus of the system and provide its stabilization and growth.
-
- It is also recommended, before implementing the suggestions system, to provide economic and financial contexts for its successful implementation and to prevent problems and interruptions during implementation.
 - It is better for organizations that seek to establish suggestions system to implement it at first as a pilot system in an appropriate unit or division and after removing the defects and deficiencies of the system, establish it in the whole organization.
 - Science communication should be created between suggestions system and scientific research centers to make practical use of the suggestions.
 - Suggestions are better rewarded by job promotion because the cash rewards are fleeting and forgotten with time.

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Identification and anchoring of customer requirements based on a customer questionnaire and an in-house survey

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Paper type Case study

Introduction

Customer satisfaction is often used as a key performance indicator, and it is strategically important to be able to identify which product attributes result in satisfied customers in order to determine which design requirements contribute to these characteristics. The customer perception of various attributes can be incorporated in the product development in Quality Function Deployment QFD i.e., design requirements (Hauser & Clausing, 1988; Omar et al., 1999; Park & Kim, 1998; Shen et al., 2000). The key to winning customers is to deliver services which meet or exceed customer expectations (Jain et al., 2003) and a poor understanding of customer requirements leads to many gaps in the process of delivering good quality services and may have disastrous consequences (Zeithaml and Bitner, 2003). To capture customers' expectations different types of surveys are used to assess how important various product features are to the customer. Kano method is designed to categorise product features and find the attractive features which increase customer satisfaction as well as features that must exist to prevent customer dissatisfaction. (Kano et al., 1984)

Focus on the customer gives quality a central aspect, and a more customer-oriented definition of quality, "fitness for use", has been credited to the Juran (Juran, 1974). He separated quality into two components: quality of design and quality of conformance. Garvin, on the other hand, thought it was necessary to have different definitions for quality. He proposed eight major dimensions for quality (Garvin, 1987); Performance, Features, Reliability, Conformance, Durability, Serviceability, Aesthetic and Perceived quality. Quality dimensions must therefore be defined. In the international system of standards (ISO 9000) the customer concept is defined.

Disagreements in product development between different groups at the company are resolved by placing focus on the customer and by defining added value at the company as customer value (Liker and Morgan, 2006).

The purpose of this paper is to improve this part of QFD by developing an effective method that streamlines the internal process of identifying customer requirements and anchoring these at the company. QFD is a means to structure and systemize the product development process. Performing a market analysis to find out about the needs and expectations of the customer is one part of QFD. The aim is to translate requirements of the customer into design requirements. To gain knowledge of customer expectations, needs and the company's perceptions of customer expectations, surveys with Kano questionnaires are conducted for both groups. The questionnaires cover standard

product features as well as new, innovative product features. First, the questionnaire is completed by the people at the company involved in the product development process. The purpose of the survey is to determine how the company perceives customer needs but also how consistent the perception is within the company. The second questionnaire is a customer questionnaire and is completed by the customers. Then, the Gap Model (Zeithaml and Bitner, 2003) is used to compare the two questionnaires to explain possible shortcomings of the company that result in poor customer satisfaction. The results are also used to anchor the customer requirements at the company.

Methodology

Kano questionnaire

The questions are formulated within different quality dimensions such as reliability, performance, maintainability, environment, appearance, flawlessness, safety and durability. However, the number of questions in a specific questionnaire needs to be limited, and therefore it is difficult to cover all dimensions in a single survey. Contributions to some of the dimensions are mainly from measurements not covered by a questionnaire, such as reliability, measuring time to first failure, the mean time between failures and failure rate per unit time.

The questions should include new innovative attributes of interest to see how customers will receive these new features. There is a weakness here concerning Kano method and attractive quality elements if the features are completely new for the customer (Witell and Löfgren, 2007). Therefore, new features should be known and use by the customer in other products. New technologies are emerging at a rapid pace and, because of the intense competition, manufacturers cannot carry out prolonged testing. This means that product development concerning software even takes place after initial delivery, as it is possible to update products that customers already use. Questions should therefore also reveal customer reactions to properties that do not fully appear.

A survey using Kano method is formulated according to the decided questions. The survey is prepared so as to elicit both the customers' expectations and the management perceptions of customer expectations. In the questionnaire, the respondents indicate what priorities the customer makes in the case of product attributes. Since Kano method also categorises the questions, it also addresses these kinds of questions; for example, whether the customer believes that an attribute must be present or that an attribute is attractive. The people at the company who rely on the survey are responsible for product features; they are involved in setting the design requirements and are responsible for product development. For the respondents at the company it is important to answer the questions according to what they think the customer expectations are, and not on the basis of their own expectations. The respondents also complete a self-stated importance questionnaire, so that the attributes can be weighted.

Gap Model

How similar pictures do the two surveys deliver? The knowledge about where the differences are is very important for the company. An often used method is the so-called Gap Model, of which the purpose is to clarify what causes customers to be dissatisfied. The model shows where the negative gaps are. Zeithaml and Bitner (2003) used the

model for service quality. The magnitude and the direction of each gap will affect the quality. Closing the gap could lead to better satisfaction and, therefore, a stronger long-term relationship. The customer gap or customer quality perceptions are influenced by four distinct gaps:

- Gap 1: Difference between customer expectations and management perceptions of customer expectations
- Gap 2: Difference between management perceptions of customer expectations and quality specifications
- Gap 3: Difference between quality specification and the actual delivery
- Gap 4: Difference between delivery and what is communicated to customers

(1)

Gap 1 highlights the problem of interest here. Big differences indicate that the company does not accurately know, understand or appreciate what the customer expects. The gap can exist because there is insufficient or no dialogue between suppliers and users.

Evaluation

To combine the responses to the functional and dysfunctional questions in a Kano questionnaire we gain a simple sense of the customer expectations and company perceptions of customer expectations. From evaluation we can read the category based on how the respondents answer. The simplest way of deciding the final category for respective attribute and group is to select the category that occurs most frequently when all of the final questionnaire responses are summed up for each group.

The coefficients for customer satisfaction, S_i , and dissatisfaction, D_i , for question number i are calculated as described by Berger et al. (1993) and Matzler & Hinterhuber (1998):

$$\frac{\sum_{j=1}^n A_{ij} + \sum_{j=1}^n O_{ij}}{\sum_{j=1}^n A_{ij} + \sum_{j=1}^n O_{ij} + \sum_{j=1}^n M_{ij} + \sum_{j=1}^n I_{ij}} \quad (2)$$

$$\frac{\sum_{j=1}^n M_{ij} + \sum_{j=1}^n I_{ij}}{\sum_{j=1}^n A_{ij} + \sum_{j=1}^n O_{ij} + \sum_{j=1}^n M_{ij} + \sum_{j=1}^n I_{ij}} \quad (3)$$

where A_i = Attractive, O_i = One-dimensional, M_i = Must-be and I_i = Indifferent.

Since the respondents also ranked the features, respective features can be weighted as a relative ranking:

$$\frac{w_i}{\sum_{i=1}^n w_i} \quad (4)$$

where w_i is the importance weight for question number i , based on self-stated importance questionnaire.

Answers for each feature and group can now be plotted in a three dimensional space, see Fig. 1. The coordinates of the space are satisfaction, dissatisfaction and relative ranking. The difference in opinion between the two groups is given by the distance between the locations of the points of each group. The distance for each question i is calculated as

$$\sqrt{\left(\frac{\sum_{j=1}^n A_{1ij} + \sum_{j=1}^n O_{1ij}}{\sum_{j=1}^n A_{1ij} + \sum_{j=1}^n O_{1ij} + \sum_{j=1}^n M_{1ij} + \sum_{j=1}^n I_{1ij}} - \frac{\sum_{j=1}^n A_{2ij} + \sum_{j=1}^n O_{2ij}}{\sum_{j=1}^n A_{2ij} + \sum_{j=1}^n O_{2ij} + \sum_{j=1}^n M_{2ij} + \sum_{j=1}^n I_{2ij}} \right)^2 + \left(\frac{w_i}{\sum_{i=1}^n w_i} - \frac{w_i}{\sum_{i=1}^n w_i} \right)^2} \quad (5)$$

where values with index 1 are for the customer group and 2 for the company group. The

maximum distance that can exist is $\sqrt{2}$.

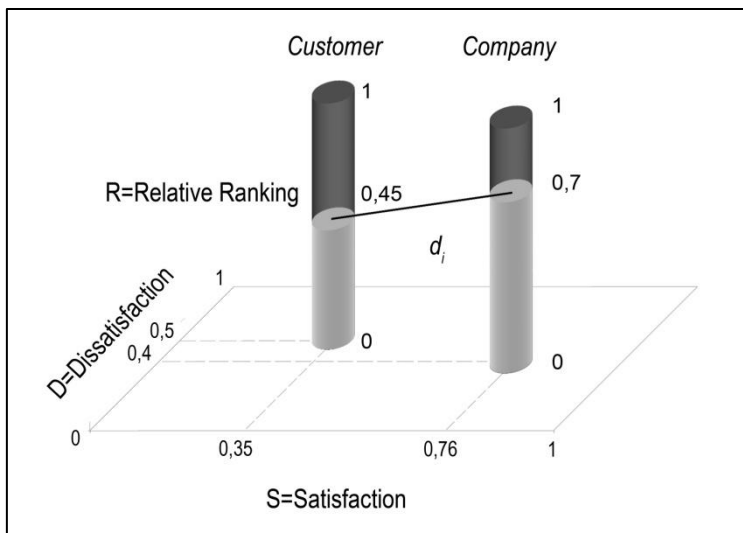


Figure 44 Distance between question points

In the product development process different departments have their separate ways of interpreting the customer's need. Consequently, a second evaluation step is carried out and the different department's perceptions of customer expectations are compared.

Questions with the greatest distance are analysed further by examining the difference in specific coordinates. The difference in opinion might be explained by a single coordinate. For example, one of the groups considers that the feature is irrelevant and, thus, both D and S are equal to zero, giving the big difference in distance.

Case Study – Climate control

Survey formulation and groups

The case study has concerned air conditioning in a car. In order to limit the investigation further, the focus has been within the dimensions of quality, performance, appearance and safety. Still, the questionnaire had thirty-one Kano questions and 17 ranking questions, which were formulated in collaboration with people at the car company.

The customer group in this study cannot be completely deemed to represent a customer group. The people in the group were too closely associated with the company. The group representing the company, however, can be considered relevant, as they were responsible for product features and establishing the design requirements.

Comparison customer and company groups

The differences between customer group and internal group were highlight by calculating the distance d_i . Results are shown in Table I. There is a clear difference between customer and in-house groups concerning questions 8, 11, 14 and 27. The questions with highest disagreement mainly concern new features of the air conditioner.

Table I Comparison of a customer and company's internal survey. distance d_i

Questions	1	2	3	4	5	6	7	8	9	10	11
d_i	0.15	0.22	0.19	0.11	0.18	0.18	0.29	0.52	0.24	0.17	0.59
Questions	12	13	14	15	16	17	18	19	20	21	
d_i	0.28	0.19	0.53	0.15	0.24	0.07	0.07	0.29	0.27	0.36	
Questions	22	23	24	25	26	27	28	29	30	31	
d_i	0.20	0.14	0.15	0.17	0.11	0.56	0.22	0.25	0.25	0.12	

Identifying deviating coordinates

The next step in analysis is to examine the coordinates and see if some of the coordinates might explain the largest differences between the groups' responses. In Table II we have the calculated distance between the two groups' responses for the four questions with the largest distance. For both groups the coordinates for satisfaction, dissatisfaction and relative ranking are presented for those questions.

In questions 8 and 11 the customer will be satisfied if the feature exists, quite contrary to what the management perceptions of customer expectations are. Regarding question 27, besides satisfaction, the customer feels dissatisfied if the feature is not provided. However, the customer group's feeling for question 14 is that the feature is neither attractive nor necessary, differing from company's perceptions of customer expectations. With respect to the rankings concerning these issues, there is fairly good agreement between the groups.

Table XVI Distance d and coordinates for the four questions with the largest distance between customer and company group.

Questions		8	11	14	27
d_i = distance		0.52	0.59	0.53	0.56
S= satisfaction	Customer	0.81	0.87	0.05	0.53
	Company	0.30	0.30	0.40	0.10
D= dissatisfaction	Customer	0.05	0.37	0.00	0.37
	Company	0.00	0.40	0.40	0.00
R= relative ranking	Customer	0.64	0.67	0.37	0.41
	Company	0.60	0.81	0.35	0.38

Comparison company internal groups

The respondents in the internal group belong to two different departments. In Table III the responses of these departments are evaluated separately. Department 1 does not consider that questions 3 and 14 are relevant to the customer, and accordingly give a great difference compared to department 2. The difference in question 17 is due to fact that department 2's perceptions of customer expectations is that the customer will be dissatisfied if the feature does not exist. Department 2 also considers that the customer ranks issue 21 high, and that feature is attractive and can give rise to a lot of

dissatisfaction if it is lacking, which the department does not agree with. It may also be noted that the two departments ranking of the features is much more narrow compared to difference in ranking between customer and company groups.

Table XVI Distance d and coordinates for the four questions with largest distance between departments

Questions		14	17	3	21
d_i =distance		0.84	0.64	0.62	0.55
S= satisfaction	Department 1	0.50	0.50	0.33	0.83
	Department 2	0.00	0.25	0.00	0.50
D= dissatisfaction	Department 1	0.67	0.83	0.50	0.67
	Department 2	0.00	0.25	0.00	0.25
R= relative ranking	Department 1	0.38	0.92	0.67	0.71
	Department 2	0.31	0.81	0.81	0.56

Anchoring customer voice

To eliminate the differences that may exist internally and the anchoring of customer requirements at the company, customer responses in the survey might be used. Disagreements between the departments about customer requirements should be eliminated as far as possible. In Table IV customer replies are included in those questions where in-house disagreement is greatest. Customers feel that feature 14 is neither attractive nor necessary, which is in good agreement with what department 2 has perceived. For department 1 it is important to realize what the customer's voice is and obey it. With regard to questions 3 and 17 it is important that these attributes remain, otherwise there is a risk of widespread dissatisfaction among the customers. Department 1 perceives a more clear picture about how customers prioritise the features. However, department 1 underestimates customer dissatisfaction and department 2 overestimates how attractive feature 21 is.

Table IV Coordinates for the four questions with largest distance

Questions		14	17	3	21
S= satisfaction	Department 1	0.50	0.50	0.33	0.83
	Department 2	0.00	0.25	0.00	0.50
	Customer	0.05	0.42	0.21	0.34
D= dissatisfaction	Department 1	0.67	0.83	0.50	0.67
	Department 2	0.00	0.25	0.00	0.25
	Customer	0	0.63	0.47	0.5
R= relative ranking	Department 1	0.38	0.92	0.67	0.71
	Department 2	0.31	0.81	0.81	0.56
	Customer	0.37	0.82	0.8	0.68

Discussion

As the customer group in the study cannot be considered as representative group of customers the results are of little use for the company. The method as such, however, shows clearly how the company may operate when identifying, updating and anchoring customer requirements.

If people with different backgrounds and with different positions and functions are involved, it might lead to difficulties with vision, communication and coordination in time, which was also pointed out by Clark and Fujimoto (1991). Therefore, a deeper analysis should be carried out at the company to find the reason for the difference in customer expectations and company perceptions of customer expectations. The difference might highlight a problem due to not accurately knowing and understanding what the customer expects. Insufficient dialogues with customers or unwillingness to investigate customer expectations are other explanations. The proposed method can be used to close this gap. However, for the company, it is essential to constantly update customer requirements, as customer requirements change with time. There is a lifecycle perspective in categorisation of customer requirements (Kano, 2001). This process requires an effective internal process, so that a coherent internal picture of the customer requirements is obtained. Therefore, regular surveys should be carried out.

Conclusions

The case study of a climate control system for an automobile clearly illustrates where the internal image of the customer is coherent and which opinions differ. The results from the comparison of a customer survey and the in-house company survey provide new insights into the company. New knowledge is captured and is used as a measure of the method's effectiveness. Furthermore, the process also contributes to clarification and support of the customer requirements at the company.

The parallel process with two surveys will make it easier to observe changes in customer requirements and allow the customer's voice to be heard at several levels of management. The results are also of great value when prioritising development projects.

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Co-opetition Strategy in Business Excellence: Confronting the Economic Crisis

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Key words: Co-opetition Strategy, Business Excellence, European Business Excellence Model, Value Added Processes, Economic Crisis

Introduction

Nowadays, the unsteady and fragile economic, social and business environment strongly imposes new approaches in management for companies and organizations that wish to better understand and more efficient manage their key business processes. Within this new external environment, companies should look up and adopt new approaches, in order to achieve their strategic goals, satisfy their customers and continue to operate.

Even though the external business circumstances are demanding and difficult for many countries in Europe and worldwide, managing and measuring Business Excellence is increasingly important for the attainment of an efficient and continuous business operation. The current, new situation, though, underlines also, the need for developing and establishing better partnership relationships with stakeholders and even competitors, when the common goal is better quality and satisfied customers.

This reality, that today's companies face, gave the authors the inspiration to combine basic concepts from two apparently different management areas, i.e. Strategic Management and Total Quality / Business Excellence Management and suggest an integrated approach for utilizing good practices for partnership and value added processes in the context of Business Excellence Models.

Therefore, in this paper the authors present the basic idea of the "Co-opetition Strategy" and interrelate that with the most known and widely used Business Excellence Framework in Europe, the European Business Excellence Model (EBEM). This way the arisen by this study approach will help organization understand that Business Excellence and Strategic Management can be interlinked and new partnerships and networks establishments can be used and contribute to continuous improvement.

Literature Review

Co-opetition Strategy

Cooperation between different independent organizations to achieve mutual goals is a prerequisite for global competitiveness and innovativeness. Organizations have

increasingly formed alliances with other parties to gain a better position in the market and create competitive advantages. Drucker (1996) stated that *“The greatest change in corporate culture, and the way business is being conducted, may be accelerating growth of relationships based not on ownership, but on partnership”*.

The question whether a firm should choose to either cooperate or compete, or if it should try to combine both competition and cooperation, has become a strategically important issue. According to Harbison & Pekar (1998) at least 50% of all new alliances are alliances between firms in the same industry. Therefore, organizations collaborate with their stakeholders, even competitors, in order to develop collaborative networks and have access to complementary resources and capabilities. This new mindset is called Co-opetition. The term “Co-opetition” was first used by Raymond Noorda (1993), the founder and first CEO of Novell and it was developed by Brandenburger and Nalebuff (1996), the authors of the book “Co-opetition”. Brandenburger and Nalebuff (1996) defined Co-opetition as *“cooperation when it comes to creating a pie and competition when it comes to dividing it up”*.

Co-opetition is based on game theory where business is a game with multiple players who play multiple roles and there are multiple winners. According to game theory, organizations have to understand the position of other organizations in the market as well as their own position. The philosophy of Co-opetition is that the success of an organization does not necessarily mean the failure of others. Instead, competing organizations may obtain more benefits at the end and generate positive-sum games. According to Brandenburger & Nalebuff (1996), there are five PARTS of a business game:

- Players
- Added value of each player
- Rules of the game (such as laws and contracts)
- Tactics which the players follow to change the perceptions of other players and
- Scope of the business game in which there are no actual boundaries.

Furthermore, Brandenburger & Nalebuff (1996) developed a framework which is called “Value Net” in order to depict the interdependence among different players of a business game:

- The focal firm,
- Its suppliers,
- Its customers,
- Its complementors and
- Its competitors.

This framework includes a network of co-opetitive relationships in which organizations “play” multiple roles and look for complementary partners to create value (Figure 1). Brandenburger & Nalebuff (1996) define complementors as players whom their products are valued more when they combine them. For example, a software company needs a hardware company to improve and market its products or services.

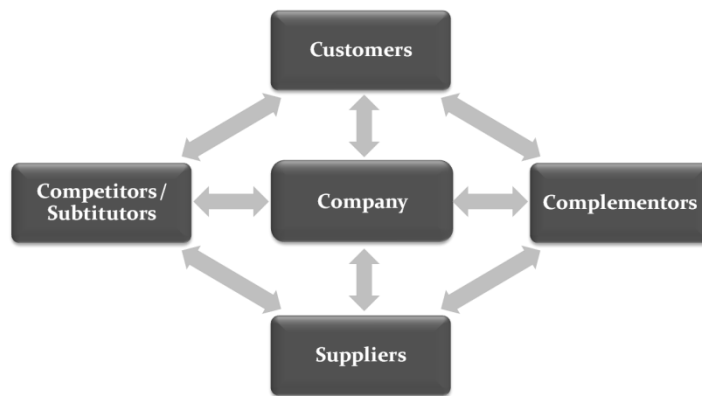


Figure 1: The Value Net - Source: Brandenburger & Nalebuff (1996), p. 16.

Bengtsson & Kock (2000) defined co-opetition as collaboration between two direct competitors in activities far from the customer and at the same time competing for market share. For example, the manufacturing departments of two organizations may cooperate and at the same time the marketing departments may compete. The reason why organizations involve in such a complex and dynamic relationship is that they cannot generate and develop products or services by themselves due to increasing R&D costs, high risks and limited resources and capabilities. Thus, competing organizations possess relevant resources and capabilities, face similar challenges and have market commonality (Gnyawali & Park, 2009). Therefore, it is crucial for them to cooperate not only with suppliers, customers and complementors, but also with competitors.

But, co-opetitive relationships have benefits and costs. According to Gnyawali & Park (2009), the benefits from a co-opetitive relationship are:

- Scale economies
- Uncertainty and risk reduction
- Product development acceleration

On the contrary, the costs from a co-opetitive relationship are technological risks, management challenge and loss of control.

Organizations cooperate through knowledge and resource transfer to create value, which is considered to be a collective action and compete to exploit and appropriate the created value, which is considered to be an individual action. Hence, they have common interests when it comes to value creation and diverse interests when it comes to value appropriation:

- Value creation arises from cooperative activities and is *“The total sum of value that is created collectively in joint innovation efforts, combining the assets of different stakeholders”*.
- Value appropriation arises from competitive activities and is *“The individual share of the value that a firm can capture from the generated value-knowledge”* (Ritala & Hurmelinna-Laukkanen, 2009).

Co-opetition is considered to be a multifaceted and multidimensional strategy. Dagnino & Padula (2002) support that co-opetition is the integration of cooperation and competition where organizations have partially convergent interests in order to create

new value. Thus, they term the interdependence among different organizations as a “Co-opetitive system of value creation”. Through this system, organizations exchange and create value to become more competitive and gain competitive advantages over other competitors.

Moreover, according to these authors (Dagnino & Padula, 2002), there are two kinds of co-opetitive relationships for value creation:

- Dyadic that is referred to the relationship between two competing business organizations whether on one or more levels of the value chain.
- Network that is referred to the condition that more than two organizations cooperate and compete at the same time along one or more levels of the value chain.

An example of dyadic co-opetition is the joint venture between Sony and Samsung for the development and production of 7th generation liquid crystal display (LCD) panels for flat screen TV’s. This partnership was critical for both firms because they could not develop LCD technology in isolation. The bottom-line was a win-win scenario as the two firms combined their strengths in order to extend the flat-screen industry (collective action) and increase their market share (individual action) (Gnyawali & Park, 2011).

An example of network co-opetition is the case of SAP, an ERP software provider, which has developed a business ecosystem with vertical, transversal and horizontal relationships in order to create synergies. The business ecosystem was composed of different players, such as clients, providers, research institutions and other companies and it was beneficial for all participating players (Gueguen & Pelleguin-Boucher, 2004).

Summing up, Co-opetition strategy implies that organizations perform better when they are involved in competitive and cooperative relationships at the same time and combine their complementary strengths to create synergies. As Afuah (2000) stated, “*Co-opetitors are considered as critical sources of innovation, organizational learning and complementary resources and capabilities*”.

According to the above, it is obvious that the key objective of Co-opetition synergies is the value creations for all stakeholders. Therefore, it is crucial to present at this point some definitions of value adding processes, before continuing with the integrated suggested approach of Co-opetition and EBEM.

Value Adding Processes

According to Davenport & Short (1990) a business process is, “*a set of logically related tasks performed to achieve a defined business outcome. Also, business processes normally occur across or between organisational sub-units. Processes are generally independent of formal organisational structure*”, while Lin et al. (2002) define a business process as “*a series of activities, often involving several organisational units and operated by actors (humans or machines) that are aiming to create value for customers*”.

More specifically, in the context of Business Excellence and particularly EBEM, the development of a framework of key processes, in order the organization to focus on the

vital few and important processes (EFQM Assessor Scorebook, Criteria 2 & 5) is supported.

Value, on the other hand, according to Ilyas *et al.* (2006), is “any activity that increases the market form or function of the product or service; and there is a need to maximise the value of every process in a business”.

Today’s organizations create and manage a framework of key processes, so to deliver their strategy in a way that adds value for their stakeholders. Therefore, what it’s really important is the recognition of the value added processes. According to Normann & Ramirez (1993) “Strategy is the art of creating value and allows a company’s manager to identify opportunities for bringing value to customers and for delivering that value at a profit”.

Thus, a “Co-opetition Strategy” approach in accordance with EBEM’s fundamental concepts and criteria could be the answer in the development of a key value added process framework, through collaboration, networks establishments and partnerships even in some cases with competitors.

The European Business Excellence Model

Over the last years organizations in Europe have shown an increasing focus on evaluating their business performance by deploying Business Excellence concepts and frameworks. Of the Business Excellence Frameworks available, the European Business Excellence Model is one of the most known ones (Figure 2).

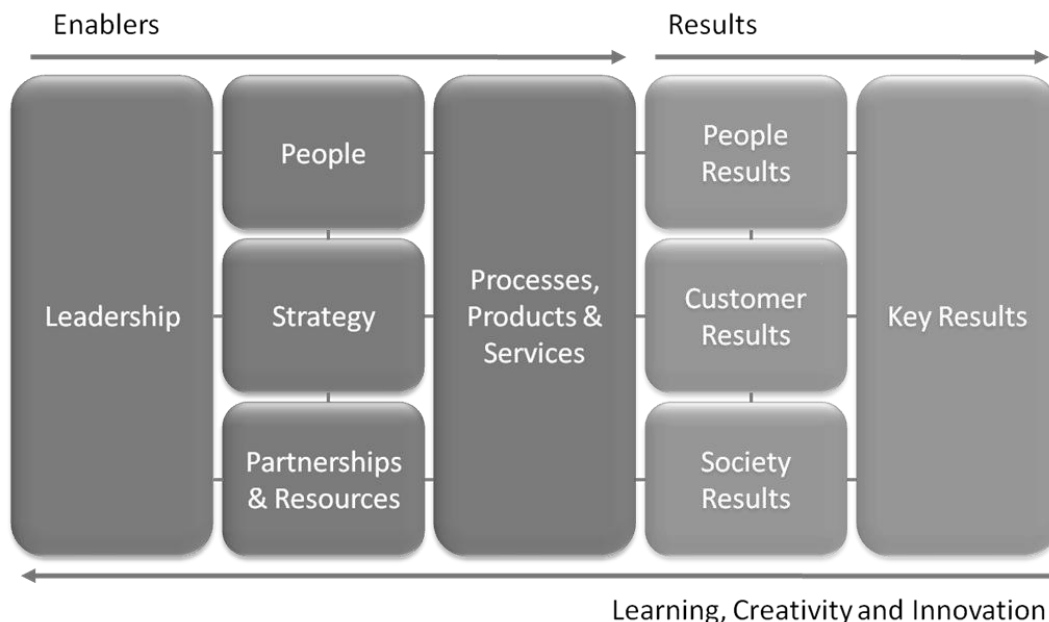


Figure 2: The European Business Excellence Model (EFQM®) - Source: [http://ww1.efqm.org/en/PdfResources/EFQM Ex Mod Teaser.pdf](http://ww1.efqm.org/en/PdfResources/EFQM_Ex_Mod_Teaser.pdf)

As it shown on Figure 2, it is based on 9 Criteria. The first five of these are the “Enablers” Criteria and the last four are the “Results” Criteria (business results for shareholders, customer satisfaction, people satisfaction and impact on society). It can be considered to be proactive model, because it defines five Enablers of the above results: Leadership, People Management, Strategy, Partnerships & Resources and Processes, Products and Services. It is also considered as a holistic and integrative approach, where strategic, managerial and operational control processes are integrated in the model (Vorria & Bohoris, 2009).

Co-opetition Strategy and Business Excellence: The EBEM

Many people believe that it is either too expensive or even impossible to implement such frameworks and especially in countries that are facing economic and social changes. This paper aims to prove that this statement is not true. When companies truly understand their own needs, goals and objectives, adapt easier in the new environment by establishing partnerships and by enriching their strategic plans with Business Excellence requirements.

As previously mentioned, the “Co-opetition Strategy” approach is based upon building partnerships with stakeholders, and even competitors, as to create value for customers. Moreover, the process of collaboration between co-opetitors is considered as critical source of innovation, organizational learning and complementary resources and capabilities.

In more detail, organizations applying the “Co-opetition Strategy” approach develop and maintain trusting relationships with various partners, including stakeholders within and beyond the supply chain (suppliers, buyers, competitors, research institutes, etc.). These collaborative relationships aim at the development of win-win situations for all co-opetitors and the creation of value for customers. The process of value creation is based on accessing complementary resources and capabilities and developing innovation within collaborative networks.

The Value Creation Network is presented in Figure 3:

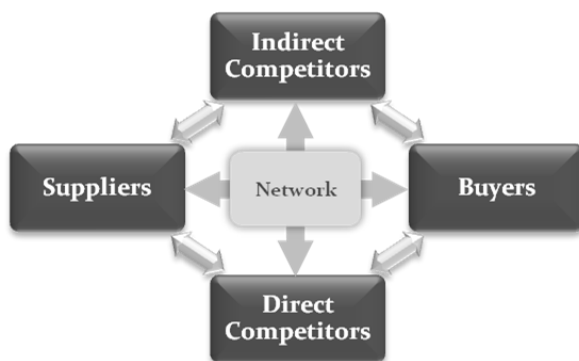


Figure 3: The Value Creation Network - Source: Adapted from Brandenburger & Nalebuff (1996)

Stakeholders within and beyond the value chain are cooperating in order to create value for the customer. It includes the interactions of suppliers, buyers, direct competitors (competitors and substitutors) and indirect competitors (complementors, research institutes, etc.). This collaboration is originated from the organizations’ co-opetition

strategy, enhanced with the value creation process. Value is created through accessing complementary resources and capabilities and developing innovation within the collaborative network. The co-opetitors' objective is to create a new market or expand a current one.

As an attempt to combine the literature review of the “Co-opetition Strategy” approach with EBEM Criteria and Concepts, it is obvious that:

- Two (2) ‘Enablers’ Criteria strongly underline the importance of the existence of strategic approach of collaboration as “Co-opetition Strategy” approach:
 - Criterion 2: Strategy
 - Criterion 4: Partnership and Resources.
- Four (4) of EBEM’s Fundamental concepts support this “Co-opetition Strategy” approach:
 - *Adding Value for Customers*: The main mission of all is the sustainable customer value.
 - *Building Partnerships*: Main objective is the development of a win-win situation with all partners and the maintenance of value adding partnerships. These partnerships may be formed with customers, society, key suppliers, educational bodies or Non-Governmental Organizations (NGOs).
 - *Management by Process*: The value added management depends on independent and interrelated systems, processes and facts.
 - *Nurturing Creativity and Innovation*: Main objective is value creation through innovation by harnessing the creativity of their stakeholders (<http://www.efqm.org/en/Home/aboutEFQM/TheEFQME ExcellenceModel/FundamentalConcepts/tabid/169/Default.aspx>).

The alignment of the “Co-opetition Strategy” approach and EBEM Criteria is presented in Figure 4. Organizations that are using both the “Co-opetition Strategy” approach and EBEM, focus on the Strategy, Partnership & Resources and Processes, Products & Services Criteria, concluding in Customer, Society and Key Results improvements. These improvements come from the implementation of the Value Creation Network, which leads to learnability, creativeness and innovability, and sustainable competitive advantages. Moreover, the importance of Strategy and Partnership & Resources Criteria is also stressed out in the revised EBEM 2010, in which these Criteria’s weights have been increased (Criterion 2 from 90 to 100 and Criterion 4 from 80 to 100).

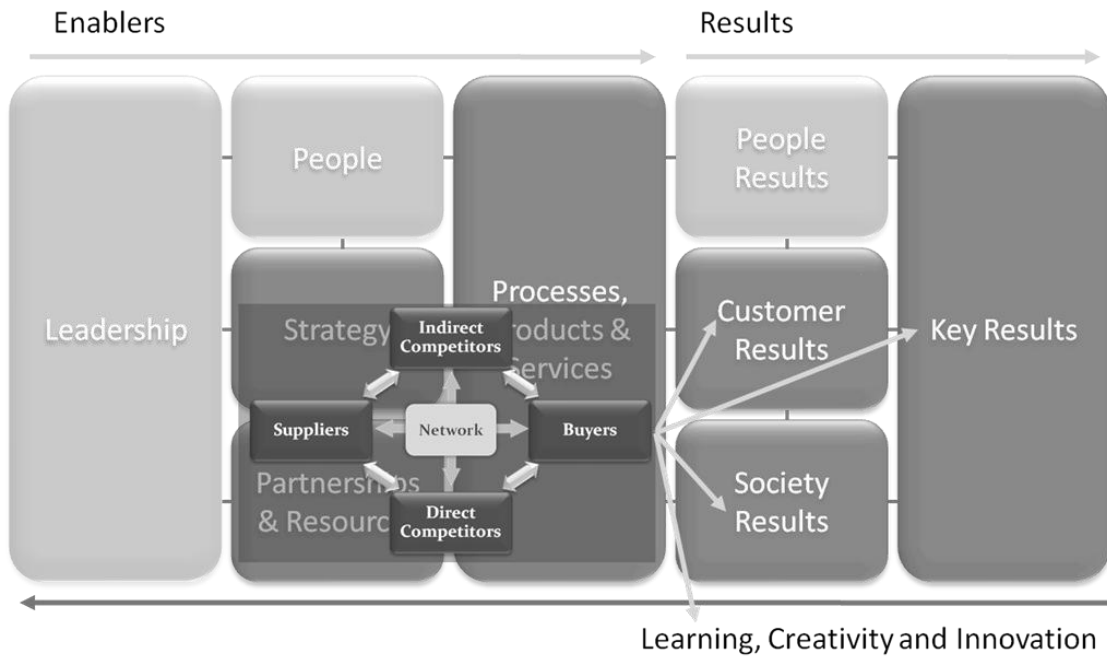


Figure 4: Co-opetition & EBEM alignment

It is also true that as the fundamental concepts of excellence affect each criterion of EBEM, these previously mentioned EBEM’s fundamental concepts affect Co-opetition, as well (Figure 5):

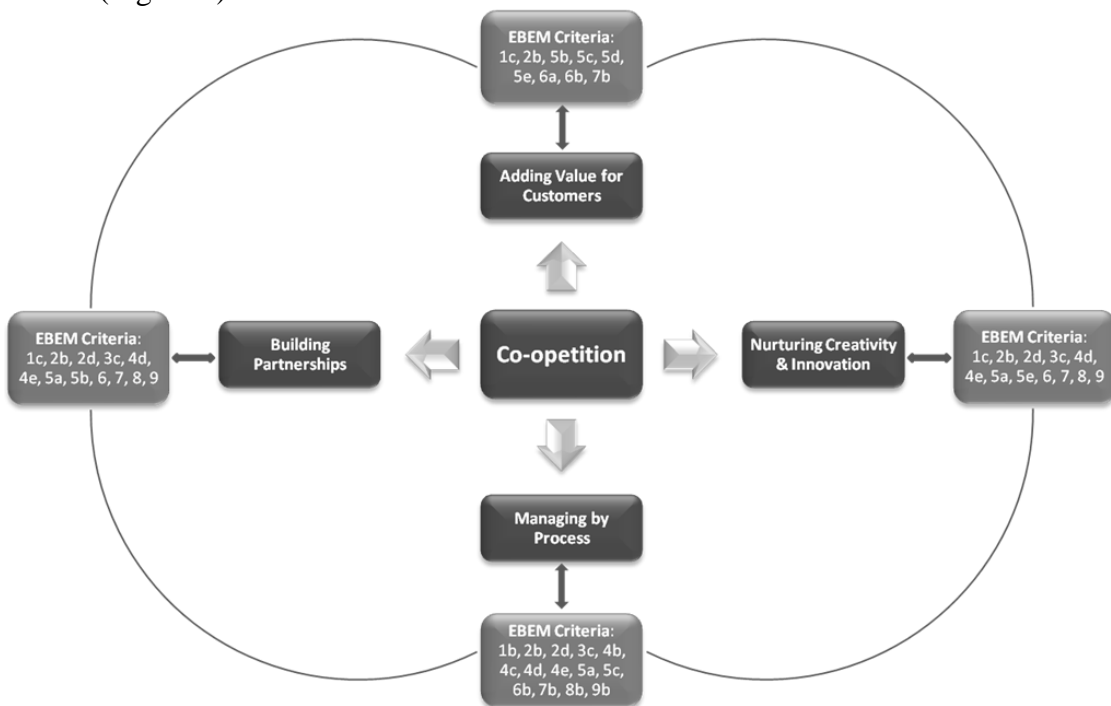


Figure 5: Co-opetition, EBEM’s Fundamental Concepts & EBEM’s Criteria

As it is shown, “Co-opetition Strategy” approach is based on these concepts and through the logic of the red thread (the sub-criteria of EBEM that these fundamental concepts affect directly or indirectly) in EBEM, it becomes obvious that these two approaches are strongly interrelated.

Conclusions and Further Research

The unsteady economic business environment has forced companies and organizations to act towards a direction with more collaborations and partnerships. Within this climate, companies should decide their strategic planning with focus on stakeholders adding value. This paper presented the concept of “Co-opetition Strategy” in alignment with EBEM’s Criteria requirements.

“Co-opetition Strategy” approach can be used by organizations to create value through collaboration with their stakeholders, even competitors, in order to develop collaborative networks and have access to complementary resources and capabilities. “Co-opetition Strategy” approach is based on the same fundamental concepts EBEM is based on, and can be aligned with EBEM for organizations to gain sustainable competitive advantages. These co-opetitive relationships can be either dyadic or network and aim at the development of win-win situations for all co-opetitors and the creation of value for customers. The process of value creation is based on accessing complementary resources and capabilities and developing synergies through collaborative networks.

This paper is only a part of the authors’ attempt to study through literature and under the prism of Business Excellence the implications of “Co-opetition Strategy” approach with Business Excellence Models. Another future aim is to examine whether “Co-opetition Strategy” can be applied in alignment with other Business Excellence Models, and whether co-opetition through Business Excellence Models is more effective than being applied completely separate. Moreover, the authors suggest that further examination of the above theoretical approaches with empirical data is required, in order to establish the previously arisen concepts.

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Cross-disciplinary method for predicting and reducing human error probabilities in manual assembly operations

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Key words: Methods Time Measurement, Expert System for Task Taxonomy, Manual Assembly Operations

Category: Research paper

Introduction

In the planning process of manual assembly operations it is the main objective of the work preparation department to create conditions that allow assembling products as economical as possible. In current practice the responsible planning team is currently focused primarily to an optimization of the time scheduling and therefore tries to achieve the aim of cost-efficient manual assembly processes via an optimal use of the time factor. For this purpose, assembly planners often use planning tools like MTM (Methods Time Measurement) to predetermine the time that is needed to assemble a product.

However, besides the execution time a considerable part of the assembly costs is determined by a faulty performance of the employees which are involved in the assembly process. Depending on several factors like complexity, installation equipment and human factors there is a process-individual quantifiable error risk of each assembly process (Refflinghaus, 2008). Although human mistakes during manual assembly operations in complex technical systems can cause serious and also costly consequences for the company and its environment, the error risk resulting from a faulty performance of employees is currently often not sufficiently taken into account during the early stages of the assembly planning process. According to current practice, the determination and evaluation of process-individual error risks is not considered during the process of assembly planning but only takes place in the temporally subsequent quality planning, or even in the current manufacturing operations.

This paper presents a method that is suitable to evaluate human reliability in manual assembly operations. In applying the new method it will be possible to evaluate potential human failures already at the beginning of the assembly planning process. So, the new method allows quantifying potential human error rates in assembly operations before the start of production and also allows comparing planning alternatives under time and cost aspects early. By this new base, in the future the user will be able to plan manual assembly operations not only time-optimized but also quality-optimized. In this way beside the costs of assembly time also the error costs should be reduced prospectively.

Human reliability

When dealing with the issue of human errors often the concept of HRP (Human Reliability Probability) is used. In this context, human reliability is defined as the ability of a person to fulfil a task acceptable under given conditions for a given time interval (VDI 4006-1, 2002). In order to determine the human reliability the user firstly has to determine the HEP (Human Error Probability). The HEP itself is defined as the ratio of the measured errors (n) and the number of repetitions of the task (N).

$$\text{HEP} = n / N$$

(1)

$$\text{HRP} = 1 - \text{HEP} = 1 - n / N$$

(2)

These formulas show that the Human Reliability Probability is defined as the complement of the Human Error Probability.

The following sequence presents some methods which are often used for determining human reliability and analyses their suitability to predict human error probabilities in manual assembly operations.

Tools for predicting human reliability

According to the VDI guideline 4006 the methods for determining human reliability can be divided into three fundamentally different types of HRA-methods (Human Reliability Analysis) – time-based methods, task-based methods and methods which predict the HEP via analysing various performance shaping factors (PSF) (Kim, 2006).

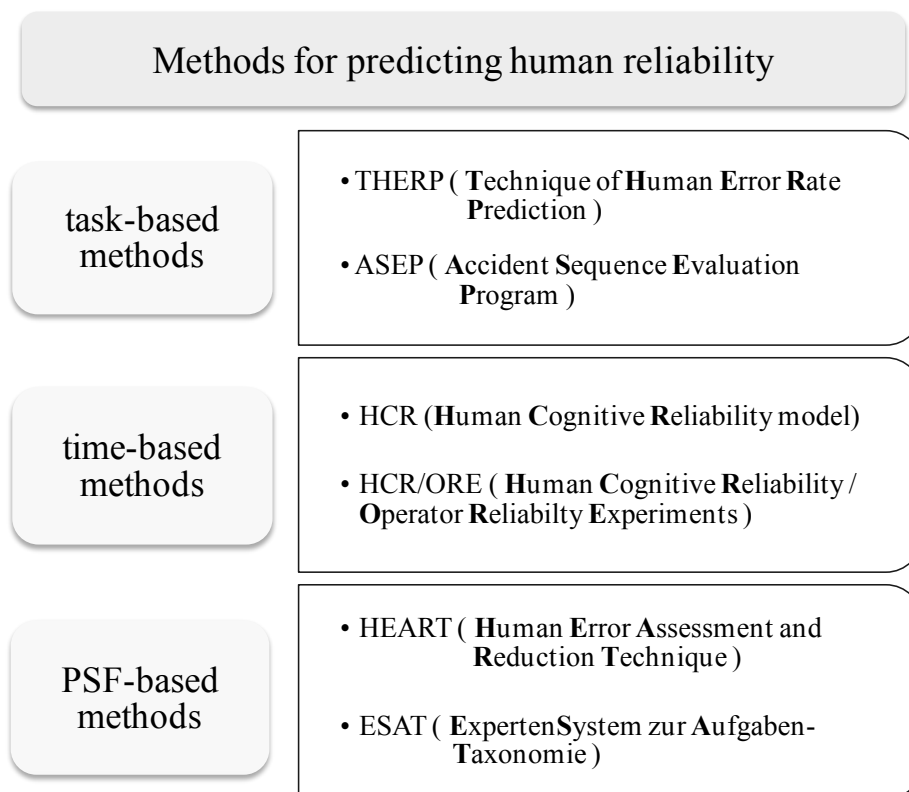


Figure 1: Extract of HRA-methods (VDI 4006-2, 2003)

Time-based methods are based on generic relationships between the Human Error Probability and the time which is available for the execution of the considered task (VDI 4006-2, 2003). In simple terms this means: the smaller the time available to fulfil the considered task, the higher the resulting HEP.

The first step of time-based methods always deals with determining the time which is required to fulfil the considered task. This is usually done through a detailed analysis of the entire work system. Depending on the considered work item, which must be assigned to a task category, the user then is able to calculate the expected error probability by using tabulated reliability-time-curves.

The main application of time-based methods are cognitive tasks that need to be done in case of a system failure within a limited timeframe in order to prevent losses for the security of the whole system (Rabe, 2007).

Commonly used time-based methods are, for example, the methods HCR (Human Cognitive Reliability model) and HCR/ORE (Human cognitive Reliability/Operator Reliability Experiments) (VDI 4006-2, 2003). The HCR model is a method which is based on experimental error research. In these experiments, it was found out that the human error probability depends on the type of action - which can be divided into skill-based, rule-based and knowledge-based activities - and also depends on the time which is available to fulfil the task. Based on these data the user is able to predict error probabilities for different types of tasks by using a three-parameter Weibull-distribution (Hennings, 1995). The HCR/ORE method represents an evolution of the HCR model and allows a more detailed error analysis by distinguishing not only incorrect and correct actions but also different error types.

The task-based methods divide the area to be examined into individual sequences of action and link these actions to previously studied, already known and tabulated HEP values. In order to determine the human reliability, it is often part of the task-based-methods to generate so-called human reliability analysis event trees. The widely used method of this category is the Technique for Human Error Rate Prediction (THERP). In general, THERP is the best known method for evaluating human reliability and was originally developed for the prospective assessment of human errors in nuclear power plants (Swain, 1983). Its approach of determining human reliability is similar to the determination of technical reliabilities. The method allows assigning probabilities to identified human errors by using existing probability tables. On this basis, through the preparation of a fault tree the overall reliability of the considered system can be determined (Heinz, 2001).

The quantification of human reliability via using a PSF-based method is always based on the identification and evaluation of factors that may have a negative effect on the human performance. The calculation of the HEP-values themselves is done by the interpretation of various models which explain the effect of performance-influencing factors. Frequently used methods of this group are, for example, the methods HEART (Human Error Assessment and Reduction Technique) and ESAT (Expert System for Task Taxonomy).

HEART (cf. Williams, 1988) is in comparison to other tools for the quantification of human reliability a method that is easy to handle. First of all, by assigning it to one of

eight predetermined classes of error probabilities an approximate classification of the considered task takes place. The next step of the procedure deals with assigning error-producing conditions to the considered task (VDI 4006-2, 2003). The overall reliability of the considered task then is defined as the result of a multiplication of the nominal error probability and the performance-influencing factors.

ESAT is a method by which any tasks that need to be done in a working system can be evaluated with regard to the human reliability in the task execution (Brauser, 1990). The reliability analysis is based on a detailed task description and is done by classifying the considered task into ten reliability classes with monotonically increasing width.

Thereby, the calculation of the time that is available to fulfil the considered task and the determination of various performance shaping factors are the most important parts of the calculation process (Lolling, 2003).

Suitability of HRA-methods for evaluating human reliability in manual assembly operations

In addition to the general suitability of a method for the considered field of application, the following criteria need to be considered (Wischniewski, 2010):

- Theoretical validity, numerical precision and reproducibility
- Completeness and scope of the method
- Cost/benefit ratio and resource requirements
- Usability and acceptance of the method

The evaluation of the considered methods through the criteria mentioned above led to the following conclusions:

The use of time-based methods for analysing human reliability in manual assembly operations does not seem appropriate, since these methods are tightly focused on the evaluation of cognitive processes. For manual assembly operations, however, cognitive processes are limited to a few informational perceptions that need to be done simultaneous to the sequences of action (Landau, 2007).

Task-based methods are also not adequate for the analysis of human reliability in manual assembly operations, because they are very much focused on their original application field (safety critical industries like aerospace engineering or nuclear engineering). For this reason, the existing error probabilities which are collected in big data tables are very application-specific. Thus, the transferability to manual assembly operations is very limited. Furthermore, in most cases analysis results prepared with task-based methods are not entirely reproducible (Lolling, 2003).

After a detailed examination the use of a PSF-based method seemed to be an appropriate way for analysing human reliability in manual assembly operations. In particular the ESAT-procedure seemed to be the most appropriate method, because by using this method it is possible to evaluate any tasks that need to be done in a working system concerning their human reliability.

Like most of the other HRA-methods also ESAT was originally developed for evaluating human error rates of control and surveillance activities in safety critical areas. However, in the recent past the ESAT-method has been adapted for other

application fields with sufficient accuracy. New applications of the method are for example the analysis of human reliability in picking activities (Lolling, 2003) and the determination of human reliability in preparation activities in the highly varied series production (Wischniewski, 2010). In both of these applications previously unrecognized potential for improvement could be highlighted by using the ESAT-method.

The use of ESAT for evaluating human reliability in manual assembly operations

In this section the suitability of the ESAT-method for evaluating human reliability in manual assembly operations is verified by performing an error analysis of the manual assembly operation “insert a new component”. In this context it will be shown, whether and how its work content can be depicted by the ESAT-method.

In contrast to the traditional use of the ESAT-method in this paper a method is presented which allows not only analysing whole job contents in terms of their risk potential but also individual task items. Through this procedure it will be possible to create a data pool which contains a variety of task items and their error probabilities. As a result, the user for the first time will be able to assemble different types of manual assembly operations out of this data pool, to evaluate their error probabilities and to compare design alternatives concerning their risk potential before the start of production.

The ESAT-procedure can be divided into four different process steps (see figure 2).

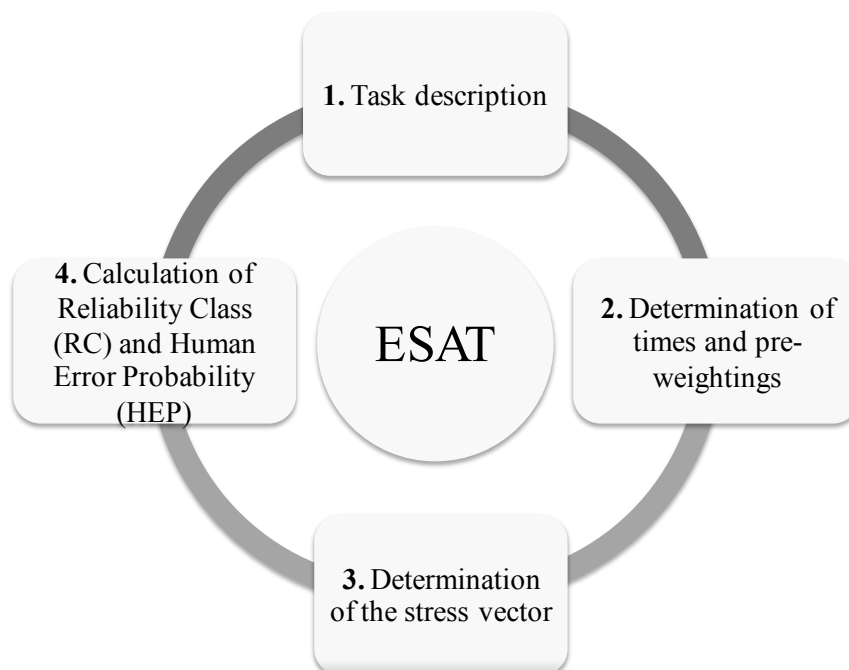


Figure 2: The ESAT-procedure

Task description

The first step of the ESAT-procedure is a detailed description of the considered task. For this purpose all actions and tools which are necessary to fulfil the task must be visualized in a process flow chart. To be able to determine the risk potential of

individual task items, the task “insert a new component” is initially divided into six sequences of actions.

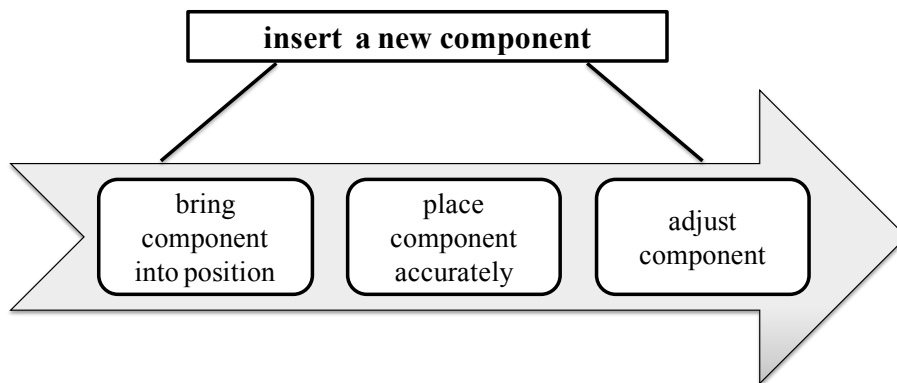


Figure 3: Division of the considered task into sequences of action

For determining the risk potential of each sequence of action via ESAT-calculation the ESAT-procedure requires also to analyze these sequences of action in more detail. For this purpose, all sequences of movement of the assembly operation “insert a new component” were finally divided into its task items. Figure 4 illustrates the division of one of the considered sequences of action into its task items.

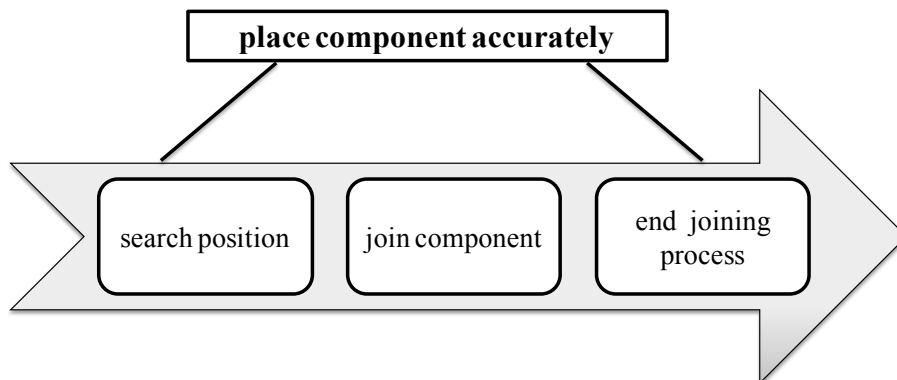


Figure 4: Division of a sequence of action into task items

The second pillar of the task description deals with determining manual errors that possibly could occur in the task execution. To identify potential errors various quality management techniques, such as failure mode and effect analysis, expert interviews, brain storming and Ishikawa-diagrams (see figure 5) or also fault records and available empirical knowledge, can be used. By identifying and structuring errors that potentially could occur in the task execution the user receives qualitative information of the risk potential of the analyzed manual assembly operation. In addition, the error analysis can be used to define variables and targets for a reduction of the calculated error probabilities, and thus contribute to process improvements.

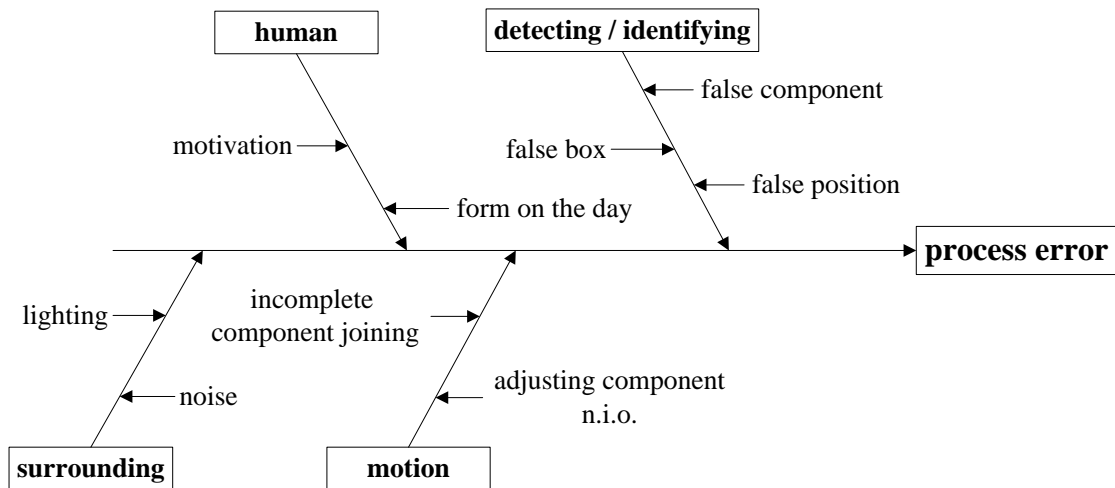


Figure 5: Error analysis of the considered task

Determination of times and pre-weightings

The second step of the ESAT-process is about reflecting the job description via transforming it into the standardized ESAT-language. For this purpose, the ESAT-database (cf. Brauser, 1990) which was determined by empirical research studies contains standardized terms, elemental times and pre-weightings (from zero to ten) for a first estimation of the potential risk of the considered task.

The following paragraphs illustrate some difficulties that may occur when transforming the job description into the ESAT-language.

For some standardized ESAT-terms there are no well-defined values for the pre-weightings but only value ranges. In these cases the selection of the value of the pre-weighting is up to the user. Whenever such a doubtful case occurred, in this case study the midpoint of the range of values was chosen to be the pre-weighting of the corresponding ESAT-term.

In some cases two or more different standardized ESAT-terms with different time-values and different pre-weightings seemed to be equally appropriate to reflect a term from the job description. In order to select the correct standardized ESAT-term, indeed there are some explanations concerning the meaning of the several standardized terms assembled in the annex of the ESAT-database, but these explanations are often not clear enough to allow an objective and reproducible selection of the right ESAT-term.

In contrast, sometimes the user is not able to select an ESAT-term that is suitable to reflect an individual element of the job description exactly. In these cases, it is necessary to draw assumptions and analogies to existing ESAT-terms.

The user should also take into account that the time-data in the ESAT-tables are merely a guide and must be adapted to the real business situation by the user of the ESAT-method. Therefore, it is useful to utilize time values that were determined by systems of predetermined times like “Methods Time Measurement” or “Work Factor”. Only then it will be possible to determine error probabilities that reflect the actual business situation.

To transform the job description of the considered task into the ESAT-language, first a textual description of each of its task items has to be done. Afterwards, the textual descriptions must be converted into standardized ESAT-terms by using the ESAT-database (cf. Brauser, 1992). As a result, the standardized terms of the considered task items must be recorded in a table of ESAT-terms - together with its corresponding times, pre-weightings and codes.

Figure 6 illustrates the resulting calculation table for the sequence of action “place components accurately” of the considered task “insert a new component”.

place
component
accurately

Job description	ESAT-term	Time (t)	Weighting (d)	Code
search position	identify	10	6	M6
	position	-	5	I9
join component	put down	20	2	H14
	article	-	1-2 → 1,5	Q6
complete joining	feel	15	5	P4
	power	-	6-8 → 7,5	I21
	syntax	-	0	S0
	end	-	0	EE
	sequence	-	4	I23

Figure 6: ESAT task analysis

The information given in figure 6 can be regarded as the starting point for the calculation of the Reliability Class (RC) and the Human Error Probability (HEP) of the considered task. However, before the user can start calculating RC und HEP at first the stress vector must be determined.

Determination of the stress vector

Based on the results of the first two steps of the ESAT-procedure, the calculation of the so-called stress vector which aims to consider performance-reducing factors in the task execution takes place. According to figure 7 the stress vector is composed of ten task factors like task complexity and task difficulty (PSF 1 and PSF 2), five personnel factors like experience and motivation (PSF 3), seven environmental factors like climate and illumination (PSF 4) and finally seven system factors like duration of work and safety (PSF 5).

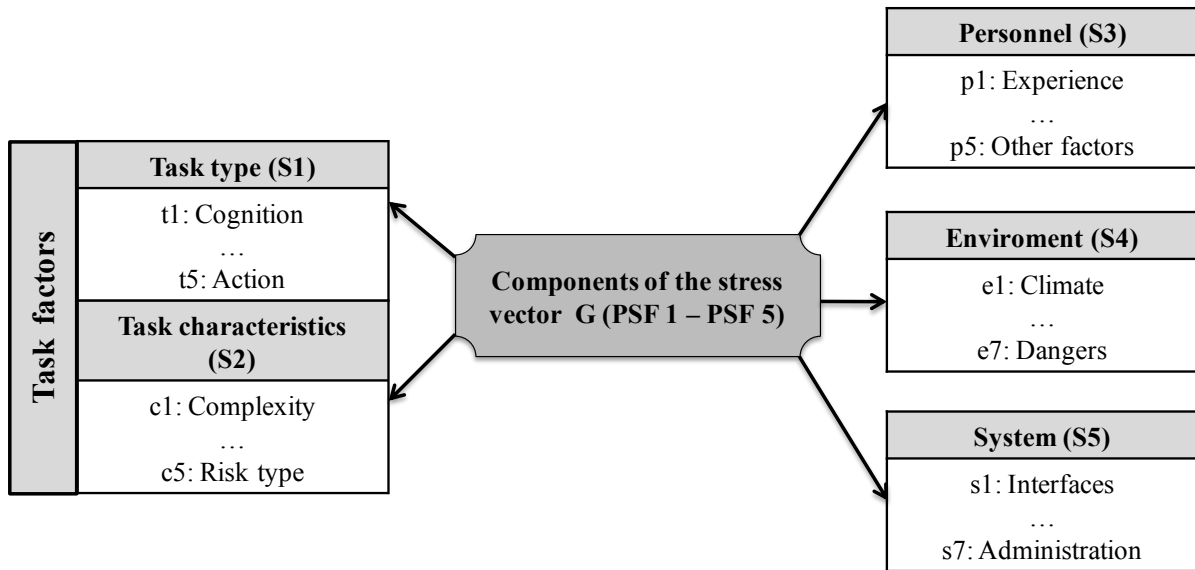


Figure 7: Structure of the stress vector

The task factors (PSF 1 and PSF 2) are calculated on the basis of the task description with its elemental times and its corresponding pre-weightings. In contrast, the performance shaping factors PSF 3 to PSF 5 must be defined by expert estimation. After determining the several PSF-components the calculation of the stress vector G takes place by adding its own components.

$$G = S1 + S2 + S3 + S4 + S5$$

(3)

In the following sections for the considered sequence of action “place component accurately” it is presented, how the stress vector was calculated and which numerical values the components PSF 1 (task type) to PSF 5 (system) assume.

The component PSF 1 (task type) takes into account the stress that results from task items that need to be executed simultaneously (Brauser, 1992). In such cases PSF1 assumes values >1 , otherwise PSF 1 assumes the value 1. In this example PSF 1 assumes the value 1, because there are no parallel task items.

For PSF 2, which considers the task characteristics, there is no general statement about its value, because it is directly influenced by the task description. Consequently, the individual components of PSF 2 must be determined separately for each sequence of action to be analysed by using the calculation formulas mentioned in the ESAT process description (cf. Brauser, 1992 and figure 6). For the example shown here (“place component accurately”) this means:

$$c1 \text{ (complexity)} = \text{number of task items} / 15 = 3 / 15 = \mathbf{0.2}$$

(4)

$$c2 \text{ (difficulty)} = \sum dij / \text{number of task items} = (0.24 + 0.15 + 0.55) / 3 = \mathbf{0.31}$$

(5)

$$dij = (t \text{ task item} / t \text{ total}) * \sum \text{weightings task item} / 10$$

(6)

In contrast to the determination of PSF 1 and the first two elements c1 (complexity) and c2 (difficulty) of PSF 2, the other three elements of PSF 2 (c3 to c5) and all elements of PSF 3 to PSF 5 are independent from the job description and therefore must be defined by the user or by expert estimation. Thereby, each factor assumes values on a scale from

zero (no influence) to one (very strong influence). It should be taken into account that usually approximately three to five elements assume nonzero values (Brauser, 1990). In light of this recommendation the following elements were determined to assume nonzero values:

- **c3** (corrections) = **0.2**, because errors in the sequence of action “place component accurately” can sometimes only be corrected with damaging the work piece.
- **e1** (climate) = **0.2**, because the climatic conditions were not optimal when performing the task.
- **p5** (other personnel factors) = **0.5**, because the task was performed by a normally experienced employee. According to the ESAT process description p5 should assume the value 1 if the task is performed by a normally experienced employee (Brauser, 1990). But according to the authors of this paper, the maximum expression of the range of the factor p5 should reflect an inexperienced employee. The recommendation in the ESAT description is therefore not followed and p5 were determined to assume the value 0.5.
- **s6** (tiredness) = **0.7**, because the task was performed at the end of a typical work day.

All other PSF-elements not mentioned yet were determined to assume the value zero, because they only have minor influence on the work performance of the employees.

In summary, the stress vector G of the considered task results in:

$$G = PSF 1 + PSF 2 + PSF 3 + PSF 4 + PSF 5 = 1 + 0.71 + 0.5 + 0.2 + 0.7 = \mathbf{3.11}$$

Calculation of Reliability Class (RC) and Human Error Probability (HEP)

After determining the stress vector G the Reliability Class (RC) of the considered sequence of action “place component accurately” can finally be calculated by using the following calculation formulas (cf. Brauser, 1990).

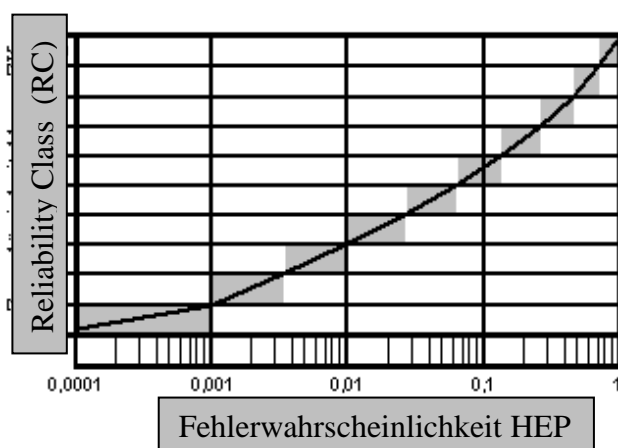
$$K(G) = 1.2 * G * \log G + S1 = 1.2 * 3.11 * \log 3.11 + 1 = 2.84$$

(7)

$$RC = \text{Integer}(K) < 11 = \text{Integer } 2.84 = 2$$

(8)

Here, the scale shown in figure 8 represents the basis for the classification of human error probabilities into ten reliability classes with monotonically increasing width. This scale has its origin in the past reliability research and has been adapted to other existing scales for subjective assessment of human performance (Brauser, 1992).



HEP _{min} (ZK)	HEP _{max} (ZK)	D(ZK)
0,7	1,0	0,3
0,45	0,7	0,25
0,26	0,45	0,19
0,133	0,26	0,127
0,062	0,133	0,071
0,026	0,062	0,036
0,0096	0,026	0,0164
0,0033	0,0096	0,0063
0,001	0,0033	0,0023
<0,0001	0,001	0,001

Figure 8: Reliability Classes, (cf. Brauser, 1990)

The last step of the ESAT-procedure is the HEP-calculation by using the following calculation formulas:

$$\mathbf{HEP} = \text{Fract} (K) * D (RC) + \text{HEPmin} (RC) = 0.84 * 0.0023 + 0.001 = \mathbf{0.0029}$$

(9)

$$D (RC) = \text{HEPmax} (RC) - \text{HEPmin} (RC)$$

(10)

$$\text{Fract} (K) = K - \text{Integer} (K)$$

(11)

$$\rightarrow \mathbf{HEP} (\text{place component accurately}) = \mathbf{0.0029}$$

Evaluation of Calculation Results

In the same manner as for the sequence of action “place component accurately” the reliability class and the human error probability can also be determined for all other sequences of action of the considered task and finally also for the total task. Here, the calculations are all based on the same assumptions about the several PSF elements. Thus, all calculations refer to the same stress vector $G = (1; 0.71; 0.5; 0.2; 0.7)$.

Table two illustrates the corresponding calculation results.

Table II: calculation results

Manual assembly operation : Insert a new component		
Sequence of action	RC	HEP
Bring component into position	3	0,003537
Place component accurately	2	0,002937
Adjust component	2	0,002039
Total task	3	0,003716

By using this table of results of the error analysis of the observed assembly operation “insert a new component” on the one hand the user can detect the human error probability of the total task and on the other hand the user can determine which sequences of action contribute most to the calculated HEP.

Analysing table 2 it is noticeable that the error probability of the total task is only a little bit higher than the error probabilities of the individual sequences of action. This takes into account that errors that were made in the execution of a preceding sequence of action can partly be corrected in the downstream sequences of action.

The overall objective of assembly planning is to reduce the calculated human error probability as far as possible. Here, the assembly planner can influence the HEP of the considered assembly operation on the one hand by changing the sequences of action or task items and on the other hand by modifying the marginal conditions.

However, changing the sequences of action in order to reduce the human error probability is predominantly applied in the analysis of larger assembly operations. In such a case it could be successful to replace a sequence of action with a high risk potential by a sequence of action with a lower risk potential. Moreover, to reduce the

HEP it is beneficial to replace sequences of action that need to be executed simultaneously by sequences of action that could be executed sequentially.

As mentioned before, another way to reduce the calculated human error probability deals with modifying its marginal conditions. The following list exemplarily illustrates which effect changes of the marginal conditions may have on the PSF-factors:

- An optimisation of the climatic conditions at the workplace leads to a change of PSF 4 (environment) $\rightarrow e1$ (climate) = 0.1.
- The scheduling of a very experienced employee leads to a change of PSF 3 (personnel) $\rightarrow p5$ (other personnel factors) = 0.2 because also a very experienced employee can make mistakes.

As the list above shows a modification of the marginal conditions especially affects the stress vector and result in a modified stress vector:

$$\mathbf{Gmod} = \text{PSF } 1 + \text{PSF } 2 + \text{PSF } 3 + \text{PSF } 4 + \text{PSF } 5 = 1 + 0.71 + 0.2 + 0.1 + 0.7 = \mathbf{2.71}$$

Taking into account the formulas (7) to (11) of the ESAT procedure the risk analysis of the modified assembly operation “insert a new component” for the considered sequence of action “place component accurately” results in $\mathbf{RC} = \text{Integer } 2.41 = \mathbf{2}$ and $\mathbf{HEP} = \mathbf{0.001943}$. Thus, by changing the marginal conditions of the considered assembly operation it is possible to reduce its human error probability significantly.

Summary and outlook

In this paper the suitability of ESAT for the evaluation of human reliability in manual assembly operations was verified by a risk analysis of the assembly operation “insert a new component”. In this context it was shown, whether and how the work content of a manual assembly operation can be depicted and evaluated by the ESAT method. Through an extension of the traditional use of ESAT it was demonstrated that the ESAT-method is not only suitable for analysing total assembly operations but also for analysing its individual sequences of action. Prospective, by using this new approach it will be able to create a data pool which contains a variety of task items and error probabilities of different typical assembly operations.

The creation of the addressed data pool and its validation in research projects with industrial partners from the automotive sector is part of the current research of the authors. Therefore, in first analysis six manual assembly operations (each assembly profile consists of about sixty task items) from the automotive industry were analysed and appropriate ESAT-data for its sequences of action were calculated. An initial comparison of the calculated ESAT-data and the actual error data of the industrial practice on the one hand led to satisfactory results and on the other hand demonstrated issues for further research.

As a result, by using the emerging data pool in future the user will be able to assemble different types of manual assembly operations out of this data pool, to evaluate their error probabilities before the start of production and to compare planning alternatives under time and cost aspects early.

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Idea of QUALITY versus idea of EXCELLENCE

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Key words: EFQM Model, quality management, change management, complementarity

Paper category: Conceptual paper

The Hypotheses

Excellence is the highest level of quality and is as such the goal of quality development efforts. EFQM Excellent Model is a model for quality management (EF-QM), and as such would be more appropriate, if the name would be **Quality Management Model**. With such a name, it would be demonstrated, that this is **not a new fad** replacing the idea of quality, but a tool to upgrade efforts for quality development of an organization. The name Excellence Award for recognized excellent organizations is not misleading, but the name Excellent Model is.

TEST OF HYPOTHESES

EFQM Model as a tool for development of organizations

EFQM Model is a very useful tool for developing quality in the direction of excellence. And in practice it is not applied only for assessment and recognition of excellent examples. It is applied mainly as an improvement tool for all organizations, regardless on the reached level of quality. By definition, the excellent level is a privilege of positive minority. If we want to honestly suggested this tool to all organizations, we must admit, that huge majority will never rich the excellent level. I am convinced, that mission of EFQM is not focused on supporting efforts only to excellent minority, but it is for **all organizations** on their way of development quality. We, professionals on the field of quality, are responsible to give to our customer honest clarification of fundamental ideas. Our marketing messages are often confusing our clients by forcing the use of a single tool. Quality movement is losing credibility with such irresponsible selling of EM as new fashion, which suggests between the lines that the idea of excellence can replace the idea of quality.

What can we learn from sports?

If we compare contest for Excellence Award and contest for Olympic Games, all are focused on different disciplines (in the case of organizations collected in the Model), but in the case of sports in names of disciplines is no word of excellence. Sports practices are not devoted only to best participants, bot to all participants. Pire De Coubertin, founder of the [International Olympic Committee](#), underlined: It is important to participate, not to win (*The important thing in life is not the triumph but the struggle, the essential thing is not to have conquered but to have fought well*).

Problems in the practice, caused by the name

Many organizations (mainly in public sector), whose management is unprepared to be responsible and actively involved in systematical quality management, use assessment with EFQM Model or CAF as an alternative for quality management and as an alibi, that they are responsibly active on the field of QM. We have situations that full beginners start to talk about excellence as an alternative for quality. They are as drivers – beginners, trying to run Formula One. Those situations are mainly quilt of those, selling them quick fix. But the name Excellent Model is them a big help. Those, who are allergic on classical long term heavy way of developing quality management, take this as a “methadone”. But we all know that there is no shortcut. One of the biggest obstacles to successful implementation is overcoming the tendency of many companies to latch on to the next management fad or to implement quality standards and improvements methodologies as a “program”.

On the other hand a lot of ISO practical applied QMS are too much bureaucratic and with too little value added. There is a symbiosis between management unwilling to involve and quality staff, which accept his “unique” role. Instead of developing QM documentation in the direction of knowledge management, many of “practical” quality experts are now “clearing” QM documentation to the level that is really less disturbing, but is also less helpful.

Is idea of excellence fashion fad, replacing the idea of quality?

The word “quality” typically has a narrower connotation associated with the quality of products and services the company delivers to its customers. But, businesses that have made quality an integral part of the way the business is designed, have successfully implemented a business strategy towards excellence. In these cases the meaning of the word “quality” goes beyond the quality of the products and services, and takes a broader meaning of maximizing the effectiveness of the business in meeting or exceeding customer value expectations. (Cobb, 2003) Use of EFQM Model is not another fad.

We can learn from the Ichak Kalderon Adizes’s thoughts about leadership (his blog, 2011): *»I would like to give a word of warning. In my judgment, this is another fad. We have seen the world »management« change over the years. At the beginning, the process was called »administration«. But when administration did not produce the desired results, the word administration was relegated to some middle management, to the bureaucrats. They still are administrators and a new word was created »management«. It was found, that administration is only a piece of the action and what we really need to amplify and to understand the concept in a much wider way. That didn't work either. The management process did not produce the results that were expected, so a new fad emerged. And it's the word executive – CEO-Chief Executive Officer. And the word management was relegated to »middle management«. Executives are much higher level. Now the word »executive« is not doing very well either. So now the new word has emerged: »Leadership«. It is the same lady in a different dress. We have not changed the paradigm of our thinking. We believe that by changing the name, when amplifying the concept, we are actually changing the phenomenon. But we are not. Or it's an administrator, a manager, an executive or a leader – the paradigm is still*

staying the same. And that's why it will not work. What we need is **complementary team**. «

If we make a parallel between management and quality management, we can realized, that on the field of quality management “**the same lady was in different dresses**”, from quality control, quality assurance, quality management, total quality management and finally management for Excellence. Many businesses have succumbed to the program du jour management trap, jumping from one management philosophy to the next looking for the ultimate solution.

When a need forced us to amplify the concept of quality, new elements must not be replacement for already existing ones, but a complementary addition.

Theory finds these complementary activities in different styles of managements which are represented with PAEI types (Adizes, 2011). And what types of quality management can we recognize?

Three types of quality management styles

Three different qualities

From Attractive Quality theory (Kano, 1997) we learned about objective and subjective perception on Quality what lead us to three different qualities:

- must be quality (fulfillment of demands),
- competitive quality (fulfillment of expectations) and
- attractive quality (fulfillment of new needs).

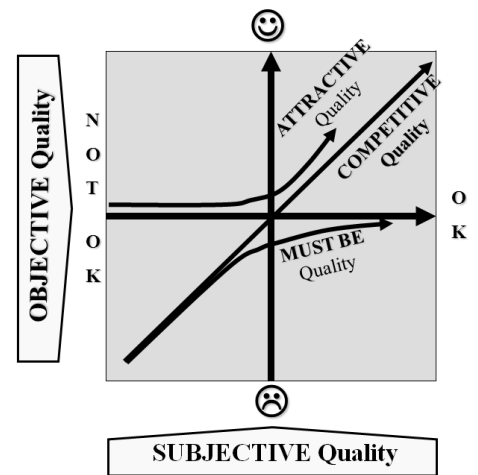


Diagram 1: Attractive Quality

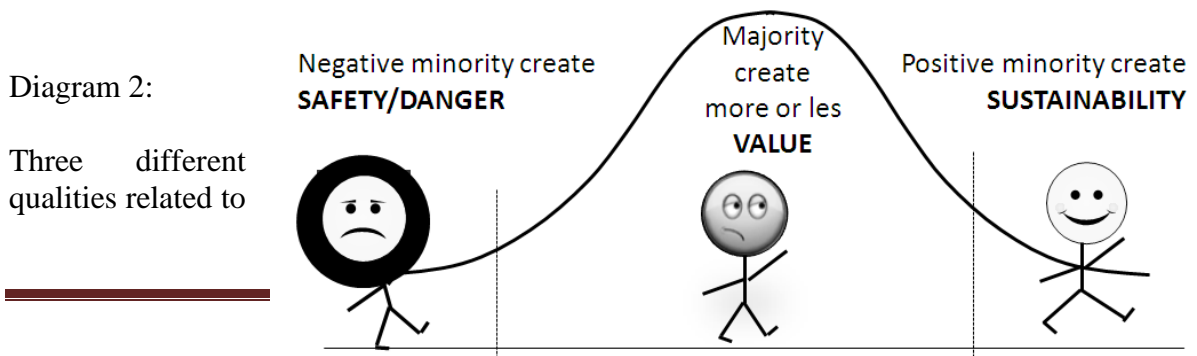
Three different focuses of quality management

I related these three different qualities to three different parts of gauss distribution:

- Must quality is a challenge for **negative minority** and is about safety in broader meaning.
- Competitive quality is challenge for **majority** and is about delivering les or more value for customer.
- Attractive quality is challenge for **positive minority** and is about creating sustainability by reacting on new needs and new conditions.

Diagram 2:

Three different qualities related to



gauss distribution (Kiauta, 2006)

Implementation of idea of quality in first faze was focused on negative aspects of finding and fixing bad quality. Quality specialists caused aversion of common people. They are against negative approach of looking for negative results everywhere and every time. The self-esteem was damaged, because there was not balance between good and bad elements. The reaction in the sector of public services is that organizations see in QMS something that is not constructive and useful. They were looking for something opposite. And they got it: Excellence Model and practice, looking for facts that evidence elements of excellence.

What is now wrong? The incomplete QM approach focused mainly on negative aspects / bad results was changed with another incomplete QM approach focused mainly on positive aspects / pieces of excellence. What could be better? We need integrity of QM approach, focused on all three fields of quality: bad, good and excellent quality. Healthy organizations and societies are those, where integration forces are stronger than those of disintegration. If not, systems are falling apart (I.C.Adizes, 2010). If we allow incomplete QM approach (negative or positive focused), this is not good base for integration forces. Let us test this thesis. If we look only for bad quality, average reactions are efforts for no transparency what is very bad for integration efforts. If we look only for excellent quality, average reaction are efforts, to demonstrate superiority to the others, what also is bad for integration efforts. What we get from integrity of approach? If we promote importance of quality instead of excellence, we speak for all, all are addressed.

The idea of quality is for all; the idea of excellence is only for minority.

Let us see, the relevance of both terms in Google:

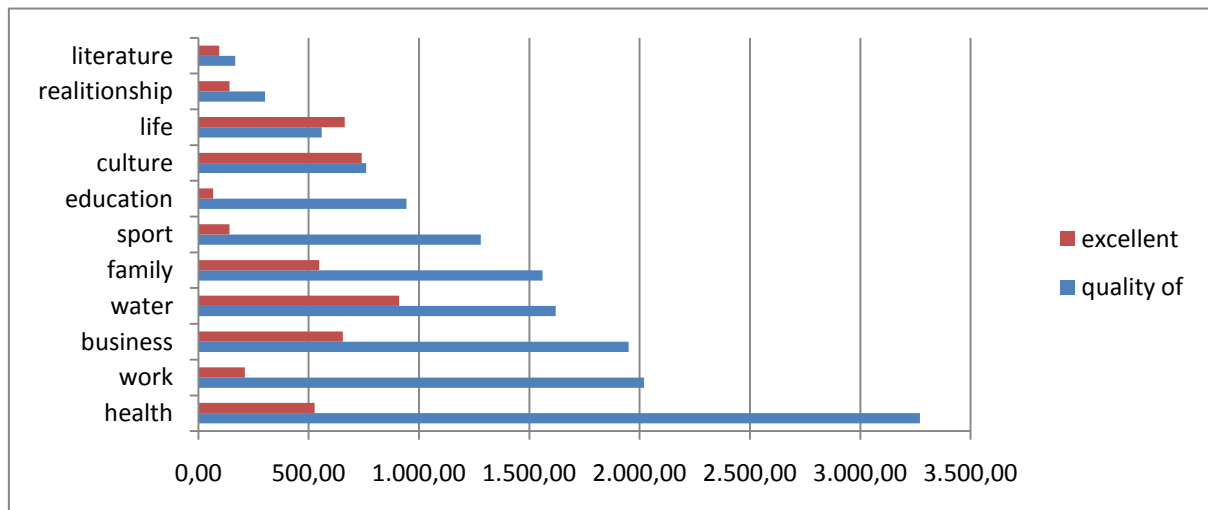


Diagram 3: millions of matches on Google on May 2011

We can assume that discussion about health is most serious and from that I understand excellent health as only one of possible states of quality of health.

Three different reactions on changes

In time of explosion of changes, **agility** is a matter of survive. » *We either learn to fail or we fail to learn*« (Ben – Shahr). The most significant differences in quality management approach are in regards of reaction on changes. If we follow the theory of How to Manage in Times of Crisis (Adizes, 2009), there are three reaction types on the change:

- **pro-active reaction** in the period of time, when the change is only opportunity and not yet problem. We can assume that this is reaction of positive minority. There are three important advantages against re-active reaction:
 - much longer time (from change to problem),
 - no need to fix the problem, caused by non-adaption to change, and
 - positive atmosphere

- **re-active reaction**, reacting only when opportunity develop into problem

- **no-active reaction**, when people don't have possibilities to react or they only think, that this is not their duty

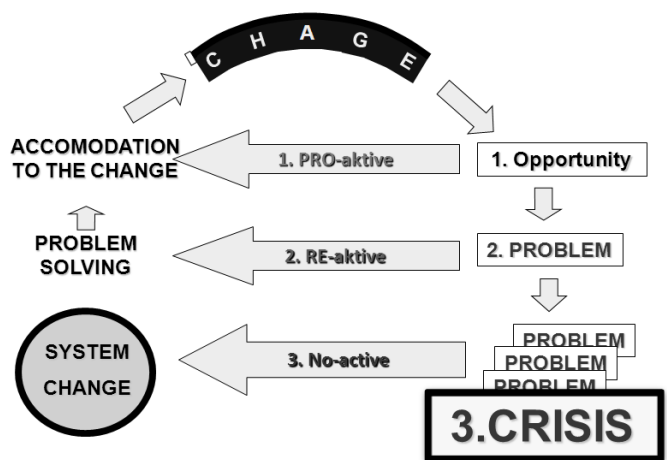
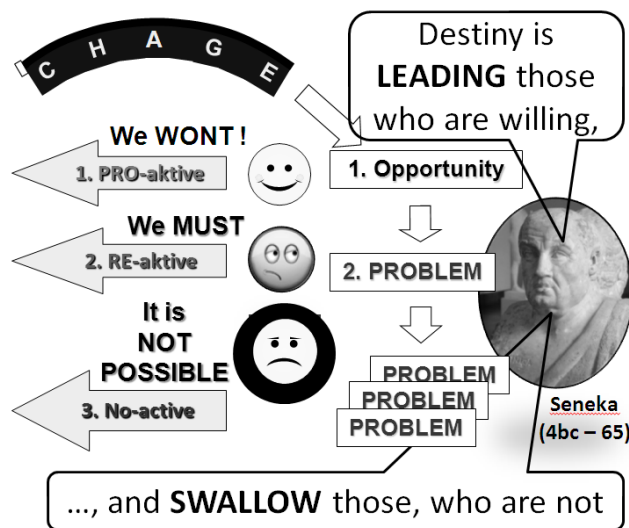


Diagram 4: Three different reactions on change



We can see this situation in the “light” of Seneca’s wisdom:

“Destiny is leading those who are willing, and swallow those, who are not.”

Diagram 5: The role of culture, the role willingness

Three different types of quality management styles in regards to changes

If quality management is about planning, measuring, analyzing - learning and reacting-improving, than on three different fields of quality (must, competitive, attractive) we have **three different sort of activities, focusing on different goals.**

- 1. Level quality management - To create higher level of **safety**, we are dealing with IMPROVEMENTS to **reach demands**
- 2. Level quality management - To create higher level of value, we are dealing with IMPROVEMENTS to **reach expectations**
- 3. Level quality management - To create higher level of sustainability, we are dealing with IMPROVEMENTS to **react on new conditions and needs**

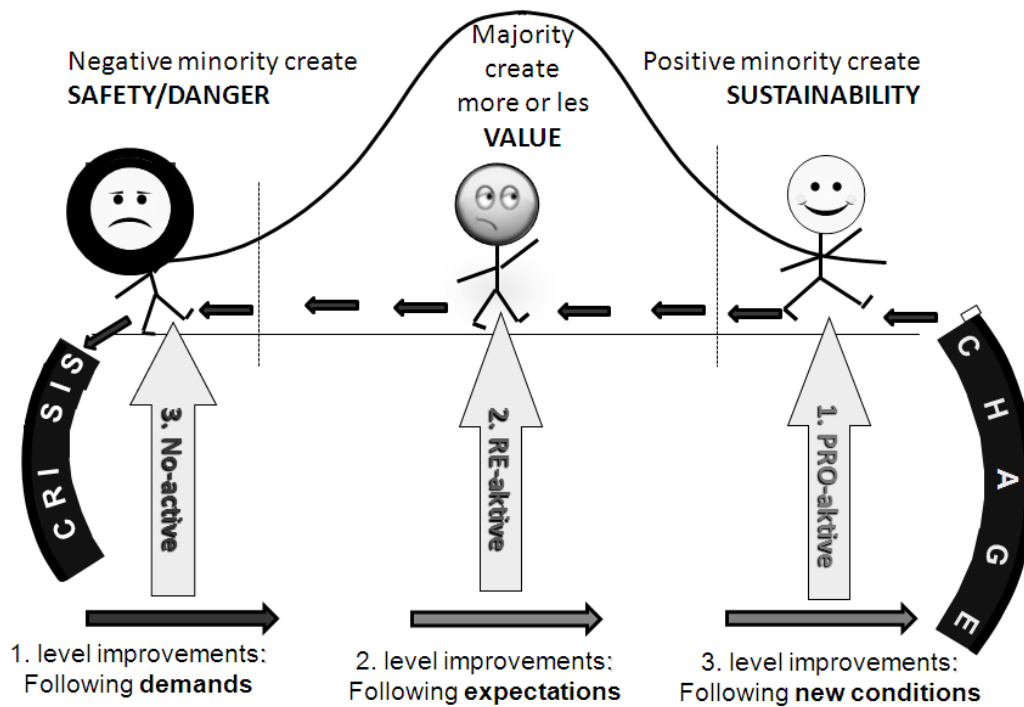


Diagram 6: Three levels of improvements

Three different level of personal development

The three styles of quality management should be connected with personal development. Each organization's employee's personal development is probably deployed according to gauss distribution. The bases of different approaches are different needs. Let us see the Trinity model of human needs (Dahlgard, 2003):

- Physical or Biological Needs (Living):
Food, Water, Air, Shelter, Clothing, Safety, Sex (biologically)
- Mental/Psychological Needs (learning):
Sense of belonging, Friends (mental love), Recognition, Individual identity, Achievement, Learning, Creativity, Development, Self-fulfillment
- Spiritual Needs or Core Values (loving):
Searching and creating meaning, Trust, Justness, Honesty/openness, Loyalty, Integrity, Love (spiritual love), Sharing, Fairness, Respect

All three types of human needs are critical motivation factors. They should be considered simultaneously in each given situation. From an organizational perspective managers should work on improving the quality of employees' work life. For having an orientation on that subject, it is good hypothesis »Like space, also a person is expanding.« (Pavliha, 2010). I can try to explain, how I understand this idea:

- At first level of development he/she is focusing on him/her selves. This enables us to be professionally good in our peace of work.
- On the second level he/she is focusing also on family and on customers of or in his organization. This enables us to be successful in serving to others.
- On the third level he/she is focusing on also on society and nature as a whole. This enables us to understand what is going on, what is good and what is bad. We need this level to be successful in corporate responsibility (ISO 26.000) and in risk management (ISO 31.000).

I assume, that these three levels can be in relations of three parts of human life, we can say 2x30 years. Humanity needs third part generations active (I am there☺). They are independent (?) and experienced. We should not measure our age with years, but with agility (easiness). Critical is building relations on the basis of hope and faith and not in fear.

Relations between ISO 9001 and EFQM Model

The standard would be less egocentric in regards to the QM specialists. For example: Instead of Measurement (paragraph 8.2) it would be better to be Results, and Customer results (paragraph 8.2.1), System results (paragraph 8.2.2), Processes results (paragraph 8.2.3) and product and system results (paragraph 8.2.4). If we integrate, in existing QMS would be integrated also view of People results, Society results and Key (strategic) results.

Activities of writing report on the basis of the Model is natural content of analyze (paragraph 8.4) and that report would be natural input for management revue (paragraph 5.6). And so on...

Words are very important. We change world by changing words!

Conclusion

We really need to amplify and to understand the concept of quality in a much wider way. To treat excellence related activities separated from all others quality management activities is not god solution. We live in time, when systems, organizations and society are falling apart. This is not healthy. We need integration moments. Integration is other word for creativity and health. It leads to integrity. Excellence is only one of three states of quality. If we ask: How? The answer is bed, good or excellent. All three are possible states of the same parameter.

There is no doubt: the idea of quality and excellence are not alternative. It is necessary to manage quality in all areas of activities both of individuals and of organizations. In this we follow development of an individual and of an organization on the road from results back to the causes.

- development lead an individual from acts to the awareness of words and thoughts, that caused that acts;
- development lead an organization from product/service to processes and from them to the environment in which those processes operate and finally from environment to leadership which created that environment.

The expanding concept of integrity led development efforts. Individuals and organizations differ both in field of quality management (higher or lower integrity), and in the level of quality that they reach in different fields.

High level on the field of results is needed for the current success. High level of quality in the fundamental causes (thought / leadership) is needed to ensure maximum sustainability.

And when »we care more, than others think is wise, risk more, than others think is safe, dream more, than others think is practical, and expect more, than others think is possible« (Dahlgaard, 2010), we are on the way towards excellence.

Let me finish with the poem of our Slovenian poet Srečko Kosovel:

*No paragraphs no laws
just work will show to human race new way,
and where the heart of genius foresaw
only there mankind will go.*



Humanity needs examples of excellence as lighthouses for all others who would like to follow!

As regards quality, we must not follow bad examples of good idea being compromised by bad implementation (sociality-socialism, quality-certification, and excellence-reward). Humanity needs values as sociality, excellence and quality. They are not property of those, who earn money with their interpretation. We are not allowed to change their meaning for our current business interests.

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Quality requirements for production software

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Key words: quality norms, software, production, automotive industry

Introduction

Modern manufacturing faces two main challenges: more quality at lower prices and the need to improve productivity. This requires a very efficient and controlled manufacturing process, where focus is on automation, computers and software. (Pires, 2005) In many industries, production is closed tracked in any part of the manufacturing cycle, which is composed by several in-line manufacturing systems that perform the necessary operations transforming the raw materials in a final product. (Pires, 2005)

The paper presents an analytical study of the software quality models used in the software industry and their application in the production of automotive products for the software used to control and trace the manufacturing processes of the industrial equipments, with the final scope to improve the software packages for production.

Software process improvement methods help to continuously refine and adjust the software process to improve its performance (e.g., in terms of lead-time, quality of the software product, reduction of change requests, and so forth). (Peterson, Wohlin, 2010)

Software process improvement aims at making the software process more efficient and increasing product quality by continuous assessment and adjustment of the process. For this several process improvement frameworks have been proposed, including the Capability Maturity Model Integration (CMMI) (CMMI-Product-Team, 2006) and the Quality Improvement Paradigm (QIP) (Basili, 1985; Basili and Green, 1994).

Our prior work is a comparative study upon the methods in using for the same practical example - the traceability software in the automotive industry. Therefore we identified the most important automotive requirements for that kind of software and analyse in which manner they are covered by the investigated methods.

The comparative study where done on process oriented methods most used and most popular in using in practice such as: ISO 9001, ISO 9000-3, TickIT, CMM and CMMI, AQAP-110/AQAP-150, IEEE 730/983, Automotive SPICE, ISO/TS 16949 or ISO/IEC 25000/9126/14598.

With our work we identify the weaknesses of those methods while using them for the production software and suggest the additional requirements that must be part of the software quality methods used for that kind of software.

Comparative Study of Process Quality Requirements

In this comparative study we chose the most important criteria for the development of software products and we studied their degree of treatability from the point of view of the above mentioned standards.

These aspects are the following: - competitive development, prototyping process, customer support consultancy, old software kit handling, standard popularity, data and document control, process of acquisition, design, corrective and preventive actions, quality regulations, managerial analysis, internal audits, internal software training, software maintenance, contractual analysis and process of handling.

As a result of scientific reports and of specified standard analysis we created chart nr.1 below and we scored each standard for each software process on a scale from 1 to 100, where 100 represents the maximum number of points that can be obtained by a standard in the respective process.

Tab. 1 Comparative study						
Domain/Process	ISO 9001	ISO 9000-3	Tick IT	CMM & CMMI	AQAP-110/AQAP-150	IEEE 730/983
Realization process	100	30	20	80	20	100
Functionality/ Verification	30	90	90	80	95	100
Design/ development	50	100	85	98	90	90
Multi tasking development	10	98	100	10	98	50
Prototyping process	10	100	98	8	95	40
Customer support consultancy	10	100	9	60	95	90
Old software kit handling	8	100	98	10	100	80
Popularity (commodity) of the norm or method	99	100	98	50	5	75
Data and documents control	85	100	98	90	99	95

Acquisition process	55	100	98	100	99	85
Design	60	100	98	10	95	65
Corrective and preventive actions	99	100	98	90	100	90
Quality rules	99	100	98	90	100	75
Management analysis	99	100	98	100	90	80
Internal audits	99	100	80	90	98	100
Internal training	100	100	90	95	90	30
Software maintenance	1	100	95	5	90	20
Contractual analysis	90	100	95	98	90	10
Handling process	5	75	80	30	70	10
Methods for company certification	1	1	10	1	1	1
Methods for auditors certification	1	1	10	1	1	1
Usability difficulty degree	50	90	75	40	85	60

The graphical representation in Fig. nr.1 below gives us an overall image of the advantages and disadvantages of this system.

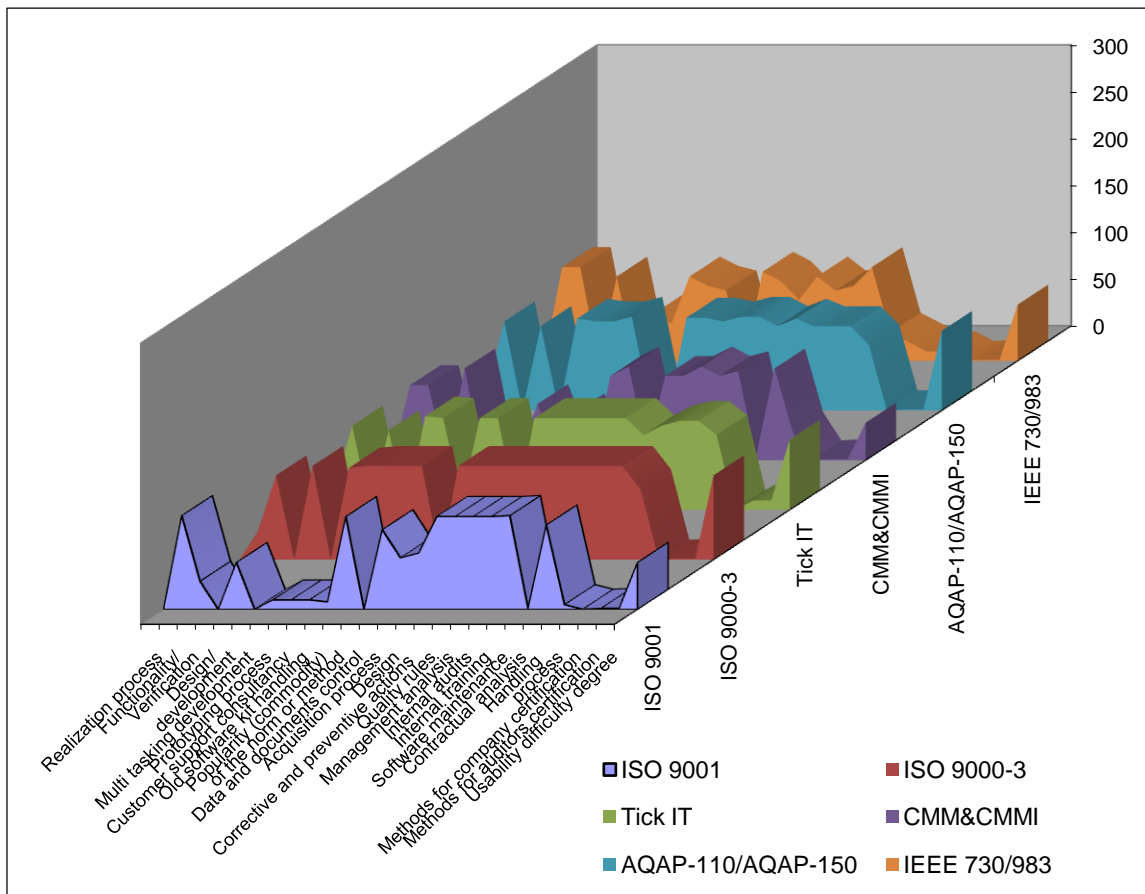


Fig. nr.1 Comparative Study of Process Quality Standards

Practical Examples of Process and Product Standard Applications in Software Product Development

In the following we present the application of these systems by using a practical example of a big European organization in the automotive industry. The audited software in our example targets the production in the automotive industry. In conclusion, the qualification, respectively the verification and the implementation of the software kit has to be done according to the quality standards of software products and the requirements of the automotive industry.

In order to make the audit easier to understand, we divided the requirements of this standard in elements with common features, specific for each method separately. Each element is calculated individually in percentage and leads to the final result. The interaction among these elements makes it possible that the results of the evaluations are very close to each other. The emergence of significant differences signals the fact that the evaluation hasn't been done correctly and objectively. Another advantage of this division is the fact that an audit can be performed simultaneously by more auditors on each element separately. The evaluation of the elements is done on a scale from 0 to 10. The meaning of the synopsis is explained in Tab. nr.2 below.

The final score is the arithmetic average of the obtained number of points by each element and their final analysis is presented in detail in Tab.nr.3.

Tab. 2 Rating legend	
Score	Description
10	Full compliance with requirements
8,9	Predominant compliance with requirements minor nonconformities
6,7	Partial compliance with requirements more severe nonconformities
3,4,5	Unsatisfactory compliance with requirements major nonconformities
0,1,2	No compliance with requirements
NA	Full compliance with requirements

Tab 3. Results description		
Result	Score (%)	Description
Excellent(A)	90-100	Full compliance
Good (AB)	80 to less than 90	Predominant compliance
Agreeable (B)	60 to less than 80	Partial compliance
Insufficient (C)	less than 60	No compliance

Implementation according to ISO 9001

For the analysis of the project according to ISO 9001 standard, we grouped the requirements in specific elements as follows:

- Element 1: 0- General Concepts
 - 1- Aim
 - 2- Normative references
 - 3- Rules and condition
- Element 2: 4- Quality System
- Element 3: 5- Management Responsibility
 - 6- Resource Management
- Element 4: 7- Product Development
- Element 5: 8- Measurement, analysis and improvement

The behavior, respectively the effect of each element on the final evaluation can be seen in fig.nr.2

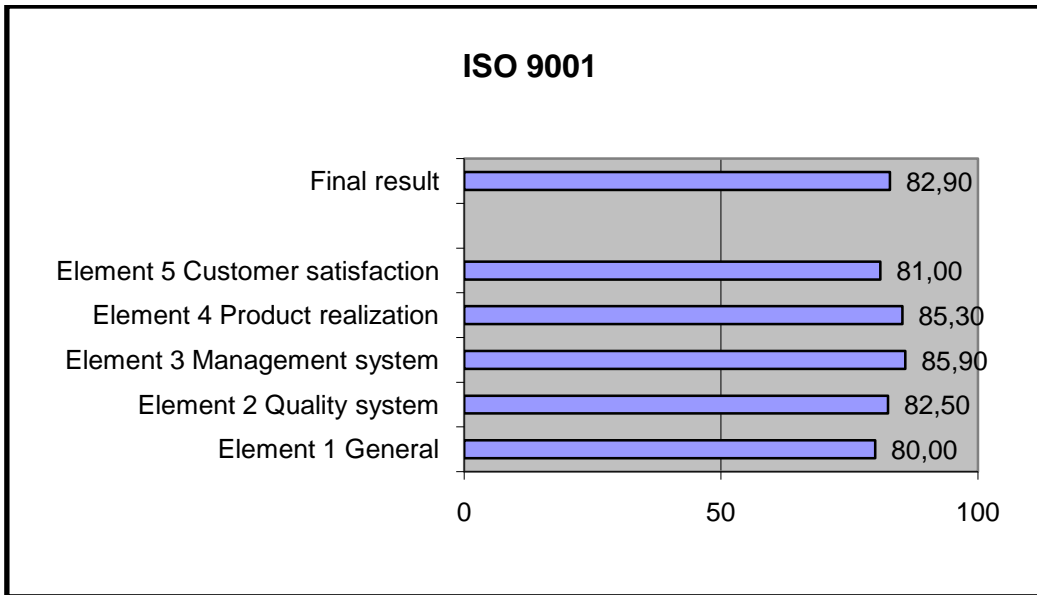


Fig. 2 Project Development and Audit according to ISO 9001

Implementation according to the norm ISO 9000-3

Since ISO 9000-3 is an advisor for application the norm ISO 9001, we obtained a better result for the reason that the requirements were better understood. The elements of this method are the same like ISO 9001 elements. The behavior, respectively the effect of each element on the final evaluation can be seen in fig.nr.3:

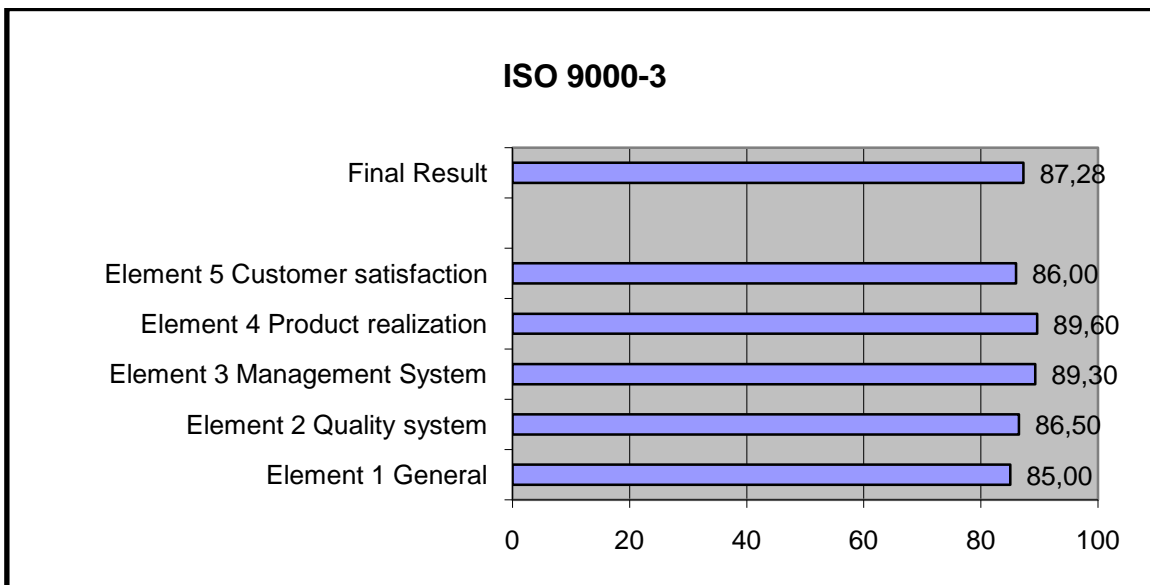


Fig.3 Project Development and Audit according to ISO 9000-3

Development according to CMMI

In this situation the requirements were very strict, requiring the alignment of the project to level 3, though ISO 9001 is level 2. The obtained result is worse than the other two methods, which is exactly due to this fact. The elements of this system are divided in the following way:

Element 1, General: - Decisions and solutions based on analysis

- Element 2, Organizational:
 - Definition of the organizational process
 - Periodic trainings in the organization
 - Focus on the organizational process (if it's applied correctly, understood, etc.)
- Element 3, Managerial:
 - Integrated project management
 - Requirement development
 - Risk management
- Element 4, Product development:
 - Product integration
 - Technical solutions
- Element 5, Validation:
 - Product validation
 - Tests, verifications based on specifications

The obtained results are shown in fig. 4:

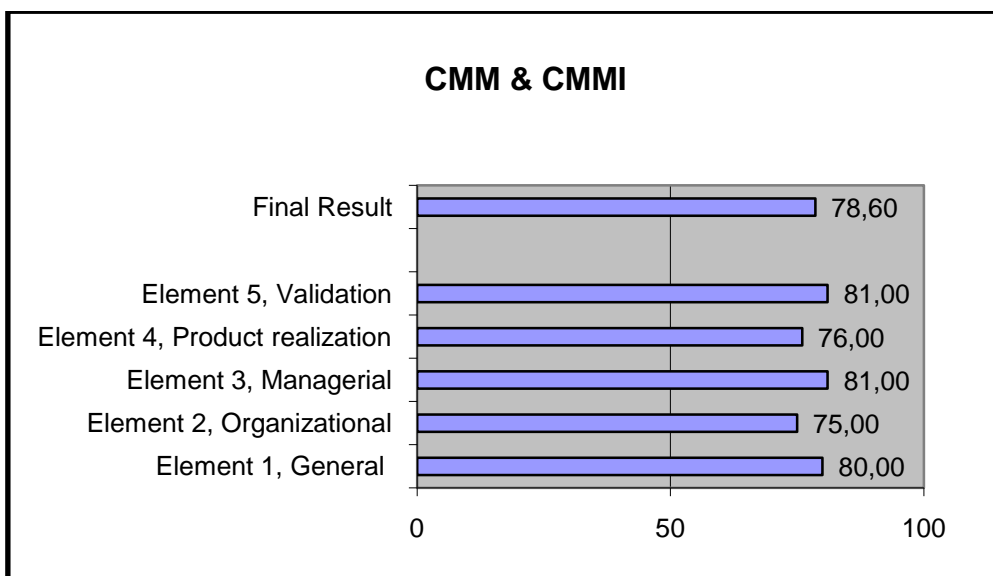


Fig.4 Project development and audit according to CMMI

Development according to AQAP100/ AQAP150

These requirements are very strictly formulated and obtained a very low number of points in the above mentioned project. The elements are divided similarly with ISO 9001 and ISO 9000-3 and the major difference lies in the fact, that in ISO 9001/ ISO 9000-3 the requirements are formulated with “SHOULD” whereas in AQAP-100/ AQAP 150 “HAVE TO” is used. The elements are identical with those from ISO9001, respectively ISO9000-3. The obtained result is shown in a chart in fig. 5:

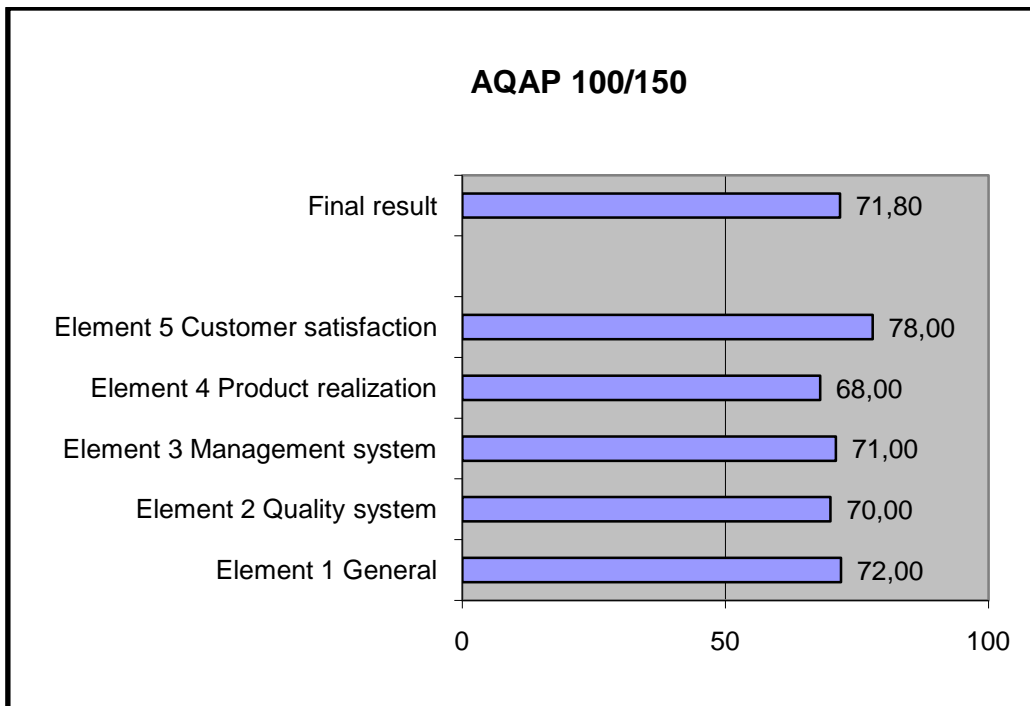


Fig.5 Project development and audit according to AQAP100/150

Development according to IEEE730

The elements in development and the project evaluation have been defined as follows:

- Element1, General:
 - Aim, goal
 - References
- Element 2, Managerial:
 - Standards, methods, conventions, metrics and monitoring control of these requirements
 - Utilities, techniques and methods
 - System control
 - Provider/contractor control
 - Risk management
- Element 3, Organizational:
 - Managerial organization
 - Internal instructions
- Element 4, Product development:
 - Documentation/ references
 - Glossary
 - Database, maintenance and their storage
 - Methods and history of modifications
 - Technical solutions
 - Product launch
- Element 5, Validation:
 - Revision and software audits
 - Tests
 - Non-conformity reports and corrective actions

The obtained result is presented in fig.6 below:

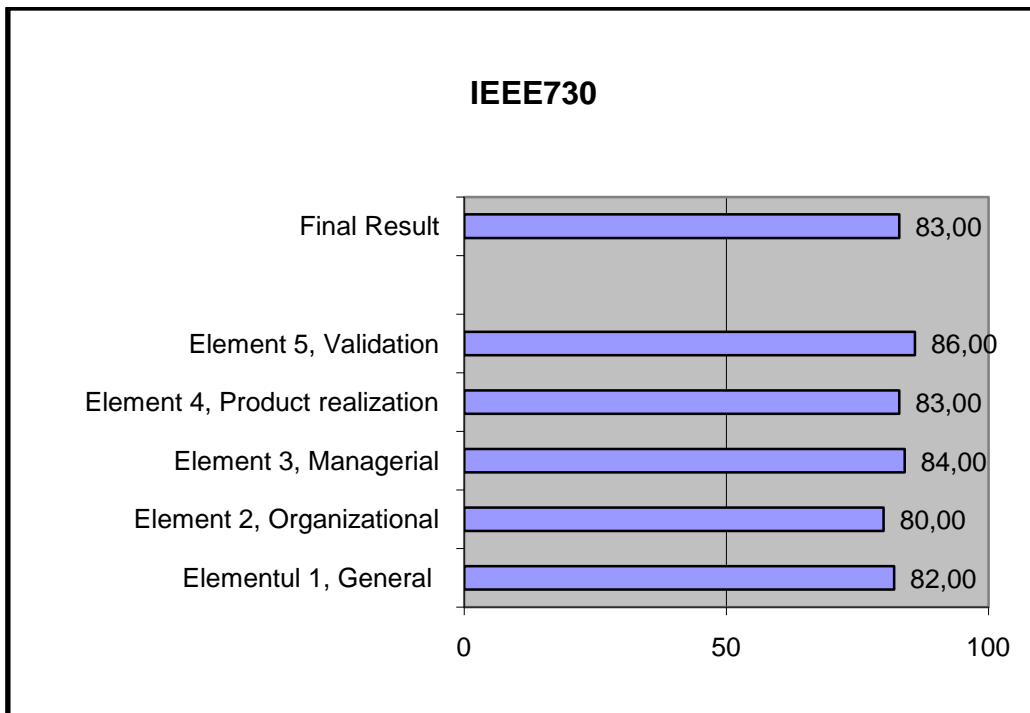


Fig. 6 Project development and audit according to IEEE730

Employment of the Automotive SPICE Standard in Software Product Evaluation and Verification in the Automotive Industry

Due to a low degree of applicability of the ISO/TS 16949 standard for software products in the automotive industry, the Automotive SPICE method has been developed. This method is the most adequate for software product development in automotive industry, though it has some shortcomings when used for software products that accompany production.

The Automotive SPICE, a model for process improvement and for software product capability evaluation in the automotive industry, was developed on the basis of a common initiative of car producers of the Automotive Special Interest Group, a special group of the acquisition forum and SPICE UG (User Group). SIG Automotive members include AUDI AG, BMW Group, Daimler Chrysler AG, Fiat Auto Spa, Ford Werke GmbH, Jaguar, Land Rover, Dr. Ing.hg F. Porsche AG, Volkswagen AG and Volvo Car Corporation (SPICE 2010). This method is based on the annexes F and H of the ISO/IEC 12207 AMD1:2002 and ISO/IEC 12207 AMD2:2004 standards. This contains all processes with small editorial changes that refer to the use of terminology and their application in the automotive industry as well as the ISO/IEC 15504 standard (SPICE2005).

Similarly, we can divide the requirements of this standard in elements with common features as follows:

- Element 1: Acquisition process (ACQ)
- Element 2: Supply process (SPL)
- Element 3: Projection and Development (ENG)
- Element 4: Assistance and Support (SUP)
- Element 5: Management Process (MAN)
- Element 6: Continuous Improvement (PIM)

Element 7: Reuse (REU)

The final result of the evaluation is presented in fig. 6, where we can also see the results of each element separately.

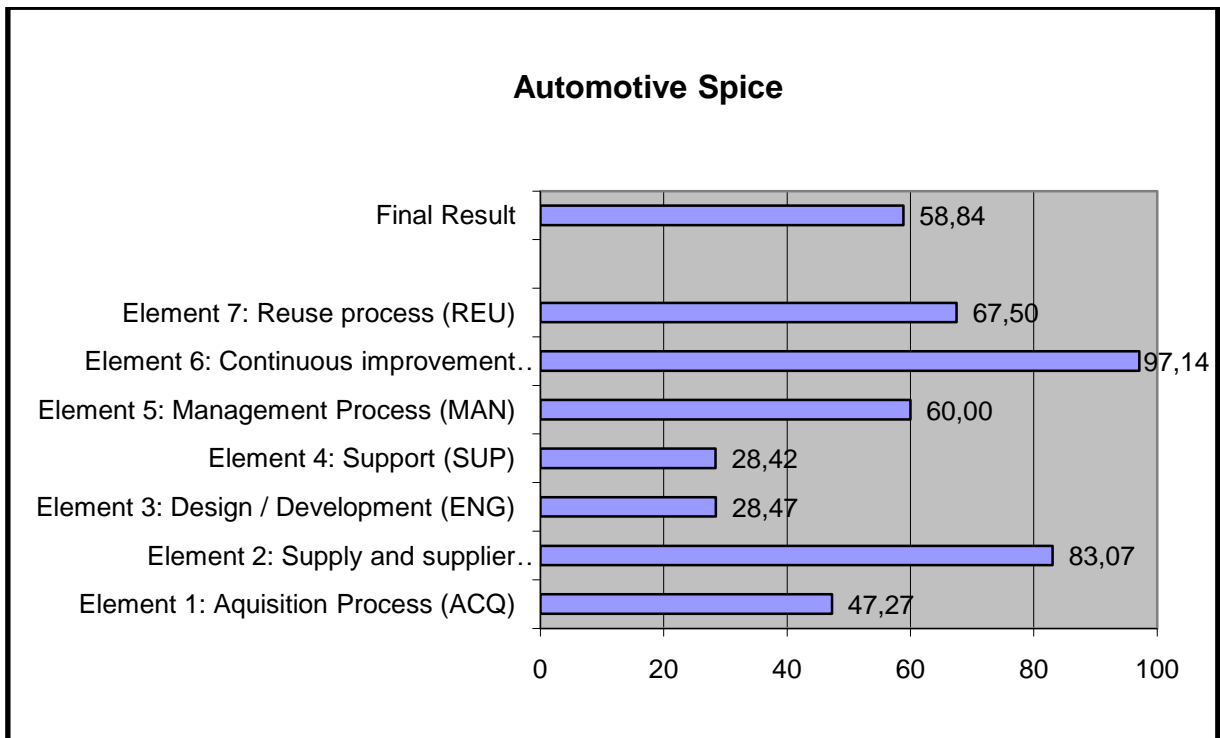


Fig.6. Product Audit according to Automotive SPICE

Application of the ISO/IEC 25000 Standard (Software Engineering- Software Product Quality Requirements and Evaluation (SQuaRE)- Guide to SQuaRE)

The ISO/IEC 9126 and ISO/IEC 14598 have been for a long time a complementary system of standards, sharing a common normative, functional and referential base. (ISO/IEC 25000:2005). But due to the independent life cycle of these two standards incoherencies appeared when they were used at the same time

The aim of creating the SQuaRE model was to develop a logical, organized and unified system that contains two major processes: - specified software product quality requirements and software product quality evaluation, a process helped by measurement processes. The intention of the ISO organization with this system was to help the development and software acquisition with specifications of the requirements in quality evaluation. SQuaRE recommends measuring units of software product quality that can be used by developers, acquirer and evaluators as well. This system is dedicated exclusively to software products. The standard presents only the recommendations for the evaluation model, on the basis of which we developed the model represented by the elements below.

Similarly to the ISO/TS and Automotive SPICE we created the software product audit according to the SQuaRE standard. This way, we divided it in specific elements as follows:

- Element 1: Quality System
- Element 2: Development Process

- Element 3: Product Quality
- Element 4: Acquisition Process
- Element 5: Assistance and Help

The final result of the evaluation is presented in fig. 7, where we can also see the results of each element separately.

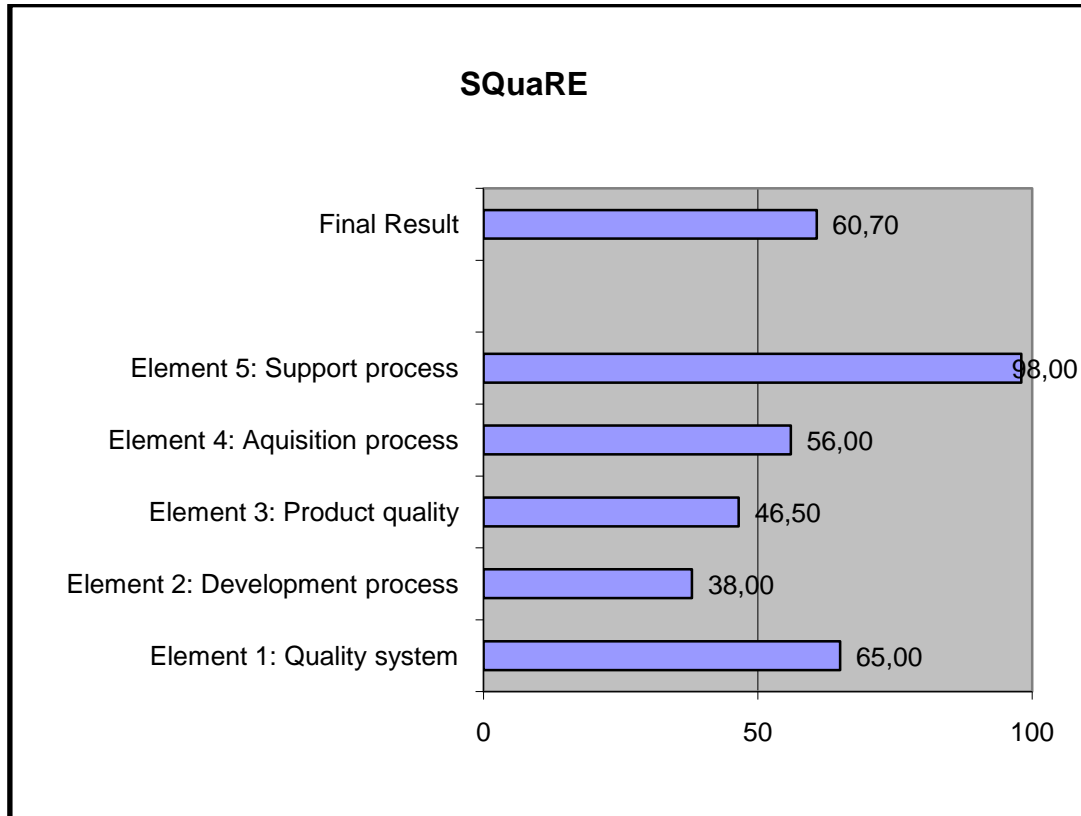


Fig 7 Product audit according to the SQuaRE Standard

As it can be seen, the obtained result is much better due to the high degree of requirement generality compared to the Automotive SPICE method. Furthermore this also shows the behavior of the software product, that obtained a very high score at the “Assistance and Help” chapter; a fact that confirms the philosophy of quick handling of software problems in a reactive way. This philosophy assumes a high degree of risk which lies in the production downtime as soon as problems arise. The risk of apparition of these problems is very high also due to the fact that other quality elements, offered by some standards, are ignored.

The Use of the ISO/TS 16949 Standard for Evaluation and Verification of the Exemplified Software Product

The audit software in our example targets the production of automotive components. In conclusion, the qualification, respectively the verification and the implementation of the software kit has to be done in accordance to software product quality standard requirements but also in accordance to the requirements of the automotive industry. As a result, for this latter requirement we chose the ISO/TS 16949 standard as a base for the software audit, defined for production usage.

In order to make the audit easier to understand, we divided the requirements in kits with common features the following way:

- Element 1: Product Development Planning
- Element 2: Product Development
- Element 3: Realization Process Development
- Element 4: Product Realization
- Element 5: Additional units/service provider for product realization
- Element 6: Production: installation, storage medium)
- Element 7: Customer satisfaction/ client service offers

With help of the questionnaire from chart nr.3, we managed to complete the evaluation of the software product and we analyzed the obtained results as shown in fig.8 below. As it can be seen, the result of the audit is” C”, which means system failure with no possibility for short term improvement.

In conclusion we can say that 15 requirements from 61 can't be applied and 19 scored 0 points. The obtained results this way reported approximately only to 44% of the requirements, a total of 56% being ignored, as fig. 9 shows below.

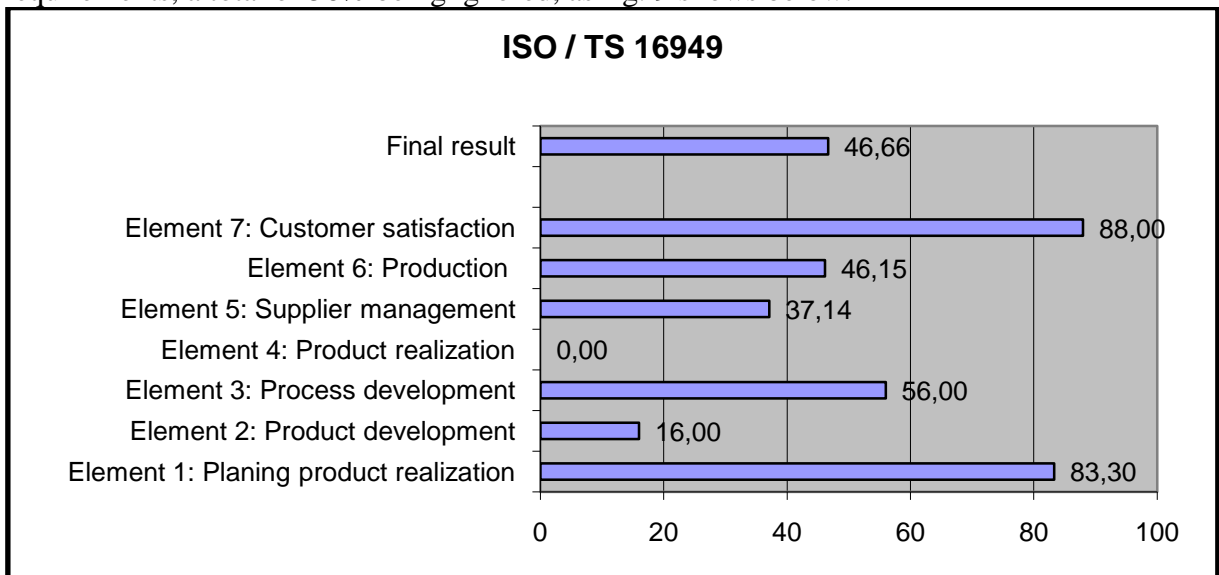


Fig 8 Product Audit according to ISO/TS 16949

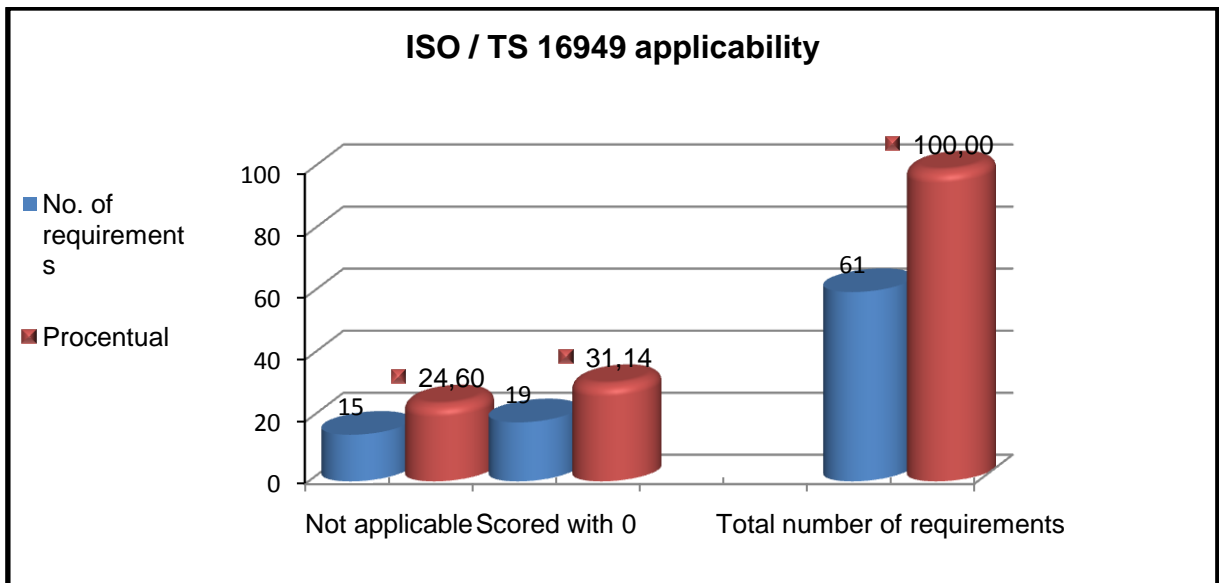


Fig.9 Degree of Applicability of the ISO/TS 16949 Requirements

Conclusions

Based on the comparative study we could demonstrate which requirements are poor in applying them for the production software, identify the additional automotive requirements missing completely in those methods like software FMEA, consideration of the manufacturing requirements by the software, software quality plan, supplier strategy, continuous improvements processes, definition and handling of the software special characteristics, first sample (trial) test report, production part approval process (software view), corrective actions process, pareto analysis, capability studies (CPK), predictive/preventive maintenance, software control plan, corrective actions and their impact/check of effectiveness. At the same time we propose a method to be used for production software in the automotive industry including the requirements above and recommendations for developer.

With our work we identify the weaknesses of those methods while using them for the production software and suggest the additional requirements that must be part of the software quality methods used for that kind of software.

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Measuring efficiency of logistics processes in distribution centers

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Paper type: Case Study

Introduction

Modern business operations primarily entail tremendously demanding market struggle, no matter whether it is about production or service rendering in any industry branch. In order to survive in the market and achieve profitability the companies have to be efficient. The efficiency represents an extremely significant indicator for the analysis and bringing important conclusions on the business operations of the companies. There is no universal and generally accepted definition of the efficiency. Different authors define efficiency in different ways. Gleason and Barnum (1982) under the notion of effectiveness means the level of the goals accomplishment ("doing the right things"), while under the notion of efficiency they mean the accomplishment of these goals in the best possible way ("doing the right things in the right way"), that is to say accomplishing the largest number of outputs while using the least amount of resources. In the past, both in literature and in practice, the greatest attention was paid to the operational efficiency. Operational efficiency can be defined as the ratio between the exploited resources and the accomplished results.

Operational efficiency is not the sufficient condition in order to survive in the market. Apart from the primary goal represented by the efficient exploitation of the company's resources, other goals, such as the service quality, must be taken into account. During the recent years, increasingly greater attention has been paid to the quality of the products and services. In such a situation, the crucial factor in the customers decision to purchase a product or service is exactly the quality. The companies must also be qualitatively efficient, that is they must accomplish the highest possible service quality while using certain resources. Achieving the balance between the operational efficiency and quality is a heavy task which companies have to solve. In this work, the mentioned problem has been attempted to be solved in the field of logistics that is the distribution center (DC) as a complex logistics system.

DC represents complex systems with a large number of interconnected subsystems, processes and activities. They also represent the basic hubs of the goods distribution process and connect a large number of participants in the supply chains. In order to maintain the competitive edge, they have to monitor and measure the efficiency, but also define the suitable corrective actions, if necessary. The managers and employees in

such systems are faced with several different tasks that are mainly connected with determining the optimal amount of the resources (input) for realizing a certain number of shipments, of a satisfactory level of quality. Only such systems can satisfy both the demands of the customers and their own demands. Apart from DC as a system, this work in more detail describes two basic subsystems, which are the transport and warehouse subsystems. Regardless of the strong connection, these subsystems have different goals, in different cases even conflicts. Just as DC, these subsystems strive to maximize the efficiency. In this sense, the DC managers must at the same time take into account the efficiency of DC as a system together with its subsystems.

This work suggests a model that actually follows the efficiency of DC together with its subsystems. The work encompasses three parts. The first part in more detail considers the problem of measuring the DC efficiency. The analysis and decomposition of the logistics subsystems, processes and activities have been performed, along with defining the key measures and efficiency indicators, the problems in measuring the efficiency have been represented and a brief literature survey has been given. The models based upon the standard CCR DEA (Data Envelopment Analysis) and MODEA (Multiple Objective Data Envelopment Analysis) approach have been developed in the second part. The third part represents the results of the model application on the example of 20 DC in Serbia.

The Problem of Measuring

DC of trading companies and DC in general represent complex logistics subsystems with a very important place and role in the supply chains (fig. 1). This work in more detail analyses the DC of the trading companies operating in the region of Serbia. The main task of these systems is to prepare and deliver the goods shipped from supplier in keeping with the demands of the retail objects. Upon the completion of this, the retail objects perform the sale to the end buyers.

The complexity of the logistics system, above all, is characterized by a large number of activities which are realized, and which are interconnected and which influence one another. DC is, in fact, an entity comprised of a large number of subsystems, and in this sense the functioning of each separate subsystem influences the functioning of the entire system. The process of acquisition (supply), preparation and delivery of the goods to the retail objects is characterized by a set of sub-processes and activities. Some of the main activities are the following: receiving the goods, dispatching the goods, controlling, packing, storing, commissioning, orders processing, transporting, inventory controlling, etc.

In the conditions of strong market competition, the need for monitoring and measuring the DC efficiency represents one of the key prerequisites for survival in the market and successful business operations. The problems in determining the efficiency of DC and its subsystems are the consequence of a large number of processes and activities that are realized within them. Above all, it is necessary to perform the decomposition of the logistics subsystems and processes and to define the activities, as well as to quantify them (Johnson, 2006). The proper definition of the sequence in the realization of all activities and processes provides the managers with the opportunity to create a clear picture on the systems functioning and to perceive the possible oversights and errors. The system efficiency, in the concrete DC case, depends upon the separate efficiencies

of its subsystems, processes and activities, and it is that much harder to estimate the overall efficiency. From the efficiency measuring aspect, it is possible to make a difference among the following: activities efficiency, processes efficiency, subsystems efficiency and systems efficiency (fig. 1).

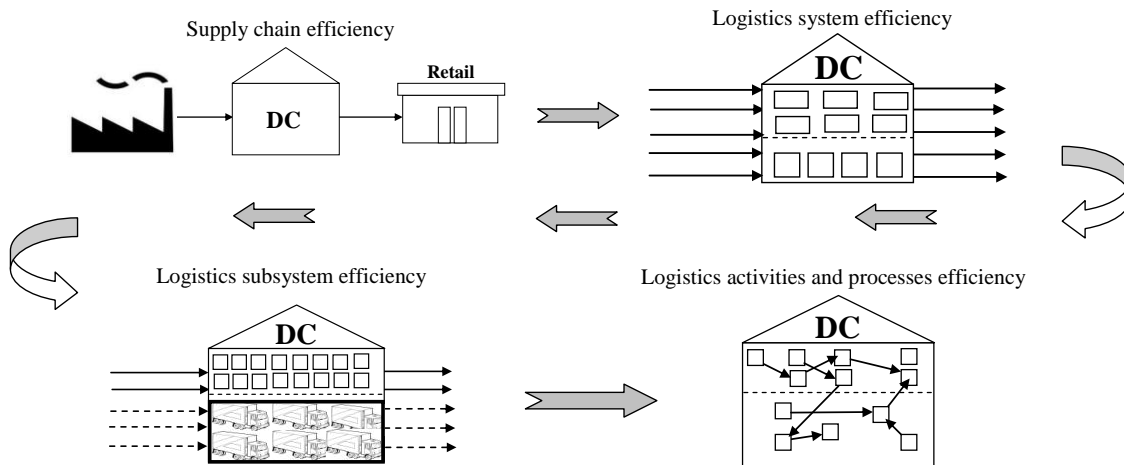


Figure 1: Different perspectives on efficiency measuring

Measuring the DC efficiency is followed by three groups of problems. The first problem is related to the division of common resources and conflict of DC subsystem goals. The basic DC task, from the efficiency standpoint, can be formulated as the maximization of the overall DC efficiency along with its subsystems with respect to the conditions in the common resources and conflicting goals. Each subsystem within DC has its own strategy of achieving efficiency. The efficiency of one subsystem can be the consequence of inefficiency of another subsystem.

The second problem refers to defining and connecting different efficiency measures. Regarding the DC efficiency measuring, it is common to think of the operational efficiency measuring. In order to estimate the DC efficiency, for a long time "single ratio" indicators have been used, such as the equipment utilization and employees productivity. Regarding the fact that the mentioned measures are not the best efficiency indicators, Min and Joo (2006) emphasize that a great number of authors is in favor of the DEA method usage. However, in the contemporary markets, the operational efficiency does not guarantee the survival in the market. During the recent years, increasingly greater significance is given to the service quality as one of the general indicators of the system functioning. The satisfaction and loyalty of the customers, entailing the repurchase and secured incomes, to a great extent depend upon the quality of the given services. Including the quality indicators into the DC efficiency measuring models represents a task to be dealt with. To the best of the author's knowledge, there are not enough works in the field of logistics that deal with these problems. In this work, a model that joins the indicators of the operative and qualitative DC efficiency has been suggested.

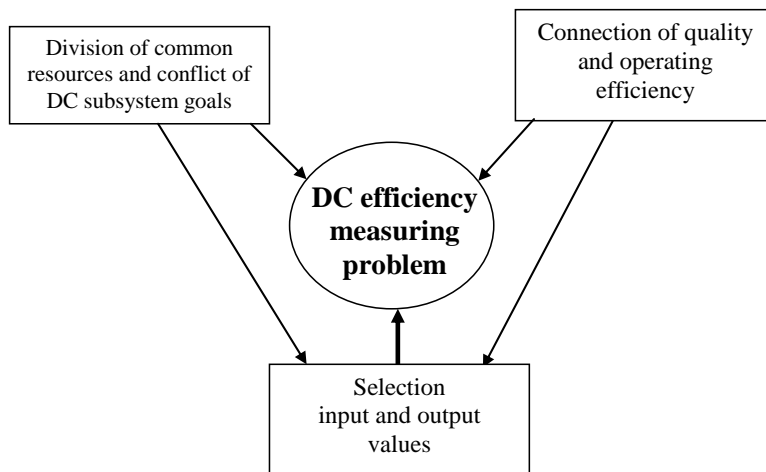


Figure 2: Problems in measuring DC efficiency

The third problem of DC efficiency measuring represents the selection of the input and output variables in DEA models. This problem is a commonplace in literature (Bousofiane et al, 1991). From the standpoint of the processing approach, DC can be perceived as systems which use a great number of entries (resources) in order to generate certain outputs. Also, among other things, as input variables there occur: number of employees, working hours of the employees, equipment, costs of equipment and transport means, object surface, automatization level, information, etc. On the other hand, output variables can be the following: turnover, degree of object utilization, number of realized deliveries, market share, etc. Apart from the mentioned DC service, the logistics services in general are characterized by a great number of quality attributes. Some of the main indicators of the DC services quality are: reliability, accuracy, speed of delivery, readiness for delivery, level of damage, etc. In the concrete case, the third problem in combination with the first two becomes more important (fig. 2). In the situation of multiple and conflicting goals, as well as joining operational and qualitative indicators, the problem of the selection of output and input variables is rendered more difficult.

Different functions of the transport and warehouse subsystem goals require from the DC management (decision maker) simultaneous optimization. Klimberg and Puddicombe (1999) solve the problem of multiple and conflicting goals by applying the MODEA approach. In order to solve multiple and conflicting goals, this work also used the MODEA approach. MODEA represents a very suitable tool to solve the mentioned problem. In the procedure of forming the MODEA model, the starting point is the fact that logistics systems use certain resources (input variables) to render services of a certain volume and quality level.

In literature, there is a certain number of approaches to measure efficiency of the logistics systems and supply chains. In further text, a short survey of the logistics systems efficiency measuring is given.

Literature Survey

From the beginning works Farrell (1957) and Charnes et al. (1978) and setting the basis of DEA method, as well as introducing the notion DMU (Decision Making Unit), an expansion of the works from this area occurs. The suitability of application and quality

of the obtained results have influenced the application of this method in different profit and non-profit organizations: banks, libraries, hospitals, schools, universities, kindergartens, etc.

In the field of logistics, the DEA method is mostly used for the evaluation of the efficiency of 3PL (Third Party Logistics) providers from the perspective of customers and the provider (Min and Joo, 2006). Zhou et al. (2008) with the help of DEA method attempt to define the benchmark performances variables for 3PL providers in China. In their work, they consider the change of efficiency during a period of time, as well as the interaction of certain factors upon the performances. Hamdan and Rogers (2008) apply the DEA method to measure the efficiency of 3PL providers with the stress upon the warehouse operations. Smaller number of works refers to the estimation of the DC and warehouse efficiency. Thus Ross and Droge (2002) examine the efficiency of 102 DC as parts of complex supply chains, as well as the change of this efficiency over the course of time. The combination of DEA and AHP is applied by Ramanathan (2007) for selecting suppliers. Among other things, Ramanathan also confirms the conclusions referring to the ratio of the warehouse size, technology level and efficiency. Hackman et al. (2001) have created a model with multiple entries and outputs for the estimation of the warehouse systems efficiency. Benchmarking and monitoring the international operators of the warehouse performances by applying the DEA method was given in the work of de Koster and Balk (2008). The method has been in many ways applied to measuring efficiency in the supply chains (Cook et al, 2010).

In the next chapter, models for efficiency measuring have been defined. Apart from this, the selection of the input and output variables has been performed.

Model Formulation

In the process of applying the DEA and MODEA approaches, one of the most important steps represents the selection of the input and output variables (Bousofiane et al. 1991). This work has evaluated the efficiency of 20 DC of three trading companies who operate in the region of Serbia and who have similar sale network, products range and distribution system. In order to estimate the DC and warehouse and transport subsystem efficiency, the variables which in the best way describe their functioning have been used. The number of employees, the number of pelletes places, and number of distribution vehicles at the DC disposal represent the main input variables, while the number of realized deliveries, number of mistakes in the warehouse subsystem and number of mistakes in the transport subsystem represent the output variables used in this work. The number of employees in DC represents the common input variable, while the number of realized deliveries represents the common output variable in the transport and warehouse subsystem. It is assumed that DC realize the deliveries the size of which are approximately the same. As the second input variable to estimate the warehouse subsystem efficiency the number of pellete places in the DC has been used. On the other hand, the number of vehicles at DC's disposal represents an input variable in the transport subsystem.

The mentioned variables primarily refer to the estimation of the operational efficiency. In order to obtain the results whose quality and reliability are higher, as additional output variables, the quality indicators have been used. DC of the trading companies, but also DC in general is characterized by a large number of indicators of the realized

deliveries . Errors in the transport and warehouse subsystems represent qualitative indicators which may be the cause of dissatisfaction and complaints on the part of the customer, that is to say a low service quality level. Errors in the warehouse subsystem are mostly related to the errors in the commissioning process (shortage/excess in the delivery, articles mix-up, damages), but also to other processes such as bad inventory management, etc. Errors in transport primarily concern the delivery that is falling behind schedule, as well as the damaging and losing goods in the transport process. As it can be seen in figure 3, in order to estimate the DC efficiency six variables have been used (three input and three output variables), while in order to estimate the efficiency of its subsystems four variables have been used per each system (two input and two output ones).

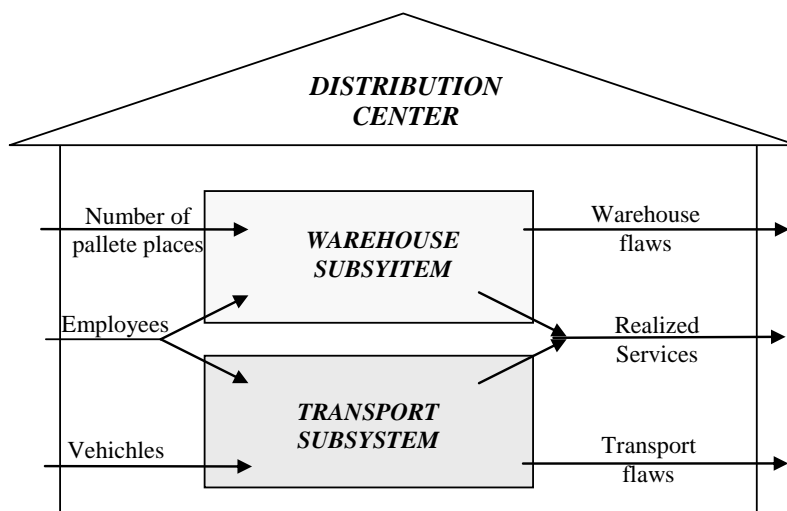


Figure 3: DC and basic subsystems

The variables of input and output variables are given in the table 1. The table 1 also offers the descriptive statistics of the variables used in this paper. In order to obtain the results of higher quality and reliability, on the recommendation of Klimberg et al. (2010), the normalization of all variables has been performed. The number of errors in the transport and warehouse subsystems represents the output variables of the negative orientation, that is to say smaller variables are favorable. Regarding the fact that DEA method perceives all output variables as positively oriented (larger variables are favorable), the change in orientation of the mentioned variables has been performed. Prior to defining the model to estimate the DC and its subsystems efficiency, it is necessary to mention that the model suggested in this works does not consider the external factors which may influence their efficiency, and do not come within the competence of the management of the company. The mentioned factors may be: weather conditions, market situation, industry branch, competition behavior etc.

Table 1: Inputs and output variables

<i>DMU</i>	<i>Employees</i>	<i>Palette places</i>	<i>Vehicles</i>	<i>Realized deliveries</i>	<i>Warehouse errors</i>	<i>Transport errors</i>
DMU 1	180	684	45	2638	270	991
DMU 2	35	4842	44	7131	85	310
DMU 3	45	5082	14	7033	270	991
DMU 4	99	4059	22	4009	1055	1125
DMU 5	94	5288	17	2667	654	1309

DMU 6	59	1566	23	1676	531	566
DMU 7	66	4597	41	8909	258	275
DMU 8	49	3373	34	2818	531	566
DMU 9	35	5541	13	3217	563	1125
DMU 10	49	6101	17	3539	321	641
DMU 11	104	1698	25	8181	1336	1425
DMU 12	183	3933	32	9006	36	133
DMU 13	137	6793	28	1207	316	337
DMU 14	176	3389	22	1721	1336	1425
DMU 15	153	1234	25	3769	168	184
DMU 16	66	1462	41	4746	138	275
DMU 17	34	2272	21	6248	531	566
DMU 18	153	6779	34	1542	214	784
DMU 19	186	5097	20	8735	570	1426
DMU 20	63	5035	42	2107	490	528
<i>Mean</i>	98.2591	3941.1002	27.9592	4544.9500	483.6505	749.2550
<i>Standard</i>	56.1095	1898.5720	10.4550	2730.5402	375.4795	444.7884
<i>Max</i>	186	6793	45	9006	1336	1426
<i>Min</i>	34	684	13	1207	36	133

In the concrete case, DC (with warehouse and transport subsystems) represents DMU (Decision Making Unit) whose efficiency is estimated. This work estimates the efficiency of 20 DC and its transport and warehouse subsystems by means of applying DEA and MODEA approach. DEA method is a technique of mathematical programming technique which gives opportunity to compare different DMU based on multiple inputs and outputs. This paper utilizes DEA approach in order to estimate the efficiency of DC, and warehouse and transport subsystems. According to this approach, logistics system, or subsystem, represents a "black box", that is to say those processes and activities that are not realized within the subsystem are not taken into consideration. From the group of DEA models, the basic CCR model has been chosen (Charnes et al. 1978). By applying the CCR models, an independent estimation of the DC, warehouse and transport subsystems has been performed. In further text, the formulation of CCR model for efficiency measuring has been described. The set of decision making units is comprised of 20 DC (DMU) ($k = 1, 2, \dots, 20$), and each of them is characterized by three input ($i = 1, 2, 3$) and three output variables ($r = 1, 2, 3$), as is illustrated in figure 3. The variable of the i th input is marked by x_{ik} , while y_{rk} marks the variable of the r -th output variable DMU $_k$. The weight coefficients joined with all entries and outputs are marked by v_i and u_r in sequence and they represent the decision making variables. In order to estimate the efficiency of all DC of the observed set, it is necessary to perform 20 independent estimations with DMU $_k$ ($k=1,\dots,20$) representing the k -th unit whose efficiency is measured, and w_k representing the efficiency of the k -th DMU. CCR model for measuring the efficiency of the k -th DC has the following form:?

$$Max w_k = \sum_{r=1}^3 u_r y_{rk} \quad (1)$$

$$\sum_{i=1}^3 v_i x_{ik} = 1 \quad (2)$$

$$\sum_{r=1}^3 u_r y_{rk} - \sum_{i=1}^3 v_i x_{ik} \leq 0, \forall k = 1, 2, \dots, 20 \quad (3)$$

$$v_i \geq 0, i = 1, 2, 3 \quad (4)$$

$$u_r \geq 0, r = 1, 2, 3 \quad (5)$$

Formulation of CCR model for measuring the efficiency of the warehouse and transport systems is very similar to the previously described model. The only difference lies in the number of variables. In order to estimate the efficiency of the subsystems, two input and two output variables have been used per each subsystem, while in order to estimate DC three variables have been used per each system.

The described model belongs to the group of standard approaches which perform independent estimation of the system efficiency without entering into the structure of the very system. In this manner it is not possible to measure the DC efficiency taking into account the efficiency of the transport and warehouse subsystems, regarding the fact that these two subsystems possess common input and output variables. CCR DEA models are not "sensitive" enough when evaluating the DMU efficiency, regarding the fact that they do not take into consideration the compromises and conflicts of independent DC subsystems goals. MODEA approach offers the possibility of overcoming the mentioned problem (Klimberg and Puddicombe, 1999). MODEA does not represent a simple set of independent standard CCR DEA models, but takes into account the common resources and multiple goals of the subsystems.

In the model suggested in this work, the common input variable is the number of employees, while the common output variable is the number of realized deliveries. In most of the cases, the contribution of the common variable in one subsystem depends upon the contribution of the same variable in the other subsystem. In the ideal case, the ratio of the common variables should be approximately 1 (the contribution of the common variable is identical). By further limitations upon the influence of the common variables in different goals on the part of the decision maker, the model becomes "closer" to the real state of affairs and good operational practice. Examination of the weights of the variables and their influence within the goals enables the decision makers to reach a suitable compromise.

In the analyzed example, the set of decision making units makes 20 DC (DMU) ($k = 1, 2, \dots, 20$), with two subsystems each ($p=1,2$). The warehouse and transport subsystems are characterized by i input variables ($i=1,2,\dots,m_p$) and r output variables ($r=1,2,\dots,s_p$). In the concrete case, the transport and warehouse subsystems have two input and output variables each ($m_1= m_2= s_1= s_2=2$). The variable of the r -th output of the p -th subsystem of the k th DC is marked by y_{rpk} , while x_{ikp} marks the variable of the i -th output of the p -th subsystem of the k -th DC. The weight coefficient assigned to the r -th output of the p -th subsystem u_{rp} and the weight coefficient assigned to the i th output of the p -th subsystem v_{ip} represent the unknown variables (decision making variables). The

coefficient φ represents the parameter of closeness of the common resources, assigned by the decision maker. In the concrete case, the MODEA model for measuring the efficiency of the k -th DC has the following form:

$$\text{Max} \sum_{p=1}^2 w_{kp} = w_{k1} + w_{k2} = u_{r1} y_{rk1} + u_{r2} y_{rk2},$$

(6)

Subject to:

$$\sum_{i=1}^{m_p} v_{ip} x_{ikp} = 1, p = 1, 2$$

(7)

$$\sum_{r=1}^{s_p} u_{rp} y_{rkp} - \sum_{i=1}^{m_p} v_{ip} x_{ikp} \leq 0, \forall p = 1, 2; \forall k = 1, 2, \dots, 20$$

(8)

$$1 - \varphi \leq \frac{\frac{u_{r1}}{s_1}}{\frac{u_{r2}}{s_2}} \leq 1 + \varphi$$

(9)

$$1 - \varphi \leq \frac{\frac{v_{i1}}{m_1}}{\frac{v_{i2}}{m_2}} \leq 1 + \varphi$$

(10)

$$v_{ip} \geq 0, p = 1, 2; i = 1, 2$$

(11)

$$u_{rp} \geq 0, p = 1, 2; r = 1, 2$$

(12)

In the next chapter, different approaches to the evaluation of DC as well as its transport and warehouse subsystems have been considered in more detail. The obtained results have been compared after which certain conclusions have been presented.

Results and Discussion

In this work, the efficiency of 20 DC and its transport and warehouse subsystems has been analyzed. The set of the observed DC can be deemed homogenous due to the fact this DC operate in the same way and under the same conditions. The efficiency estimation has been carried out by applying the CCR DEA and MODEA approaches. The DC efficiency variables, by applying different approaches, have been represented in the table 2. The first three models refer to the MODEA approach, in which the coefficient φ (closeness parameter) takes the variables of 10%, 20% and 50%. By comparing the number of DC efficiencies obtained by applying the MODEA and CCR DEA approaches, it is pointed to a considerably larger number of efficient DMU by applying the latter approach. This can be explained by the fact that CCR model joins all indicators into a unique measure of efficiency with no separation or observation of the efficiency of its subsystems, that is to say it "overrates" the efficiency of DC.

Table 2: DC Efficiency

<i>DMU</i>	<i>MODEA</i>			<i>CCR</i>
	<i>10%</i>	<i>20%</i>	<i>50%</i>	
DMU 1	0.9783	0.9837	0.9997	1.0000
DMU 2	2.0000	2.0000	2.0000	1.0000
DMU 3	1.7778	1.7969	1.7969	1.0000
DMU 4	0.6835	0.6911	0.6951	0.4783
DMU 5	0.5022	0.5177	0.5379	0.3704
DMU 6	0.7862	0.7923	0.8051	0.6182
DMU 7	1.5490	1.5832	1.6336	0.9496
DMU 8	0.7859	0.7931	0.8149	0.5650
DMU 9	1.0605	1.0718	1.1087	0.6912
DMU 10	1.0524	1.0577	1.0736	0.7153
DMU 11	1.4337	1.4961	1.6667	1.0000
DMU 12	2.0000	2.0000	2.0000	1.0000
DMU 13	0.6147	0.6216	0.6240	0.5063
DMU 14	0.3101	0.3175	0.3180	0.2289
DMU 15	1.6086	1.6086	1.6097	1.0000
DMU 16	1.6267	1.6349	1.6594	1.0000
DMU 17	2.0000	2.0000	2.0000	1.0000
DMU 18	0.3523	0.3554	0.3554	0.1921
DMU 19	1.0539	1.0948	1.2194	1.0000
DMU 20	0.5993	0.5993	0.6045	0.4670
<i>Average efficiency</i>	<i>1.1388</i>	<i>1.1508</i>	<i>1.1761</i>	<i>0.7391</i>
<i>Efficient DMUs</i>	<i>3 (15%)</i>	<i>3 (15%)</i>	<i>3(15%)</i>	<i>9 (45%)</i>
<i>Inefficient DMUs</i>	<i>17 (85%)</i>	<i>17 (85%)</i>	<i>17(85%)</i>	<i>11 (55%)</i>

By applying the MODEA approach, it can be obtained only 15% efficient DC, while CCR approach yields even 45% efficient DC (table 2). Such results can be explained by the fact that CCR model does not take into consideration the efficiency of subsystems in DC. On the other hand, acc. to MODEA approach, DC is efficient if the transport and warehouse subsystems are efficient. The average efficiency of DC by applying MODEA approach for $\varphi = 10\%$ amounts to 1.1388 (table 2) with the average efficiency of warehouse subsystem amounting to 0.5158, and transport one to 0.6229. The observed DC set can be considered as relatively inefficient and the largest portion of this inefficiency is a consequence of the warehouse subsystem inefficiency.

Efficiency of one DC subsystem (warehouse or transport one) does not entail the DC efficiency. Based upon the table 3, it can easily be concluded that warehouse subsystem efficiencies are smaller than the transport subsystem efficiencies regardless of the variable of the parameter φ . By analyzing the obtained variables, it can be concluded that there is a certain number of DC whose subsystems do not change the efficiency regardless of the approach. DMU 2, DMU 12 and DMU 17 represent DC with stable performances and which are efficient according to both the MODEA and the CCR DEA approach. Stable efficiency of these centres can be explained by a relatively small

quantity of the used resources for the realization of a great number of deliveries over 7000 (considerably higher than average), with the number of errors in the transport and warehouse subsystems DMU 2 and DMU 12 considerably lower than average.

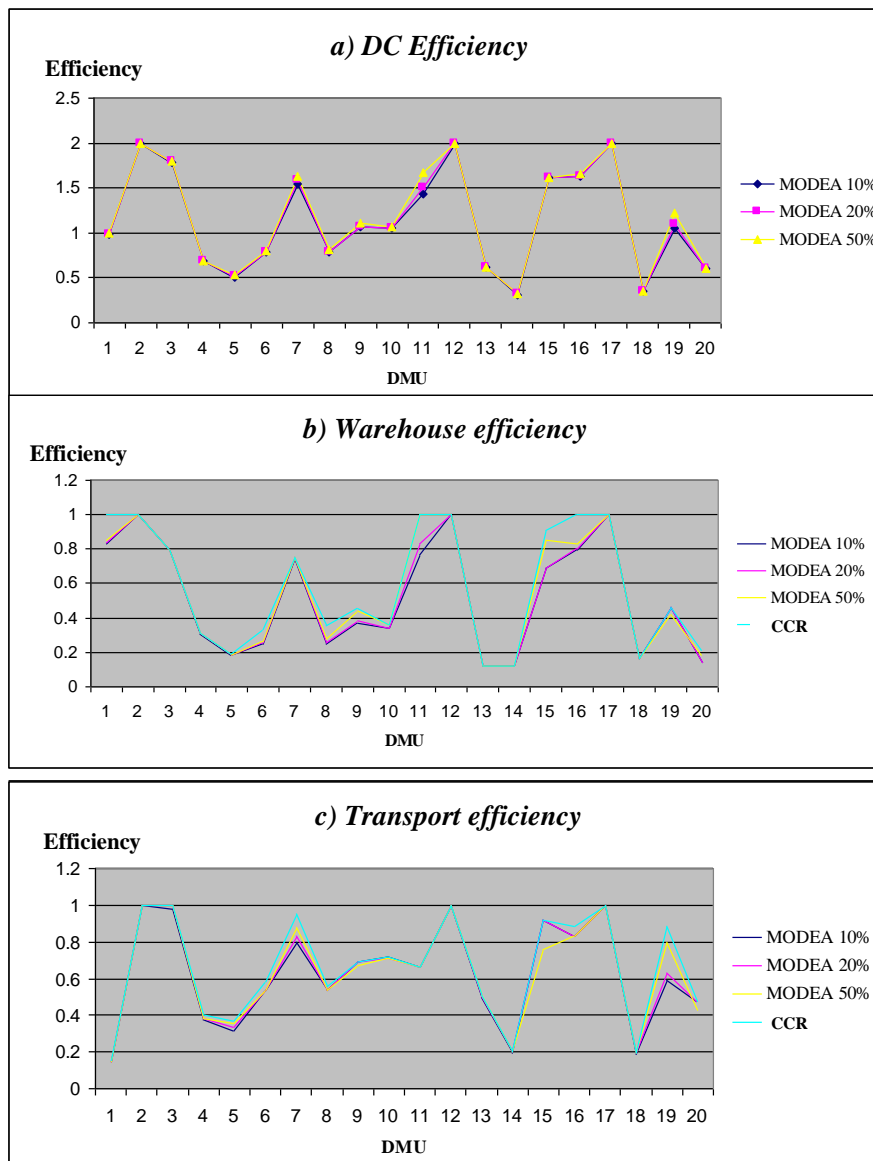


Figure 4: Efficiency of DC and its subsystems

By analyzing table 3 and figure 4 in more detail, three characteristic DC groups can be selected. The first group is comprised of the formerly mentioned efficient units. This group includes DMU 2, DMU 12 and DMU 17 whose transport and warehouse subsystems are efficient. The second group includes the units whose warehouse subsystem is significantly more efficient than the transport subsystems. Such units are DMU 1 and DMU 11. As opposed to them, DMU 3, DMU 6, DMU 8, DMU 9 and DMU 13 have significantly more efficient transport subsystems. The last two DC groups, apart from inefficiency of at least one subsystem are characterized by the overall DC inefficiency. This confirms the claim that no DC can be efficient if one of its subsystems is inefficient.

Table 3: Efficiency of the Warehouse and Transport Subsystems

	<i>Warehouse subsystem</i>				<i>Transport subsystem</i>			
	<i>MODEA 10 %</i>	<i>MODEA 20%</i>	<i>MODEA 50%</i>	<i>CCR</i>	<i>MODEA 10 %</i>	<i>MODEA 20%</i>	<i>MODEA 50%</i>	<i>CCR</i>
DMU 1	0.8299	0.8353	0.8513	1.0000	0.1484	0.1484	0.1484	0.1573
DMU 2	1.0000	1.0000	1.0000	1.0000	1.0000	1.0000	1.0000	1.0000
DMU 3	0.7969	0.7969	0.7969	0.7969	0.9809	1.0000	1.0000	1.0000
DMU 4	0.3048	0.3122	0.3122	0.3122	0.3788	0.3789	0.3829	0.3991
DMU 5	0.1853	0.1853	0.1853	0.1902	0.3169	0.3324	0.3526	0.3704
DMU 6	0.2466	0.2527	0.2655	0.3358	0.5396	0.5396	0.5396	0.5851
DMU 7	0.7487	0.7524	0.7535	0.7535	0.8003	0.8308	0.8802	0.9496
DMU 8	0.2500	0.2573	0.2790	0.3516	0.5358	0.5358	0.5358	0.5549
DMU 9	0.3693	0.3806	0.4383	0.4514	0.6912	0.6912	0.6704	0.6912
DMU 10	0.3381	0.3438	0.3603	0.3603	0.7143	0.7139	0.7133	0.7153
DMU 11	0.7670	0.8293	1.0000	1.0000	0.6667	0.6667	0.6667	0.6667
DMU 12	1.0000	1.0000	1.0000	1.0000	1.0000	1.0000	1.0000	1.0000
DMU 13	0.1177	0.1177	0.1177	0.1177	0.4970	0.5039	0.5063	0.5063
DMU 14	0.1179	0.1179	0.1179	0.1225	0.1921	0.1996	0.2001	0.2023
DMU 15	0.6886	0.6886	0.8502	0.9060	0.9201	0.9201	0.7595	0.9201
DMU 16	0.7976	0.8058	0.8304	1.0000	0.8291	0.8291	0.8291	0.8846
DMU 17	1.0000	1.0000	1.0000	1.0000	1.0000	1.0000	1.0000	1.0000
DMU 18	0.1632	0.1632	0.1632	0.1632	0.1890	0.1921	0.1921	0.1921
DMU 19	0.4629	0.4650	0.4201	0.4650	0.5910	0.6298	0.7994	0.8844
DMU 20	0.1323	0.1323	0.1800	0.2029	0.4670	0.4670	0.4245	0.4670
<i>Average efficiency</i>	0.5158	0.5218	0.5461	0.5765	0.6229	0.6290	0.6301	0.6573
<i>efficient DMUs</i>	3 (15%)	3 (15%)	4 (20%)	4 (20%)	3 (15%)	4 (20%)	4 (20%)	4 (20%)
<i>Inefficient DMUs</i>	17 (85%)	17 (85%)	16 (80%)	16 (80%)	17 (85%)	16 (80%)	16 (80%)	16 (80%)

The weight coefficients of the number of employees in DC, as common input variables, and of the number of realized deliveries, as common output variables, depend upon the variables of the parameter φ assigned on the part of the decision maker. Based on tables 2 and 3, as well as the figure 4, it can easily be concluded that the variables of the efficiency of DCs and its subsystems change with the increase in the variable of the mentioned parameter. Smaller variables mark larger "closeness" and smaller variations in the weight coefficients assigned to the common variables. By reducing the area of the allowed solutions, the variables of the goal function that is to say efficiency are reduced too. As opposed to this, larger φ variables mean a larger area of the allowed solution, entailing larger efficiency variables.

Variables of the average DC efficiencies for different parameter φ variables (10%, 20% and 50%) amount to, in sequence, 1.1388, 1.1508, 1.1761. The change in the parameter φ variables has influenced little or not at all upon the efficiency of certain DC (DMU 1 and DMU 3), while in some of them it significantly changed the efficiency (DMU 11). DMU 11 for $\varphi = 10\%$ has the efficiency of 1.4337, while for $\varphi = 50\%$ the efficiency rises to 1.6667. The change in variables of the observed parameter, that is in the efficiency of the observed DC, has reflected exclusively in the efficiency of the

warehouse subsystem which from an inefficient one (0.7670) has become an efficient (1.000) subsystem. On the other hand, in the transport subsystem DMU 11 there are no such changes in the efficiency.

Concluding Remarks

In the conditions of market economy and strong competition, companies have to be ready for development and application of the widest range of methods, models and techniques, by means of which to enhance their business system, all with the aim of winning a strong enough position in the market. The modern customer does not wait to satisfy their own need. This is why the readiness of the company to respond to any demand on the part of the customer has to be at the highest level. Measuring DC efficiency, as well as determining the influence of certain subsystems, processes and activities upon the overall efficiency, over the recent years, has become an extremely important task.

The model proposed in this paper illustrates the significance and influence of subsystems efficiency upon the overall DC efficiency. The significance of the model is reflected in the fact that the model simultaneously measures the efficiency of DC, that is to say its warehouse and transport subsystem, including the indicators of both the operational and qualitative efficiency. The application of this model can produce useful information on the organizational changes which may influence the costs reduction and increase in the quality of services. The illustrated model represents the basic model which may further be built upon, perfected and used to multiple purposes. Above all, it represents assistance to DC managers in the decision making process. Apart from this, the model, with minimal corrections, can be used to estimate the efficiency of other logistics systems and supply chains. The model, also, represents assistance to the decision makers in the process of choosing logistics providers.

In literature, there is a lack of case studies, that is model testing in the concrete DC examples. This fact indicates the insufficient amount of researches in this area. The efficiency of supply chains is also influenced by a great number of factors upon which the company management have no influence. In future models, it would be desirable to introduce certain indicators which, to a certain extent, can describe external factors such as: weather conditions, market situation, competition behavior, etc.

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The importance of graphical tools for measurement systems analysis

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Category: Research paper

Introduction

The decision making based on facts is one of basic principles of the quality management. The application of this principle within the scope of planning, management and process improvement means that all decisions made on process interventions are based on data analysis of this process. Most often such data present measured values of quality characteristics of the product or of its parts. In practice, we face the question whether the measured values are credible, whether they really describe the true behavior of the production process and whether the values are not considerably distorted by the measurement system. In case where the measurement system properties are not suitable and measured values of the characteristic do not correspond to the reality, there is a risk that, based on these distorted values, the well-intentioned interventions into the production process mean the wrong decisions that can cause no small financial loss. Due to this reason, the recognition of the measurement system properties is the basic condition for correct decision making within the planning, management and process improvement.

The measurement system properties can be evaluated by means of measurement system analyses. Today the analysis of measurement systems is required at all suppliers within the automotive industry. Its realisation is required by the standard ISO/TS 16949 that defines the requirements on the quality management system of the automotive industry and its suppliers. The MSA methodology is the most used in the practice, it was created by the trinity of largest American automotive companies Chrysler Group LLC, Ford Motor Company and General Motors Corporation within standards QS 9000 (AIAG, 2010). There also another procedure, for example the VDA 5 methodology (VDA, 2010) that has been created within the branch standards VDA of the German automotive industry. The evaluation of uncertainties of measurement in the VDA 5 methodology is based on evaluation experience with measurement uncertainties by testing and calibration laboratories where this evaluation is required by the standard EN ISO/IEC 17025 that defines the general requirements on the capability of these laboratories. The definition of uncertainty of measurement and instructions for its determination can be found in the manual GUM – Guide of Expression of Uncertainty in Measurement (ISO/IEC, 1995).

Measurement system analysis

The methodology MSA – the measurement system analysis is the basic document of the measurement system analysis within the sphere of suppliers of the American automotive industry. The newest fourth edition of this manual has been published in the year 2010. The purpose of this handbook is to provide guidelines for assessing the key characteristics of measurement systems. Among the most important characteristics include:

- Stability
- Bias
- Linearity
- Precision
- Repeatability
- Reproducibility

The stability or the drift is the total variability of measurement, obtained by the measurement system on the same product (etalon) in case of measurement of the same characteristics in the longer time period. The stable system does not show the change of bias in the time. This means that the stability is the change of the bias in the time.

The bias is the difference between the average of repeated measurements and the reference value. The bias is the level of systematic error of the measurement system and contributes to the total error made by combined effects of all sources of variability, known as well as unknown. If the bias is nonzero, it is necessary to recalibrate measurement system.

The change in bias over the normal operating range is called as linearity. **The linearity** is determined by means of samples or etalons of which the characteristics are distributed all over the whole supposed working range of the measurement system. The linearity can be understood as the change of bias as for the size of measured value.

The precision is usually described as the whole effect of the threshold, sensitivity and repeatability within the work range of the measurement system. The rate of measurement precision is usually given by its non-precision that is expressed by means of standard deviation of measurement results. The precision of measurement characterises the effect of random errors of measurement.

The total variability of measured data about product quality is caused by the variability of the production process in itself and by the variability of used measurement system. The measurement system variability is compound of the measurement repeatability, i.e. the gauge variability, and reproducibility that can be characterised as the variability (variation in behaviour) of operators. The division of the total variability is shown in the Figure 1.

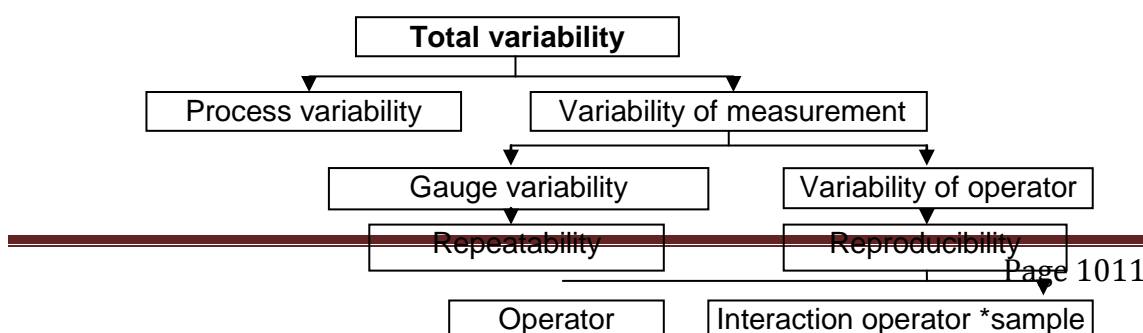


Fig. 1 Map of total variability of measured data about product quality

The measurement **repeatability** is closely related to the term of measurement precision which is expressed using the standard deviation of measurement results and characterizes the actions of random measurement errors. The repeatability itself represents the precision of measurements in conditions of repeatability, it is denoted as EV and usually refers to gauge variability (Fig. 2). The repeatability conditions are those, when independent measurement results are acquired by the one operator by the same method, with the same measuring device at the same measurement site and within the shortest time period.

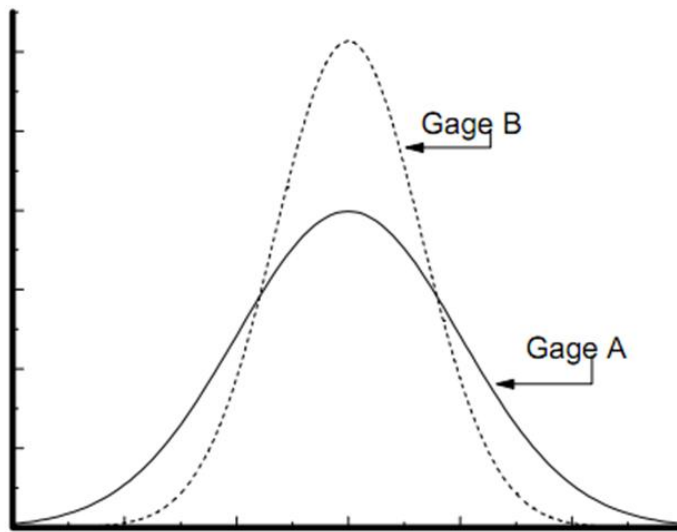


Fig. 2 Measurement systems with different repeatability

The measurement reproducibility is the variability of averages of the measurements carried out by various operators using the same gauge to take measurement of the same characteristics on the same product (Fig. 3). It is the variability of the measurement system caused by difference in conditions under which the measurement is executed.

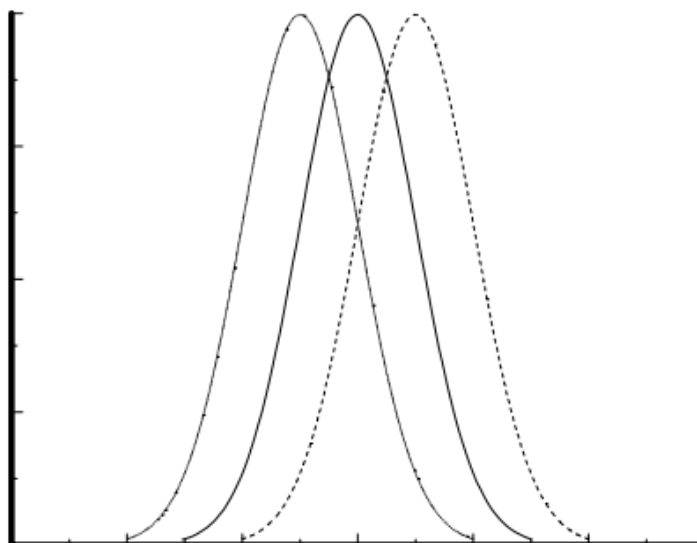


Fig. 3 Reproducibility

Gauge repeatability and reproducibility study

The evaluation of combined repeatability and reproducibility of the measurement system (GRR) is implemented because it is mostly impossible to ensure constant conditions (repeatability conditions) during the measurement itself in practice. The actual measurement conditions usually vary whereas the operator taking the measurement is the one who is most frequently changed. The study on repeatability and reproducibility of the measurement system can be done using several different procedures. The three most used methods are the following:

- Range Method
- Average and Range Method
- ANOVA

The Range method is also called the “short method” and enables the quick approximation of the measurement variability. This method provides only the whole picture of the measurement system because it does not decompose the variability into the repeatability and reproducibility. Usually it is used for the quick assessment if the GRR value change has not happened.

The Average and Range Method is used for the standard study of measurement system repeatability and reproducibility. Contrary to the Range Method it enables to evaluate not only the combined repeatability and reproducibility but also the repeatability and the reproducibility separately.

The ANOVA (Analysis of Variance) is the standard statistic method and can be used for analysing of measurement errors and other sources of the variability of data during the study of measurement system. In contradiction to other two methods, ANOVA also enables to define the size of interaction between parts and operators effects. Its disadvantage consists in the complexity of numeric calculations and in its difficulty for the user, especially as for the specific level of statistic knowledge for the correct use of this method.

Average and Range Method

This method is the most used in the practice, even it is more demanding as for sources and time compared to the Range Method. This method is divided into three phases, i.e. the preparative phase, measurement phase and analysis evaluation phase.

During the preparative phase it is necessary to define all basic parameters of the measurement system analysis, i.e. the number of operators for performance of the measurement system analysis, number of measured samples and number of repeated measurements per each sample. There should be ten measured samples at least. Each sample shall be measured by the operator two times at least and the number of operators shall be based on the real usage of the measurement system. The choice of measured samples is very important part of the preparation stage. The measured samples shall equally cover the whole production range of the monitored characteristic for the purpose of the standard analysis procedure.

The measurement phase includes the assurance of measurement independence. This independence can be achieved so that particular operators do not know number of particular samples even not the results of previous measurement. Due to these reasons the monitoring of measurement and data recording is performed by the charged employee.

The analysis evaluation is divided in several coherent steps. In the first step it is possible to calculate the value of repeatability of measurement (EV). The repeatability is evaluated by the following relation:

$$EV = \bar{R} \times K_1$$

(1)

Where:

- \bar{R} average range of repeated measurements for all operators
- K_1 coefficient depending on the number of repeated measurement, number of operators and number of measured samples

In the following step it is possible to proceed to the calculation of the measurement reproducibility. Based on the given value of range of arithmetic averages of repeated measurements of particular parts by particular operators R_0 it is possible to evaluate the reproducibility of measurement (AV) based on the following relation:

$$AV = \sqrt{\bar{X}_{DIFF} \times K_2 - \frac{EV^2}{n \cdot r}}$$

(2)

Where:

- \bar{X}_{DIFF} range of averages of all measurements taken by individual operators
- r number of measured samples
- n number of trials
- K_2 coefficient depending on the number of operators

At this stage we have the necessary information to evaluate the repeatability and reproducibility of measurement (GRR) based on the following relation:

$$GRR = \sqrt{EV^2 + AV^2} \quad (3)$$

The only GRR value cannot predicate the suitability of the analysed measurement system. The suitability of the analysed measurement system can be defined only after the comparison of the repeatability and reproducibility regarding the total variability. For the calculation of total variability it is necessary to define the value of range of averages of all measurements of particular samples R_p . We determine the variability among measured samples PV by the following relation:

$$PV = R_p \times K_3$$

(4)

Where:

- R_p range of averages of all measurements of particular samples
- K_3 coefficient depending on the number of measured samples

Now, based on the variability among measured samples and the repeatability and the reproducibility of measurement we can define the total variability (TV) by the following relation:

$$TV = \sqrt{GRR^2 + PV^2}$$

(5)

In the last step, we can proceed to the definition of the repeatability, reproducibility, repeatability and reproducibility and variability among samples in the total variability percentage. The percentage portion of the repeatability and reproducibility of measurement in relation to the total variability is calculated as follows:

$$\%GRR = \frac{GRR}{TV} \cdot 100 \quad (6)$$

In the similar way, the percentage portions of other compounds of the total measurement system variability are calculated. (%EV, %AV, %PV).

In case the measured samples do not represent the production range, it is necessary to estimate the total variability value by another method. It is possible to use the value of standard deviation of monitored characteristic achieved by the production process, the value of standard deviation of monitored characteristic that should be achieved by the process under the required capability or the sixth of the tolerance width. The method of total variability estimation must be always stated.

For the final evaluation of the measurement system it is necessary to add the ndc value that represents the number of distinct categories that can be discerned by the measurement system. The ndc value is calculated as follows:

$$ndc = 1,41 \cdot \frac{PV}{GRR} \quad (7)$$

The conclusion regarding the acceptability of the measurement system should be made after evaluation of all indicators based on the values calculated. Three situations may occur as described in Table I.

Table I GRR analysis acceptance criteria

%GRR ≤ 10% and ndc ≥ 5	the measurement system is acceptable
10% < %GRR ≤ 30% and ndc ≥ 5	the measurement system is conditionally acceptable owing to global variability of the process or the tolerance range, and it depends on the proportion of the remedy cost and importance of the quantity monitored.

%GRR > 30% or ndc < 5	the measurement system is unacceptable and it must be improved
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The numeric results of the analysis of repeatability and reproducibility of the measurement, based on which the measurement system acceptability is evaluated, can be affected by many factors. The number of affecting factors is not small, for the lucidity purpose they can be divided into categories: operator, measured samples, measurement conditions, gauge and measurement method. The detailed enumeration of possible affecting factors and their classification in categories is shown in the Figure 4.

It can be seen that number of influencing factors is rather high and they are related to the various areas. These factors can be for simplification divided to the two groups:

- Factors affecting values of GRR analysis results
- Factors affecting confidence of GRR analysis results

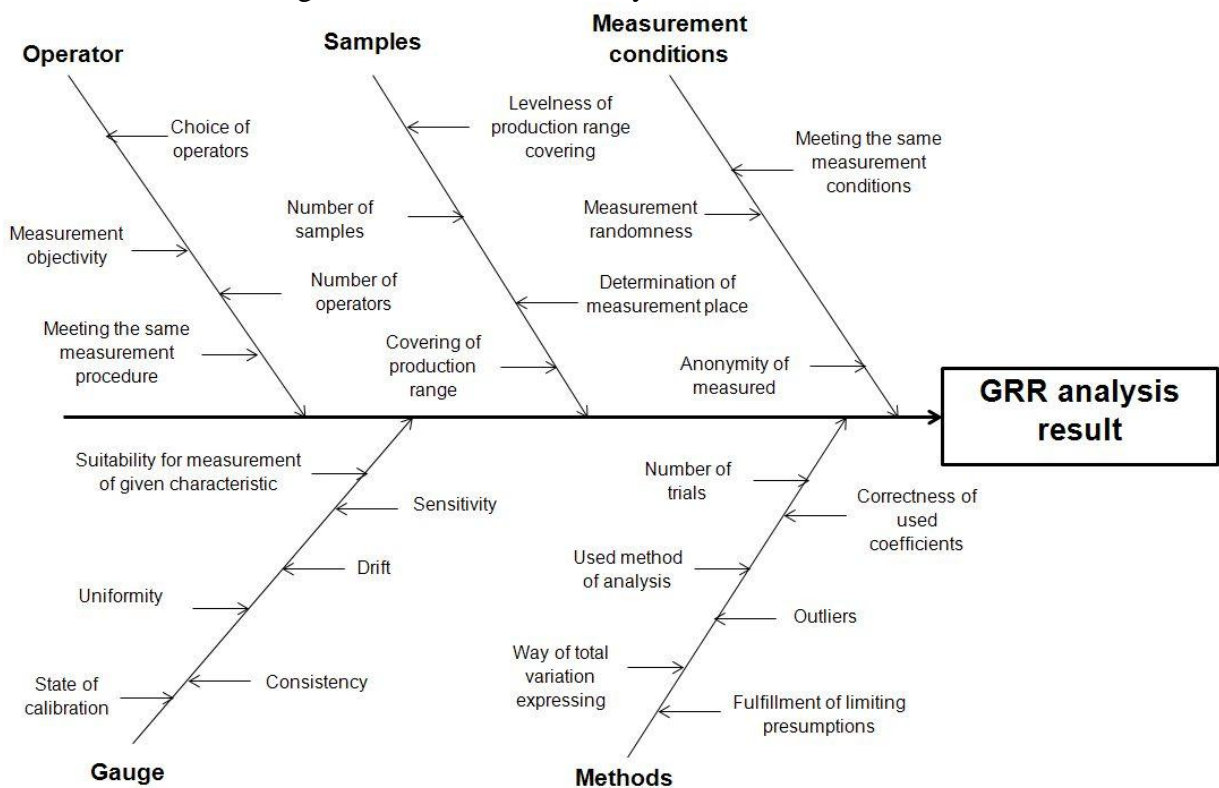


Fig. 4 Ishikawa diagram for factors affecting GRR analysis result

Factors affecting the values of GRR analysis results

The importance of factors affecting the values of GRR analysis results consists in the fact that they may significantly influence the resulting value of combined repeatability and reproducibility of measurement system and subsequently its percentage share in total variability of the process. The following ranks among these factors, for example:

- Coverage of production range
- Uniformity of production range coverage
- Outliers

Coverage of production range

After selecting the number of samples to be used for the measurement system analysis, it is necessary to ensure that the selected samples cover the overall production range of the given process. If samples not covering the overall production range are selected for GRR analysis, its result may be significantly distorted. If overall variability of the process is computed using the variability among the measured samples by default, the failure to cover the overall production range results in an increased value of the percentage share in the GRR value. In cases when it is not possible to provide samples covering the overall production range, it is necessary to acquire the value of overall variability of the process in other way (e.g. based on the knowledge of standard deviation of the process), or to use the sixth of tolerance width of the monitored characteristic.

Uniformity of production range coverage

The samples for GRR analysis should cover the production range of the monitored characteristic uniformly. The presumption of uniform coverage of the production range is utilized in evaluation of suitability of the measurement system to assess the variability among samples using an average control chart. The average values of the monitored characteristic plotted in this control chart represent the variability of the production process whereas the control limits represent the variability of the measurement process. The measurement system is considered as satisfactory for assessment of the variability among the measured samples in the case that at least 50% plotted averages are found beyond the control limits (see Fig. 12). If the measured samples did not cover the production range uniformly, this criterion would not be applicable.

Outliers

The same way as in other spheres of quality planning and management, it is also necessary in the case of measurement system analysis that the results from the statistical methods used are not affected by any outliers. Depending on the amount of remoteness and the locality of these values in the data file, fictitious overestimation and underestimation of the resultant values of GRR analysis may occur. The occurrence of both situations is illegal and that is why the outlier values must be discovered in a suitable way and their causes analysed and consequently eliminated in justified cases. The application of graphical tools of GRR analysis is the suitable tool for detection of outlier values.

Factors affecting the confidence of GRR analysis results

The resultant values of GRR analysis are just point estimations and their real values lie with the predetermined probability in the confidence interval round this point estimation. So the width of the confidence interval characterizes the quality of analysis results and its knowledge should be considered when comparing the acquired results with the limit values. Due to the point estimation, the confidence intervals are asymmetric with a greater distance to the upper limit which is important for the assessment of acceptability of measurement systems. The enhancement of quality of GRR analysis results is dependent on possibilities of narrowing the confidence intervals of the results from this analysis. Apart from the selected level of significance, the size of confidence intervals of the GRR analysis results executed by means of Average and Range Method (A&R) on the following parameters:

- The number of operators taking measurements
- The number of measured samples
- The number of trials.

The influence of different values of input parameters on the reliability of GRR analysis results was discussed in detail in former work (Plura, Klaput 2011)

Graphical tools of the GRR analysis

In case of influence by discussed effects the state of measurement system can appear as better or worse compared to the reality. This fact can cause the useless effort in searching for the non-existing problem or can mean the failure to act in case where it would be necessary to immediately improve the measurement system. Not only for these reasons the analysis of gathered data by suitable graphical tools, should be the important part of the evaluation of repeatability and reproducibility.

Usually the graphical relations of given parameters are constructed, based on the number of sample, i.e. in the random order. The authors of this article recommend to rank the samples according to measured values, and to preserve this sequence also in the relevant graphs. It is due to the fact that when the samples are ranked, the relevant graphs are more transparent and more easily evaluable. In addition, this arrangement makes possible to evaluate also other measurement system properties, which evaluate dependence on measured values size (e.g. linearity and uniformity).

Such constructed graphical tools can serve also for the evaluation of effects by several factors stated in the Ishikawa diagram in the Figure 4. Particular graphical tools were applied on real data shown in the Table II. This table presents the practical measurements of matrices height made by three operators by means of digital calliper (Plura, 2001).

Table II Measured data of matrices height

Operator	Trials	Measured sample									
		1	2	3	4	5	6	7	8	9	10
A	1	10,96	10,9	10,67	10,35	10,71	10,82	10,55	10,65	10,46	10,55

	2	10,97	10,89	10,68	10,4	10,68	10,81	10,56	10,63	10,47	10,57
B	1	10,99	10,89	10,68	10,42	10,73	10,8	10,54	10,64	10,45	10,57
	2	10,96	10,93	10,74	10,39	10,72	10,84	10,6	10,69	10,43	10,54
C	1	10,94	10,85	10,71	10,36	10,73	10,75	10,48	10,65	10,42	10,55
	2	10,91	10,84	10,64	10,33	10,65	10,76	10,49	10,66	10,45	10,53

Diagram of sample choice suitability

The first graph that should be done after the data gathering is the diagram of sample choice suitability by means of which it is possible to check whether the set of measured samples covers the production range of monitored characteristic and whether the relevant covering is even (Fig. 5).

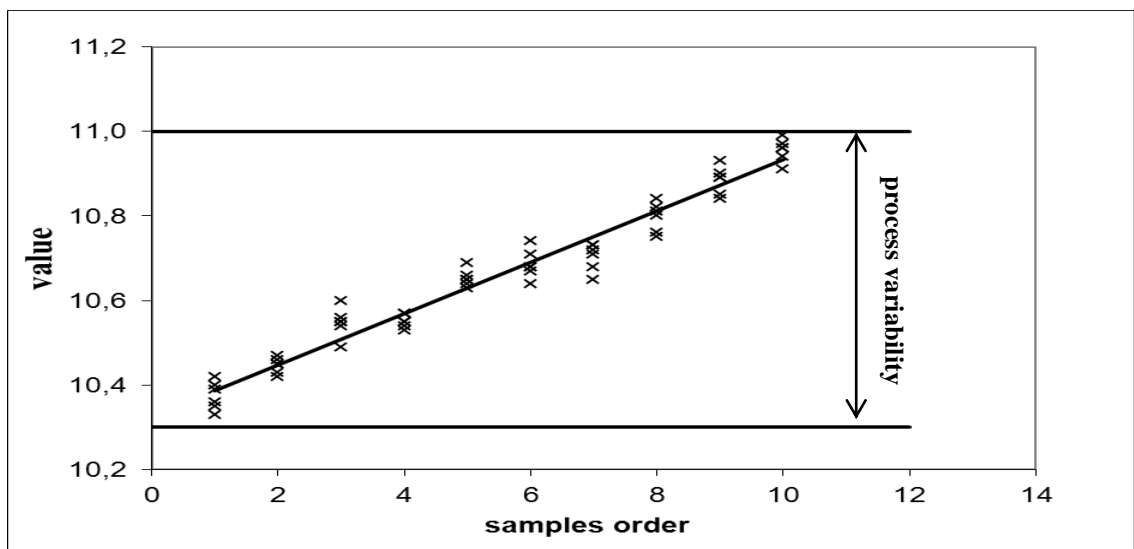


Fig. 5 Diagram of sample choice suitability

Production range covering is required for the calculation of total variability (TV) with using of variability among measured samples (PV). The premise of covering evenness is used for evaluation of measurement system suitability for evaluation of variability among samples by means of the average control chart of repeated measurements of particular samples by particular operators. In the relevant picture (Fig. 5) the production range covering by measured samples can be evaluated based on the comparison of measured values with the area of variability of monitored characteristic. The covering evenness can be evaluated using the straight-line dependency of measured values of ranked samples on the order.

In case of given real data it is obvious that the suitable set of samples has been used. The measured samples cover the production range and this covering is even at the same time.

Scatter plot

This diagram clearly shows all particular measurements of samples made by particular operators. This diagram (Fig. 6) enables to consider the conformity of repeated measurements made by particular operators as well as the conformity among the

particular operators respectively. The scheme of real measured data, for example, points out the fact that the operator C, in case of some samples (samples order 3, 7, 9 and 10), has measured considerably lower values in both measurements compared to operators A and B.

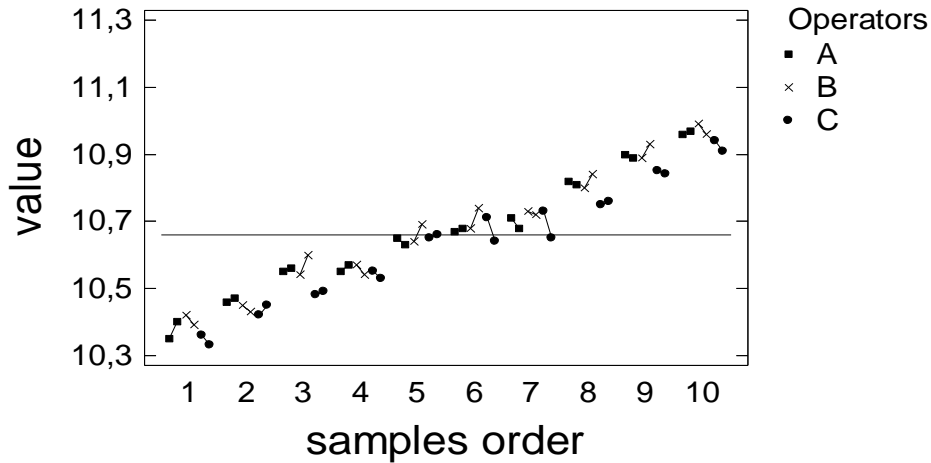


Fig. 6 Scatter plot

Error Chart

The diagram of deviations of data measured by particular operators from reference values of particular samples is another very appreciated graphical tool of the measured values analysis. In case the reference values of samples are not at the disposal, the deviation from averages of all measurements of particular samples (Fig. 7) can be evaluated.

Compared to the previous diagram, this graphical tool also enables to objectively consider how the particular operators differ in reference or average values in case of particular samples and to assess the dependence of deviations on the size of measured value. The figure shows that the operator A achieved the lowest and the most well-balanced values of deviations. The other two operators had much more bigger deviations, in addition, the operator B overvalued the measurements results and the operator C undervalued them.

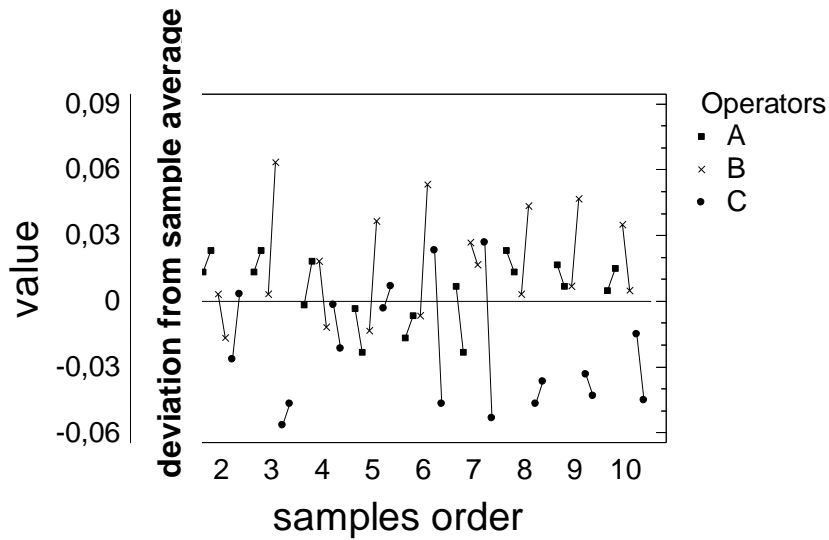


Fig. 7 Error chart

GRR diagram

Even this diagram is not stated in the newest edition of the MSA manual, it is a part of many software products containing analysis of repeatability and reproducibility of measurement system. In this diagram (Fig. 8), in bordered rectangle fields, the results of measurement by particular operators are shown. Every point in the diagram shows the deviation among the particular measurements of the specific part and the total average of all measurements of the sample. The horizontal levels in particular rectangles correspond to differences between the averages of all samples by particular operators and the total average of all measurements. Like in case of the previous diagram, it is possible to use this diagram for evaluation of the variability of repeated measurements achieved by particular operators.

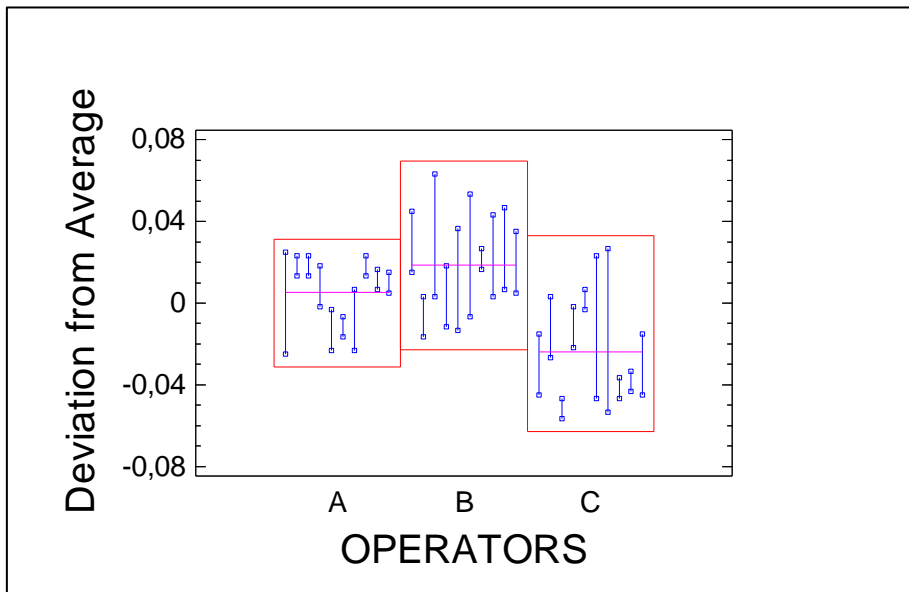


Fig. 8 GRR diagram

The relevant scheme of real data in the Figure 8 for example shows that the lowest variability of measurements has been achieved by the operator A and that his measured values are nearest to the average of all measurements. Regarding the fact that the measured samples in this diagram are ordered by the value of monitored character, this diagram provides also the information on the measurement system uniformity (change of measurement repeatability depending on the size of the measured value). In given case it can be considered that the uniformity is acceptable because the variability of repeated measurements obviously does not depend on the order of sample.

Error histogram

The objective consideration of the quality of samples measurements by particular operators can be done by comparison of distribution of achieved measurement deviations from the reference sample values, eventually of averages of their measurements, by means of histograms. The relevant picture enables to clearly compare the size of deviations of particular operators and also to check whether some operators measure systematically lower or higher values. The Figure 9 shows the relevant comparison for the presented case study.

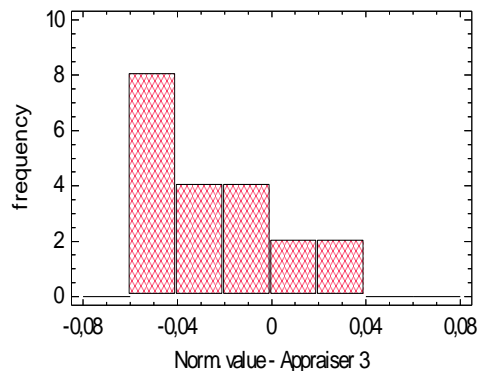
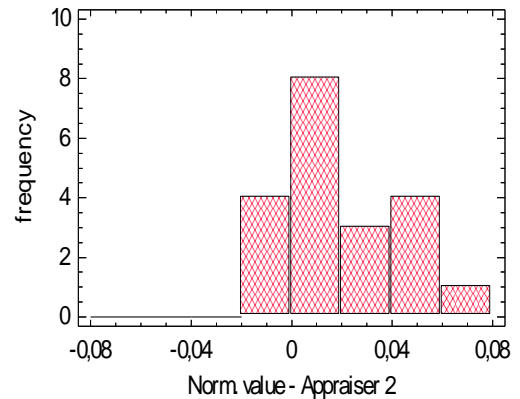
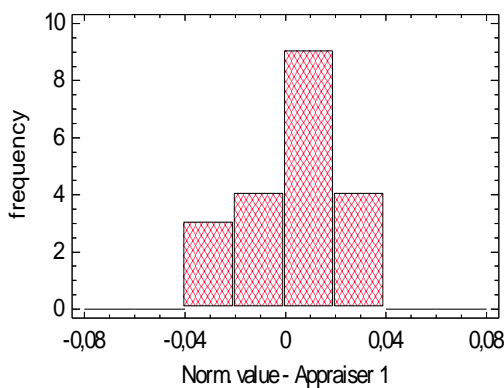


Fig. 9 Error Histograms

The figure shows that the operator A achieved the lowest and the most well-balanced values of variations. The other two operators had much more bigger variations, in addition, the operator B mostly overvalued the measurements results and the operator C mostly undervalued them.

Box and whisker plot

The box and whisker plot is another very important graphical tool of the measured data analysis that enables to identify the occurrence of outliers and to characterise the symmetry of distribution of measured data. Regarding the fact that this tool should be applied to data for which the homogeneity is supposed, it should be applied separately for repeated measurements of particular samples by particular operators. At this application, the problem of small quantity (often only two measurements) of data can occur. The valuable results can be obtained also by application of box and whisker plot on all measurements of particular samples (Fig. 10).

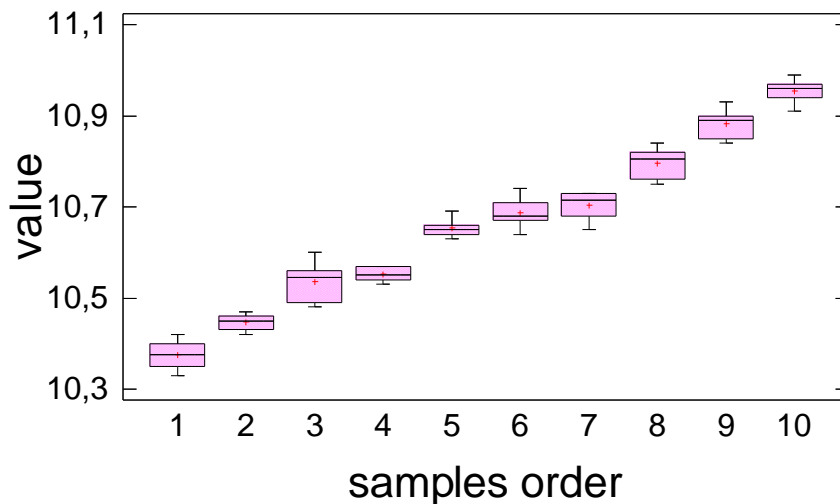


Fig. 10 Multiple box and whisker plot

The application of box and whisker plots to the real data shows that measured values of particular samples do not contain any outlier value.

Range control chart

Before the calculation of measurement system repeatability it is necessary to check one of premises, i.e. the statistical stability of measurement process as for the variability of repeated measurements. This verification is done by means of the range control chart. The level of central line of control chart corresponds to the average range of repeated measurements for all operators. This is calculated based on the following relation:

$$CL = \bar{R} = \frac{\sum_{i=1}^h \bar{R}_{i..}}{h}$$

(8)

$$UCL = D_4 \cdot \bar{R}$$

(9)

$$LCL = D_3 \cdot \bar{R}$$

(10)

Where:

$\bar{R}_{i..}$ average range of repeated measurements achieved by each operators
h number of operators

Subgroup size, for which it is necessary to find the values of coefficients D_3 and D_4 , corresponds to the number of repeated measurements of particular pieces by particular operators. Thus the statistical stability is achieved when all values are found within the control limits of the chart.

From the Figure 11 it is obvious that the analysed real measurement system of matrix height is, regarding the variability of repeated measurement, in control. It can be also concluded that the variability value of repeated measurements do not depend on the size of measured value (conforming uniformity).

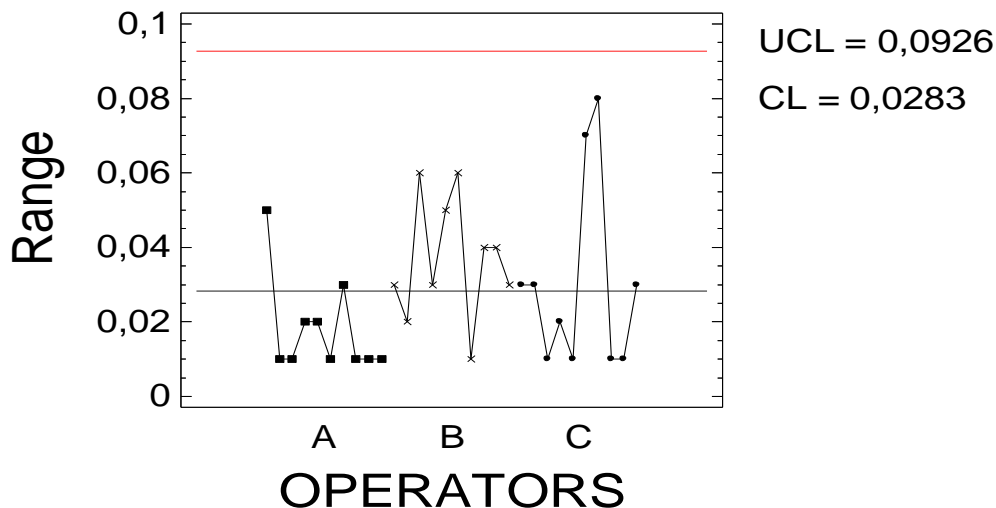


Fig. 11 Range control chart

Average control chart

The measurement system suitability for the evaluation of variability among measured samples can be evaluated by means of the average control chart. The values of averages of repeated measurements of particular parts by particular operators are drawn in this

diagram. For better transparency, these averages shall be drawn separately per each operator.

$$CL = \bar{x} = \frac{\sum_{i=1}^h \bar{x}_{i..}}{h}$$

(11)

$$UCL = \bar{x} + A_2 \cdot \bar{R}$$

(12)

$$LCL = \bar{x} - A_2 \cdot \bar{R}$$

(13)

Where:

- $\bar{x}_{i..}$ average measurement of all samples per operator
- A_2 coefficient depending on the number of trials

Regarding the fact that the relevant control limits are defined based on the variability given within the subgroups (they represent the variability of measurement system) it cannot be expected that the values will be found within the control limits. The measurement system is considered as conforming for the evaluation of variability among measured samples if the half of drawn averages is out of control limits at least. If this condition is not fulfilled the measurement system is without the relevant effective resolution or the production range is not covered evenly. The Figure 14 shows that the analysed real measurement system is conforming for the evaluation of variability among measured samples.

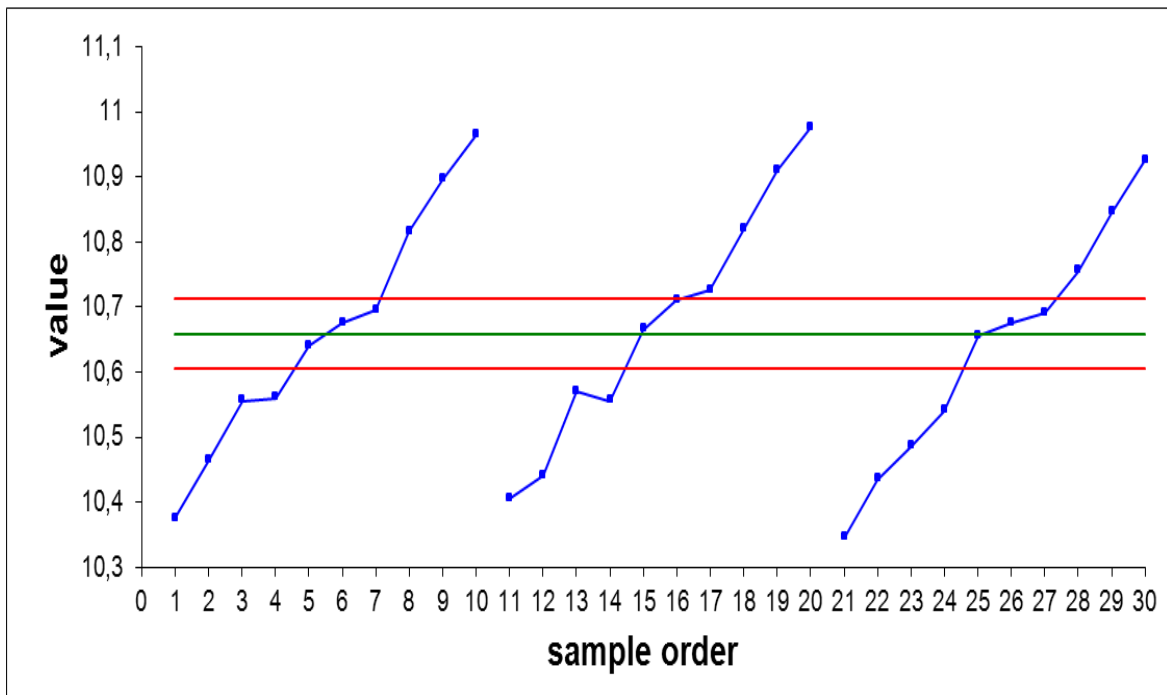


Fig. 12 Control chart

Detection of outliers

As previously discussed, the presence of outliers affect the resulting values of GRR analysis so that there is either an overvaluation or undervaluation of the results. Both situations are undesirable and should therefore be possible presence of outliers in the data file to detect as soon as possible. All of the above presented graphical tools are capable of a greater or lesser rate to detect the presence of outliers. This ability is dependent on the number of outliers, the size and parameters that affecting these values. To determine precisely for which the sample, operator and trials was an outlier measured is usually necessary to construct and analyse a minimum of two presented graphical tools.

For the initial determination of outliers it is recommended diagram of sample choice suitability through which we can determine whether the measured data for individual samples measured some outliers exist.

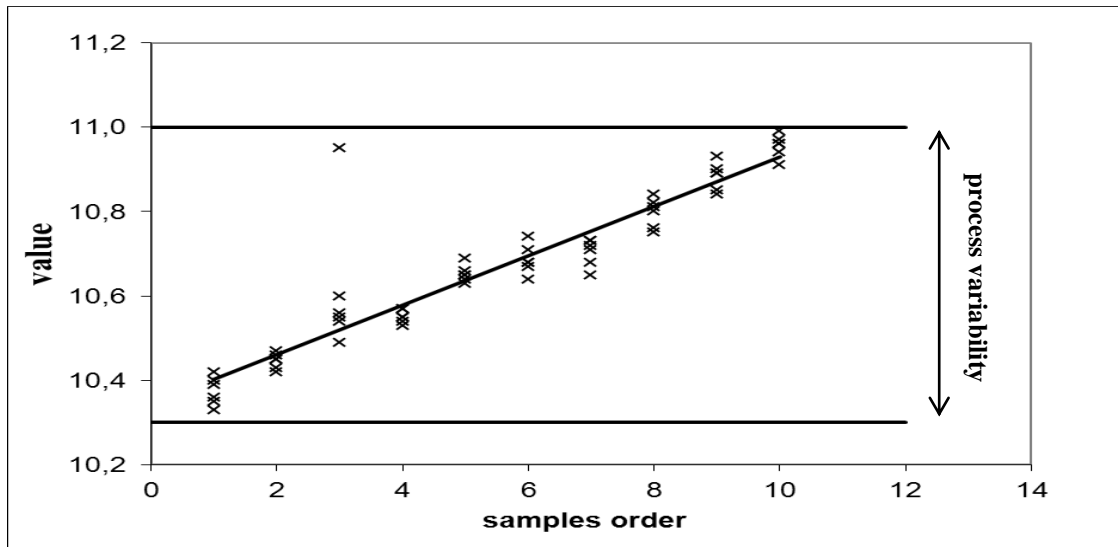


Fig. 13 Diagram of sample choice suitability with outlier

Figure 13 shows the diagram of sample choice suitability simulated occurrence of outlier at the third sample. Now we know that an outlier occurs at the third measured sample, we can use a scatter plot or error chart, for determining precisely the operator who measured outlier. Accurate identifying the location of effect of outliers to quickly determine the cause of occurrence outliers.

Conclusion

This paper is focused on the stressing of importance of graphical tools usage for the measurement repeatability and reproducibility analysis. Today this analysis is evaluated by means of several application of Excel or by means of software products focused directly on measurement system analysis or containing this task as one of modules. The graphical tools of measurement system analysis are not often available or are disregarded or ignored. Nevertheless their usage brings several valuable information on the analysed measurement system that cannot be read from the numeric analysis. Regarding the fact that the numeric results of analysis can be influenced by several factors (Fig. 4) that can overvalue or undervalue the resulting properties of measurement system, the construction and analysis of graphic tools of GRR analysis are necessary for correct evaluation of measurement system quality. Besides the verification of basic premises on the evenness of covering of the production range or on the statistical stability of measurement process, all presented graphs and diagrams are beyond the price in case of identification of causes of the non-conforming state of the measurement system.

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Practical application of fuzzy logic in process control

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Key words: Fuzzy logic, process control, fuzzy regulators, fuzzy set

Category: General review

Introduction

Fuzzy logic was first discovered in 1965, designed by Professor Lotfi A. Zadeh. The concept of fuzzy mens "hazy, indistinct, blurred, vague, which corresponds to the definition of fuzzy logic. However can, these concepts exist in the technical science? The basic objectives of the technical science is moving from simple human perception to exact and accurate description of a phenomena, which led to many successes, such as landing on the moon and building a robot that can perform operations on the human body. However, there remains an area where technical science is not enough. It is unable to configure a foreign language interpreter which would translate the level of human interpreter, it can not build a robot that would drive the car in heavy traffic and much more. In these areas, fuzzy logic offers a surprising solution that really works. This leads to an example of the harm to the Hubble Space Telescope and was needed to repair the automatic arm that was controlled by a fuzzy controller, whose development took 14 days and use was more than satisfactory and the fuzzy controller is robust due to random failures and unpredictable situations. At the same time, the proposed classical PID controller, was unusable. (Novák, 2000) (Jura, 2003)

Currently, there are jobs that can be satisfactorily addressed through fuzzy control, using fuzzy logic as possible to implement such rules that govern a person based on their experience, and so the whole process is automated.

Fuzzy set

Fuzzy set is a central concept in fuzzy logic. For an easier understanding of fuzzy set a simple example is given It is set to specify the role of young people. A starting point can be set to include the following: $U = [18, 40]$. But just what type of objections arise for young a lady who just graduated from high school and will be 18 in 4 months, we'll still consider her a child, because there is no legal age or a young man, or a man 41 years old, who is an active sportsman and has small children, can he already be regarded as an old man? This leads to many contradictions. The theory of fuzzy sets down a set of every conceivable age, which is called the universe $U = [1, 99]$. Every age of the universe under consideration is assigned a number from the interval $[0, 1]$, which will reflect the degree of membership (truth). Level 0 means absolutely no jurisdiction to set, and the untruth of the claim, and vice versa implies a degree of responsibility and absolute truth. Between these two figures represent a partial agreement or disagreement. Fuzzy logic, therefore allows partial membership in the set, ie. that an element belongs to a set with certain probability (degree of jurisdiction), which permits exactly to describe reality and thus prevent diversion from reality. Vague concepts are part of the

natural expression of people (poor, very young ...), so it is important to work with them and one of the solutions is a fuzzy set.

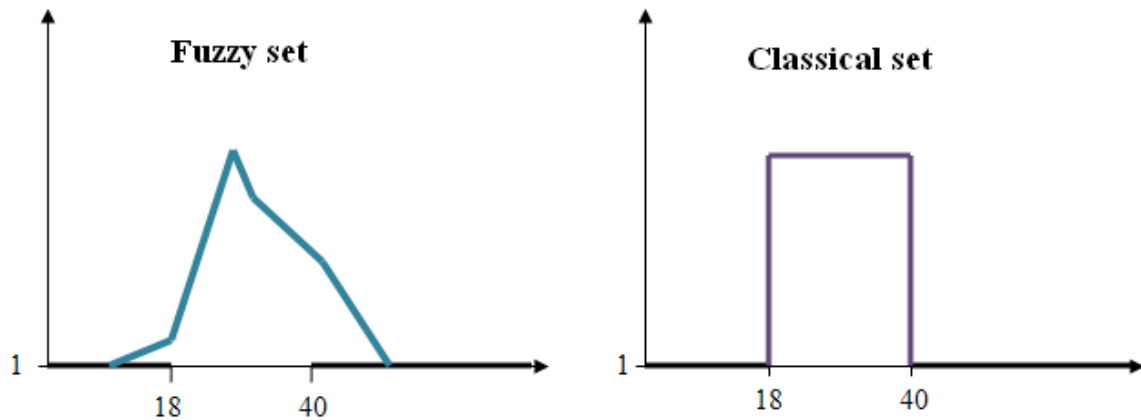
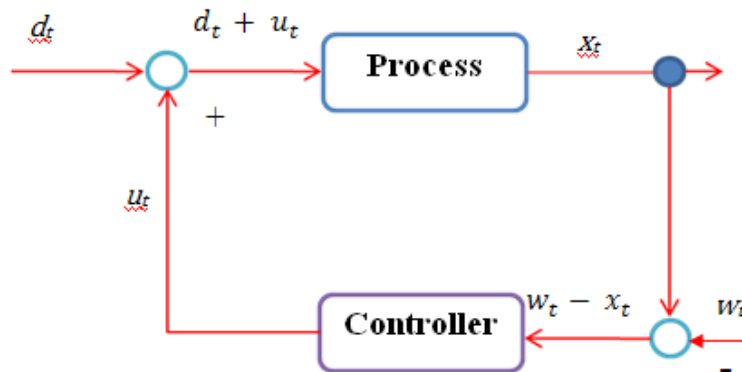


Fig. 1: Fuzzy set and classical set

The principle of fuzzy control

First, it is important to understand the main difference between fuzzy control and conventional control. Classic regulation can take place, if the mathematical description of the process to be controlled is known. Find, but the mathematical description, is quite difficult in practice, because it used an approximate and simplified method, which leads to the fact that the final regulation does not produce satisfactory results. In most cases, the process is complex, it carries its own regulation of a human "operator", who knows how to manage the process, based on their experience. The operator has a rough idea about the behavior of the process and therefore does not need a mathematical description of the process and can manage. When the operator was asked whether describing his experiences about the process, it certainly describes his own words, that it is their native language, a typical feature, which can not be avoided, are vague concepts. Therefore, this statement can not be transferred directly into mathematical formulas. In classical mathematics the presence of precise numbers is necessary however in this case it may lead to unsatisfactory results, because accurate data is usually not adequate to reality. (Jura, 2003)

In this situation fuzzy logic is a solution because it allows to model the meaning of the words in native language. Fuzzy controller is able to mimic the behavior of the operator's control algorithm, which implements the activities described by the operator using the native language. Fig. 2 shows a diagram of the classical control feedback loop.



x_t – vector states of the system at T

u_t – vector control actions (inputs to the controlled system)
 d_t – vector of disturbances
 w_t – vector of desired values

Fig. 2: Basic control scheme

This scheme is a mathematical description of the controlled system. It is valid for both the classic controller and the fuzzy controller. The difference however lies in the fact that the classic controller is from mathematically certain functions derived from the mathematical description of the regulated process.

Mathematically, the situation can be characterized as follows:

It will - if implemented deviation from the desired value, the equation can be rewritten as:

That e_t is an established deviation:

Fuzzy controller operates on a different principle, which is calculated with a variant of the mathematical description of the system in practice may not always be known or is too complicated, but what is always known is control strategies, ie how to manage the process. This strategy is described in the knowledge base, which forms the basis of a fuzzy controller. Based on experience and broad vision of man, which manages various kinds of processes, but its interpretation is often not translated into mathematical expression or a mathematical description is so complex that it does not derive a satisfactory management strategy. This situation is based on fuzzy control, because the only requirement for the design of fuzzy controllerem is to know the control strategy, without a mathematical description of the regulated process, which constitutes its major advantage. (Novák, 2000), (Novák, 1999)

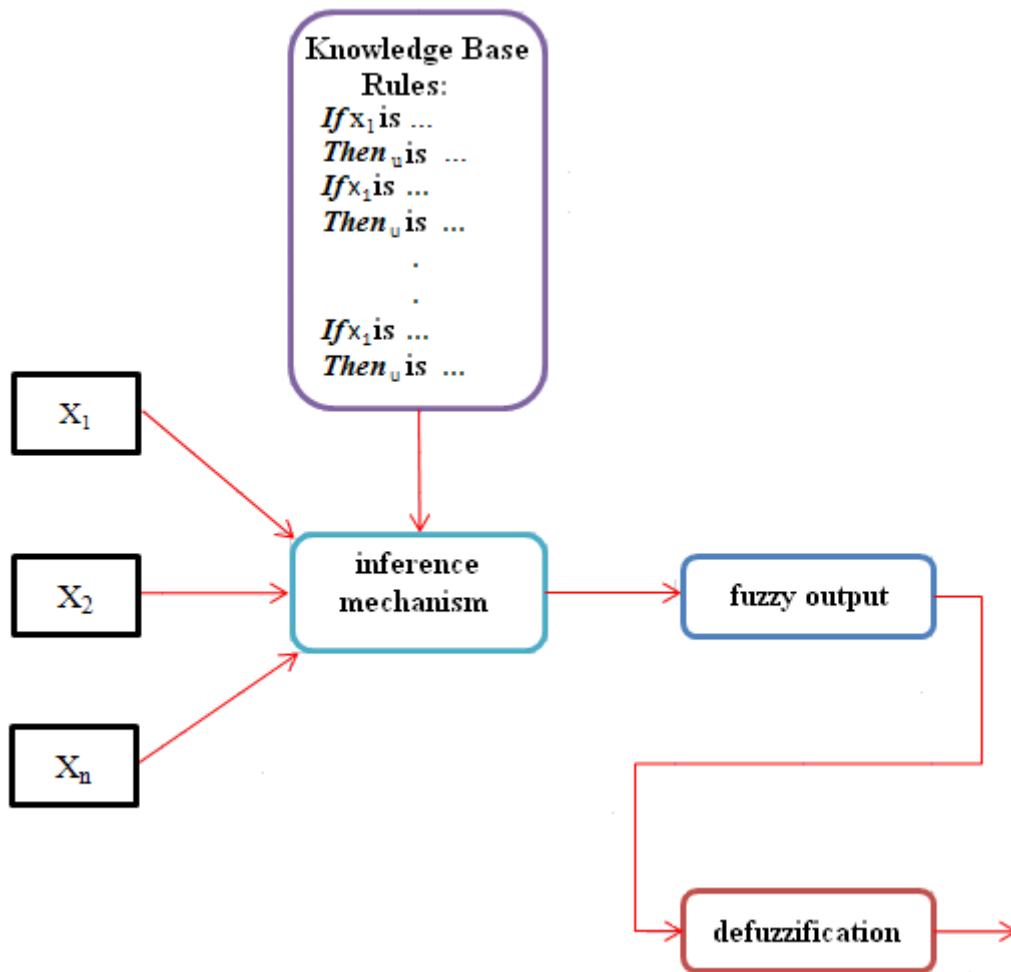


Fig. 3: General scheme of fuzzy controller

Knowledge base consists of a description language - the rules of type IF - THEN the knowledge base that leads into inference mechanism that processes the inputs, which are measured values of independent variables X_1, X_2, \dots, X_n that occur in the rules, as the underlying assumptions. Their number and character depends on the type of process and regulation. Fuzzy output, thus resulting in a fuzzy set represents the control action to be taken. Only one specific value is found by the means of condition for the implementation of regulation, which can be compared with the situation when the operator said: "slightly loosen the adjusting nut, then the matrix would allow everyone to understand how the expression slightly, is clear that people understand the concepts of the native language as well, and such action would not make a substantial difference. This procedure is implemented using fuzzy control defuzzifikace, a special operation which transforms a fuzzy set to a specific number and there are several methods to realize defuzzification.

Defuzzification methods

- **Method COG – Center of Gravity/area**, the resulting value is obtained as the locus of fuzzy set.
- **Method MOM – Mean of maxima**, the resulting figure is the center of maximum values.

- *Method FOM, LOM – First of maxima, last of maxima*, is selected either first or last element, which is the maximum degree of membership.
- *Method COS – Center of sums*, another variant of the COG.
- *Method DEE – Defuzzification of evaluating expressions*, the resulting value depends on the shape and location of membership functions. (Perfileva, 1999)

Types of fuzzy controllers

From a mathematical point of view, a fuzzy controller nonlinear function which is determined by fuzzy rules of type IF - THEN. As with conventional control in a closed feedback loop, see Figure 2, one can identify the fuzzy controllers, P, PD, PI, PID. Controller type, is set dependent and independent variables. Firstly, it is good to bring the principles of classical controllers.

Basic types of classical controllers

P (proportional) controller – is the simplest and intended function:

where u_t is the control action and K_p is constant (proportional gain)

PD (derivation) controller - deviation function is determined and its amendments:

$$u_t = K_P \cdot e_t + K_D \cdot \Delta e_t$$

where K_D is derivation constant

PI (integral) controller – not set on control action, but only a change:

$$u_t = K_P \cdot e_t + K_D \cdot \Delta e_t$$

$$u_t =$$

PID controller – deviation is a function, its changes and its second difference:

$$u_t = K_P \cdot e_t + K_D \cdot \Delta e_t$$

Fuzzy P controller

- is given by fuzzy rules:

If e is A_e **Then** u is β_u

where A_e is a linguistic term describing the size of deviations (big positive, negative) and β_u a linguistic term describing the size of the output level (positive very big). This type of controller is designed directly to control action variation.

Fuzzy PD controller

- is given by fuzzy rules:

If e is A_e and Δe is $B_{\Delta e}$ **Then** u is β_u

where A_e and β_u linguistic expressions are the same as the fuzzy P controller, and $B_{\Delta e}$ a linguistic term describing a change variations. In this type of controller the control action is determined by its tolerance and change.

Fuzzy PI controller

- is given by fuzzy rules:

If e is A_e and \dot{e} is $B_{\dot{e}}$ **Then** Δu is C

linguistic expressions are similar to the previous controller. The main difference is that the fuzzy PD controller determines the size of each output level and the fuzzy PI controller is entered only to change the output level. This type of controller is used most often because it is easier for the operator to think of two independent variables and determine the change in output level.

Fuzzy PID controller

- is given by fuzzy rules:

If e is A_e and \dot{e} is $B_{\dot{e}}$ **Then** Δu is C

It is a complex fuzzy controller, which is necessary for highly nonlinear and unstable processes. This type of controller may determine the rules to the problem, because the number may be too large. In practice, this controller to replace the combination of PI and PD fuzzy controllers. (Novák, 2000)

It should be emphasized that all the above types of fuzzy controllers are based on classical control theory. Which means that the input variables are considered as deviations from expected values and their derivatives. In practice, there are further variables that can not be neglected, and management also plays a role. In this case, it means nothing more than the extension of the assumptions, than that of the rules of other variables.

Procedure for applying fuzzy control

1. Determine the dependent and independent variables (control action). It depends on whether the regulation takes place in a closed loop feedback and what type of controller will be chosen.
2. After a fuzzy controller is selected by way of approximate reasoning, either:
 - a) **the fuzzy logical inference** can be understood as a process in which some facts are derived on the basis of other previously known facts, and by the rules, which mimic human thinking.
 - or
 - b) **the fuzzy function approximation**, is where the approximation of functions whose exact form is unknown, using language derived from the description given fuzzy rules of type IF - THEN.
3. Build a knowledge base, which means on the basis of expert information management strategy described by one or more language tags (fuzzy rules)
4. For all variables determine their linguistic context, so the interval $V = [{}^l v, {}^r v]$ meaningful values of which the variables can take. In practice this means that you can enter the smallest and largest possible error values, or output level.

Fuzzy control in practice

This chapter describes the application of fuzzy control in the company AL INVEST Inc., which is engaged in the manufacturing of aluminum containers, aluminum foil and

aluminum sheet and strip. All products are of high quality. The company ranks among the leading European manufacturer with a tradition of more than 80 years. Currently, the use of fuzzy control is the whole factory, it is 5 melting furnaces, each furnace has a capacity of 10 tons of raw aluminum.

The main problem that the company struggles with is, the melting temperature of aluminum. Over the years, they tried to regulate the temperature range from various PID controllers via adaptive algorithms with continuous identification systems to the fuzzy approach. During the melting range there are complicated physical processes inside the furnace. The melting phase is very slow with large inertia, while it negatively affects the latent heat, which is the energy to be supplied to change the state of the substance, not a change in temperature.

Characteristics of the controlled system

Entry into the system's power output burners and temperature of the metal. This transfer is highly nonlinear and is given by the relevant physical phenomena and the design of self care. Among the most important nonlinearities are:

- Changing the state of metal from solid to liquid. (Let burners heat, or warm the room, the temperature change)
- Changing the time constants for heat transfer to the sensor. (Initially, the temperature sensor measures the temperature in the furnace, but after fusion is immersed in a liquid metal.
- Changing the time delay between the power source, burner and metal temperature sensors. When you change the burner output the distance sensor and the burner are changed.
- The exothermic reaction refining molten aluminum salts with metal refining (burners not heating, but the metal temperature is rising).
- Temperature Stratification. The temperature of the upper layer (20% of the total layer) during operation is significantly higher than the temperature of the middle layer (65% of the total layer). The temperature of the lower layer (15% of the total layer), reacts to burner performance much slower than the previous layer.
- During melting, sometimes the liquid metal has added another solid impurity.

Before it reached the melting point of elapse of 3 hours. After another hour, the temperature begins to change. After the main phase begins, during which it is necessary to regulate the desired temperature (740-800 ° C). Temperature rises 0.1 ° C/10 sec. If overshoot occurs it takes no further supply of heat for 5-10 minutes. before the temperature begins to decrease.

In terms of metal temperature, were important regulator features the following are:

- resistance algorithm to each operating condition, including the transition from automatic to semi-automatic or manual control mode in case of failure and vice versa.
- power control, temperature and pressure.
- Minimum temperature overshoot measured in response to a step, the desired value.
- Minimum regulation.
- Minimum specific fuel consumption.

As already mentioned, various algorithms options were tested. Conventional PID control structures have proved inadequate. The best results were achieved when testing adaptive systems. Preliminary screening tests were conducted on electric heating, melt represented approximately 17 kg tin. The results were excellent. The Overshoot temperature jump to the desired temperature values were minimal.

Results were much worse, however, in a large industrial furnace. Although in terms of results, the algorithm was in accordance with the theory but was unworkable in practice for the following reasons:

- Long delay in sampling, and 2 less minutes
- Large and variable inertia, variable transport delay system, which led to many problems
- Improper placement of temperature sensors for design reasons
- When using large quantities of purified salt, the algorithm failed. This was followed by an exothermic reaction and thus the heat occurred and was identified by the negative reinforcement system, which led to an unreasonably long time, which algorithm is the aftermath of this storyline needed for recuperation and re-correct behavior.

Application of fuzzy controller

The use of the fuzzy apparatus is based on the possibility of LFLC program that allows work in creating the system of rules consistent with linguistic description, and thus takes full advantage of the knowledge gained from previous solutions.

Characteristics LFLC software system and its main advantages

LFLC (Linguistic Fuzzy Logic Controller) was developed at the University of Ostrava in the Institute for Research and Applications of Fuzzy Modeling. It is a software system that allows you to compile and test the fuzzy model focused on management and decision making. This system is a software implementation of the theory, which has been written in the introduction to this article . It knows the two variants of approximate reasoning, fuzzy logical deduction, and fuzzy approximation. Fuzzy logic deduction, means that the language description is indeed ready with words of the native language. This means the description of such a system and implementing what has been entered. Efficient algorithms give the impression of human behavior. The basic idea, as already noted, the control strategy described by fuzzy rules of type IF - THEN, this idea is shared by all the fuzzy controllers. Basic features LFLC:

1. LFLC allows you to use common words of the native language and act like they understand. In practice this means that the user description of the procedure explains in everyday language, the same way it would explain for example, your colleague. The user does not need to look for a fuzzy set, which is the hardest part of the work. The user can concentrate solely on their description in their native language.
2. LFLC continue to work with the linguistic description, which consists of fuzzy rules of type IF - THEN, interpreted either logically or functionally. On the basis of allowing them to realize fuzzy inference, either as a logical deduction, or as a fuzzy approximation. (Novák, 2000)

For the fuzzy temperature control metal, the algorithm was with fuzzy logic reasoning defuzzification Dee, the train has a total of 155 rules for the three input and one output

variable. Type structure is used PD control action is determined by its tolerance and change. The first input variable is the temperature of the first metal sensors, the second variable is the temperature difference and the third variable is the temperature of second temperature sensors. The first sensor measures the temperature, which represents the entire volume of the melt temperature (temperature of center of gravity). The second sensor, which temperature is normally displayed instructions, is located in a place where the dynamics of the system are significantly higher and can be better taken into account in particular the transition happens in the regulation.

The shape of the fuzzy rules for fuzzy control of metal:

•
•
where $E_1 = w - T_1$, ΔE_1 the deviation and the difference against the first T_1 a $E_2 = w - T_2$ deviation against the second T_2 . The achieved results are illustrated in fig. 4.



Fig.4: Results of fuzzy control 12. 5. 2011

Conclusion

What, then, is the main source of the success of fuzzy logic? In essence, the fact that fuzzy logic allows the inclusion of uncertainty and, above all the ability to work easily with the meanings of the native language, which belongs to the most important part of human life. Fuzzy logic extends to many spheres of human activity and spectrum its use is constantly expanding. Using fuzzy control, leads to a better proces as a whole which is logically related to the quality of the entire production. Because of a implemented fuzzy control, the company and AL INVEST Břidličná Inc., can boast of high-quality products.

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An Extended Fuzzy QFD Methodology in the Design and Evaluation of Academic Courses

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Paper type Research paper

Introduction

The primary role of higher education institutions is to generate, enhance, preserve and disseminate knowledge (Clarke et al., 1984). However, higher education not only facilitates the acquisition of the desired professional qualifications through a strict study process but also fosters the intellectual development of students, influencing their lives in the long run (Norris, 1978). Therefore, efforts should be geared to ensuring and improving the quality of academic programs and consequently the quality of their offered courses.

Several customer-oriented definitions of service quality can be found in the literature that stem from the idea of satisfying customers' requirements (Deming, 1986; Juran *et al.*, 1974) or of constantly meeting and surpassing customers' expectations (Parasuraman *et. al.*, 1985; Zeithaml et al., 1990; Lewis, 1989; Moore, 1987) and of determining to what extent a given service corresponds to customers' expectations (Lewis and Booms, 1983; Ghobadian *et al.*, 1993). Gronroos (1984) suggested that customers understand quality as the difference between their expectations and the perceived level of the delivered service. Although, various definitions present conceptual similarities, there seems to be no agreement on the definition of service quality.

Likewise, education quality is a rather indeterminate and contentious concept (Cheng and Tam, 1997; Pounder, 1999), for which it is difficult to find consensus on a single definition, regardless of its growing popularity in higher education policy and practice (Owlia and Aspinwall, 1996). For example, Harvey and Green (1993) dealt with the elusive notion of quality in higher education and based on the perceptions of different interest groups, gave five discrete but interrelated conceptualizations, categorizing quality as *exceptional*, *perfection* (or consistency), *fitness for purpose*, *value for money* and *transformative*. Birnbaum (1988) considered stakeholders' view and defined quality from the perspective of purpose and requirement, identifying three dimensions: the

meritocratic that expresses the institution's compliance to professional and scholarly rules with academic professionals as a reference group, the *social* that signifies the extent to which an institution serves its significant interest groups needs, and the *individualistic* that refers to the contribution of the institution to the individual growth of students.

To conclude, while quality has become a crucial issue in the field of higher education, taking into consideration the scholars' diverse conceptions and stakeholders' different perceptions of education quality, there are alternative strategies to achieve education quality (Cheng and Tam, 1997). A well-known method, that is applicable in educational settings (Ermer, 1995; Koksai and Egitman, 1998; Lam and Zhao, 1998; Aytac and Deniz, 2005) and successful in designing high quality services with reported results in customer satisfaction, is Quality Function Deployment (QFD) (Stuart and Tax, 1996; Mazur, 1997). QFD is one of the total quality management (TQM) techniques, which can be used in managing quality and delivering quality educational programmes and services (Aytac and Deniz, 2005; Hwang and Teo, 2001; Gonzalez *et al.*, 2008). In this paper QFD principles are applied in conjunction with quantitative methods to develop an undergraduate course in accordance to students' requirements.

The purpose of this paper is to present new insights about the QFD that could potentially improve the value of information generated from it. A new methodological approach in designing and developing high quality services, based on Fuzzy-AHP and Data Envelopment Analysis (DEA) (LP-GW-AHP) concepts, is introduced. A comparative analysis between the proposed methodology and the traditional AHP method, which has been already used in conjunction with QFD, is conducted in order to determine the one that produces the most reliable results. The contribution of this paper is twofold, in capturing the true "Voice of the Customer", and in accurately prioritizing customer requirements. The rest of this paper is organized as follows: section 2 provides a literature review of QFD in course design. A short analysis of QFD shortcomings and the possible benefits from its joint utilization with AHP is given in section 3. Section 4 highlights a number of issues regarding AHP criticism and proposes two quantitative methods Fuzzy AHP and LP-GW-AHP that can be integrated into QFD in order to overcome its deficiencies. In section 5 the QFD-LP-GW-Fuzzy AHP methodology is described and employed in the design of an academic course. Finally, the last section compares the results of the proposed methodology with those derived from the QFD-AHP methodology and discusses the outcome of the comparative analysis as well as strengths and limitation of the study.

QFD and its applications in course design

QFD can be utilized towards the direction of developing and delivering flawless services based on customer requirements. QFD, driven by the "voice of the customer", provides a detailed structured process, consisting of a series of matrices - Houses of Quality (HOQ) (Cohen, 1995), for service providers to interpret customer requirements into palpable service features and communicate quality throughout the organization assuring customer satisfaction whilst maintaining a sustainable competitive advantage (Akao, 1990; Chan and Wu, 2002a, b). By systematizing communication, decreasing costs, increasing revenues, reducing new services development time, facilitating coordination and fostering customer-oriented decisions QFD enables companies to

remain competitive (Karsak *et al.*, 2002; Chan and Wu, 2002; Bouchereau and Rowlands, 2000; Gonzalez *et al.*, 2004; Andronikidis *et al.*, 2009).

Implementations of QFD in higher education could be classified into five categories, namely, course design and evaluation (Hwarng and Teo, 2001; Wiklund and Wiklund, 1999; Franceschini and Terzago, 1998; Shamsuddin, 2006), educational quality improvement (Koksal and Egitman, 1998; Owlia and Aspinwall, 1998), curriculum quality enhancement (Aytac and Deniz, 2005; Ermer, 1995; Gonzalez *et al.*, 2008), teaching effectiveness evaluation (Jaraiedi and Ritz, 1994; Lam and Zhao, 1998) and research planning (Chen and Bullington, 1993). A limited number of research papers can be found in the relevant literature regarding applications of QFD in course design. Murgatroyd (1993) conducted a preliminary study to examine the applicability of QFD in designing, developing and delivering distance education courses of high quality. Higgins *et al.* (1994) suggested a QFD process to revise and monitor a B.eng Honours course in mechanical engineering at the University of Glamorgan getting feedback from students. Mazur (1996) used QFD to design a TQM course in the industrial and operations management department at the University of Michigan considering both external and internal customers' requirements. He managed to concentrate on areas that customers appreciate the most and to form a feedback process to help constantly advancing the course content. Franceschini and Terzago (1998) employed QFD to design an industrial training course about statistical process control. The course was structured to provide all participants with additional skills and competences needed to meet their educational or career goals. The prioritization of service characteristics was made using the AHP method and the Kano's model respectively. Wiklund and Wiklund (1999) used QFD and conjoint analysis to specify students' requirements and design a course in quality technology that fulfils students learning needs, resulting in a high level of student satisfaction. Hwarng and Teo (2001) demonstrated how an institution can apply a three-phased and service-based QFD methodology to deliver quality programmes and services in higher education. They applied the QFD methodology in the Business School at the National University of Singapore to design and deliver an Operations Management course, and to highlight areas for improvement in the student online course registration system and in the research grant application process. Duffuaa *et al.* (2003) implemented QFD for designing a basic statistics course in the department of systems engineering at the King Fahd University of Petroleum and Minerals. Shamsuddin (2006) described how the Kazakhstan Institute of Economics, management and strategic research applied QFD to interpret the Voice of the Customer into instructional specifications. Chan *et al.* (2006) illustrated how QFD can help vocational education course planners to develop customer-oriented courses and satisfy the need for skilled labourers. They applied QFD to curriculum planning for the clothing merchandisers in Hong Kong. Nguyen *et al.* (2006) developed an assessment tool based on the QFD concept to evaluate the degree of achievement of a course's learning objectives. Chan *et al.* (2009) utilized a combined QFD - AHP approach to develop an industrial training course to provide the merchandising trainees of a clothing trading company with the essential skills and knowledge to achieve management's performance requirements as well as job incumbents' learning requirements.

Why to integrate AHP into QFD

QFD reported limitations (Bouchereau and Rowlands, 2000; Andronikidis *et al.*, 2009) prompted the need to jointly use it with the Analytic Hierarchy Process (AHP).

Specifically, QFD is a well-known service planning and development support method that is powerful in designing high-quality services (Mazur, 2008), while AHP is one of the most versatile and widely used Multi-criteria decision making methods (MCDM) (Madu and Georgantzas, 1991; Zhou *et al.*, 2006; Shahin and Mahbod, 2007) that can effectively aid decision making by offering a comprehensive, systematic and rational framework for ranking and determining accurate importance weights for a set of alternatives in the presence of multiple, usually conflicting, criteria (Saaty, 1980; 1990; Lam and Zhao, 1998). Although, QFD ensures that the “voice of the customer” is incorporated into all phases of service development, still it is possible to not capture the actual customers’ preferences and thus to fail to translate them into measurable service attributes and an invalid conclusion may be drawn. Chan and Wu (2005) stressed that the “voice of the customer” contains ambiguity and multiplicity of meaning due to the fact that not everyone has the same perception of a particular linguistic description. Moreover, QFD is mainly a qualitative tool (Bouchereau and Rowlands, 2000), which by design uses simple qualitative inputs and judgments in interpreting data. On the other hand, AHP is a quantitative method, whose major strength is that it soundly imitates human thinking by breaking an intricate decision problem to its fundamental components, forming a hierarchy and prioritizes decision alternatives through a series of judgments based on pairwise comparisons (Saaty, 1980; 1990; 2000; Karsak *et al.*, 2002; Salo and Hämäläinen, 1997). Furthermore, AHP outweighs due to its ability to include decision elements that are measured on a number of different scales or that are even intangible and to incorporate both numeric, descriptive, and categorical data (Saaty, 2006; Saaty and Vargas, 2001; Saaty, 2000; Wedley, 1990). AHP converts a multidimensional scaling problem to a unidimensional scaling problem through ratio scales (Saaty and Vargas, 2001; Wedley, 1990). In addition, it allows the quantified judgments to be tested for consistency. Consequently, in the view of the fact that customer requirements interpretation and prioritization is a critical part of QFD implementation, the AHP technique was integrated.

From AHP to LP-GW-FUZZY AHP

Despite its numerous applications and its widespread acceptance, several authors have questioned the validity of AHP over the years. Dyer (1990) and Belton and Gear (1983, 1985) claimed that the axiomatic foundations of AHP do not derive from a specific mathematical theory. Watson and Freeling (1982a, b) supported that the form of the questions associated with AHP do not provide useful information about the decision-makers’ preferences. Arbel (1989) stressed that the nine point AHP scale has some obvious shortcomings, because the exact ratio scale used in the pair-wise comparisons sometimes fails to take into account the imprecision or the vagueness in the mind of respondents. Belton and Gear (1983; 1985) criticized AHP for its possible rank reversal phenomenon, regardless of the fact that the rank reversal may happen in many other decision making methodologies either (Wang and Luo, 2008). Recently, Bana e Costa and Vansnick (2008) argued that although the eigenvalue method is very elegant from a mathematical viewpoint, the priority vector derived could violate the condition of order preservation (COP) – an activity that is essential to respect values and judgments. Finally, although, Saaty strongly recommends the eigenvalue method (EV) to determine local weights from pairwise comparisons (Saaty, 1980), there is no consensus in the literature about its superiority (Mikhailov, 2000; Srdjevic, 2005), resulting in a significant number of alternative approaches (Chu *et al.*, 1979; Crawford, 1987; Cogger and Yu, 1985; Islei and Lockett, 1988; Mikhailov, 2000).

A methodology based on concepts from fuzzy theory and Data Envelopment Analysis (DEA) is introduced in this paper to deal with the reported shortcomings of AHP. Especially, to overcome the inherent subjectivity of human judgements and to replace the eigenvalue method (EV), in order to prioritize customer preferences and determine proper importance levels in a QFD framework. In particular, the integration of Fuzzy-AHP and the linear programming method (LP-GW-AHP) into QFD is proposed (LP-GW-Fuzzy-AHP). Triangular fuzzy numbers (TFNs) are introduced in the pairwise comparison matrices of AHP to overcome the intrinsic bias of human judgments - which sometimes conventional AHP cannot effectively take into account - while the LP-GW-AHP method is used for the derivation of the priority vector.

Customers' preferences are characterized by vagueness and diversity of meaning due to the fact that different people may give different interpretations to a particular linguistic description. Moreover, precise numbers fail to express the subjectivity and elusiveness of decision-making. A Fuzzy AHP approach is possible to accommodate the potential uncertainty in the subjective judgements of customers. Zadeh (1965) is the one who introduced fuzzy set theory in decision making, while one of the earliest studies in Fuzzy AHP belongs to Van Laarhoven and Pedrycz (1983). Since then, Fuzzy AHP applications have been repeatedly reported in the relevant literature (Buckley, 1985; Chen, 1996; Kwong and Bai, 2002; 2003; Kahraman *et al.*, 2003; Promentilla, 2006).

Several papers have already utilized DEA method for weights derivation from AHP pairwise comparison matrices (Zhang and Cui, 1999; Sinuany-Stern *et al.*, 2000; Takamura and Tone, 2003; Yang and Kuo, 2003; Ramanathan, 2006; Wang *et al.*, 2008; Hosseini *et al.*, 2009). According to Belton and Vickers (1993) a relationship exists between DEA and multi-criteria decision analysis (MCDM) due to the reason that they both calculate weights for decision elements. DEA is a non-parametric linear programming method (Charnes *et al.*, 1978). It has been employed for assessing the relative efficiency of a homogeneous set of Decision-Making Units (DMU) in both profit and non-profit organisations (Thanassoulis, 2001). DEA implementation results in the classification of the homogeneous decision units into two categories, efficient and inefficient, based on two sets of multiple criteria which estimate maximum output levels for given input levels or alternatively minimum input levels for given output levels. DEA estimates a single score for each DMU but all the efficient units are equally good in the Pareto efficient sense.

Hosseini *et al.* (2009) studied the DEA-AHP literature and proposed a linear programming model based on DEA to generate weights of alternatives using the values from the AHP judgment matrices (LP-GW-AHP). A distinguished feature of the LP-GW-AHP method is that it requires solving only one LP model for local weights derivation from a pair-wise comparison matrix or group of them and it does not need to normalize the derived weight vector. Thus, a considerable number of linear programming models do not need to be solved as it happened in the previous models.

In the literature there is no evidence about the joint use of QFD with the Fuzzy-AHP and LP-GW-AHP method (LP-GW-Fuzzy-AHP). In this paper the LP-GW-Fuzzy-AHP method is proposed as an alternative method to the crisp AHP method for completing the relationship matrix of the HOQ. The presented implementation of QFD along with LP-GW-Fuzzy-AHP is examined using data from a higher education setting, and the results are then compared to the ones derived from the QFD-AHP approach.

An illustrative example

Background and aim of the study

Considering an academic course as a basic service offered by a higher education institution one can easily observe that it encompasses all the salient traits of a service: intangibility since most quality attributes can not be seen, felt or touched in advance, inseparability of production and consumption, heterogeneity because standardization of a course according to some predetermined norms can be achieved but it is impossible to standardize the performance of the faculty or of the student and finally, perishability (Shank *et al.*, 1995; Owlia and Aspinwall; 1996). Due to these unique features of education services, quality cannot be assessed objectively (Patterson and Johnson, 1993) and consequently, the design of a course is a complex activity.

An academic course can be identified as a system of learning objectives, covered topics, lectures, instructional methods, assignments and students' evaluation processes, which is developed through the complementary educational processes of teaching and learning. Marzo *et al.* (2007) classified stakeholders according to the process they are involved and as external and internal customers. They concluded that in the learning process students are the internal customers while the external are the employers of university graduates and the society in general. In the teaching process, they identified students as the external customers and the faculty members, the administrative and service staff as the internal. Although, there are multiple stakeholders who benefit from a course, the direct beneficiaries are the students who take a course. Hwang and Teo (2001) used Juran's Triple Role concept to determine the various roles of higher education customers and specified students as the primary customers of a course. Therefore, efforts should be made to define quality from a students' viewpoint.

The nature of most services involves the direct participation of the customer when the service is performed (Ghobadian *et al.*, 1994). Higher education is a "pure" service as it is characterized by high levels of interpersonal interaction (Solomon *et al.*, 1985; Oldfield and Baron, 2000) and from this angle; the delivery of a course greatly depends on the students' involvement and the interactions between students and between instructors and students. There is evidence that positive outcomes are more likely to be produced when people are encouraged and facilitated to participate in decision making (Oldfield, 1997; Thurgood, 1990). Moreover, the dynamic participation of customers in the design of educational processes provides guidelines for improvement initiatives (Hwang and Teo, 2001). Therefore, it is reasonable to assume that students' active participation in course design and delivery is extremely important for the potential success of a course. A course should be planned and performed in a way that facilitates students learning, encouraging them to adopt a deeper approach to learning.

According to Ghobadian *et al.* (1994), the perceived service quality is influenced both by the "service outcome" and the "service process". In a course context, the term "service outcome" can be translated to "learning outcomes" and the term "service process" to "learning and teaching activities". Hence, learning outcomes provide an ideal starting point for designing a student-centred academic course.

Mintz (1997) was opposed to a course design where the producers of a course are usually responsible for its planning without even questioning potential students. Many

academics when planning a course choose a body of content and allocate it over a set time period. Unfortunately, in this approach the transmitted information is often presented and received as discrete packages, making difficult for both teachers and students to further analyse the underlying principles or themes and develop skills. An alternative approach is a course design oriented to learning outcomes and particularly, to the alignment of learning outcomes with learning and teaching activities (Biggs, 2003). Consequently, the first step in a QFD process in course design is to specify and prioritize the various learning outcomes according to students' preferences. While, the second step is to plan "learning and teaching activities" based on the prioritized learning outcomes. The proposed QFD process is illustrated in figure 1. The main aim of the proposed process is to obtain student feedback regarding courses for improvement purposes and to provide a clearly defined and useful methodology to ensure that proper actions are taken to design and deliver courses.

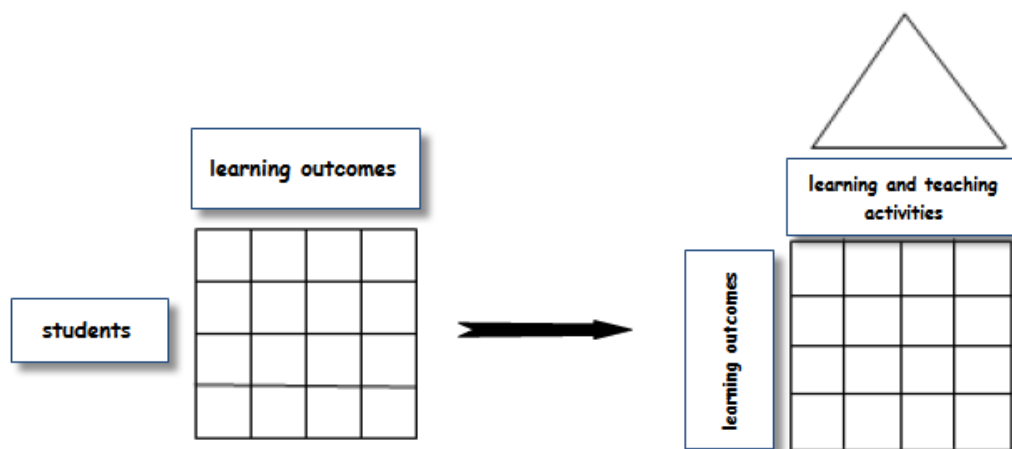


Figure1. QFD process for course design

In this paper we limit our research to identify the importance of various learning outcomes from a students' viewpoint. The objective is to demonstrate the implementation of QFD in utilizing two different methodologies, namely, QFD-AHP and QFD-LP-GW-Fuzzy AHP, and to perform a comparative analysis. The effectiveness of QFD in conjunction with these two quantitative methodologies as an approach to prioritize learning outcomes is investigated.

Data collection

In this illustrative example, we emphasize in revealing the expectations and preferences of one particular customer of higher education: the undergraduate business students. First and fourth-year students who study business administration at the University of Macedonia in Thessaloniki, were asked to express their preference on the expected learning outcomes of the offered courses. The objective is to identify the desirable learning outcomes as a statement of what students want to know, understand and be able to do by the end of a course and to prioritize them in accordance to their requirements. Entwistle (1997) defined learning outcomes as knowledge enhancement and alteration in understanding that are accomplished through university's experiences.

This application utilized data collected from the following sources: A focus group consisted of 4 students, 3 professors and 3 potential employers; and a survey conducted

by means of a questionnaire that was distributed to 60 undergraduate business students of University of Macedonia.

Initially, the learning outcomes were obtained through a focus group in conjunction with thorough study of the relevant literature and syllabuses of nine leading UK universities (Bloom, 1956; Carter, 1985; Allan *et al.*, 1996; Allan, 1996; Franceschini and Terzago, 1998; Wiklund and Wiklund, 1999; Hwarng and Teo, 2001; Shamsuddin, 2006); taking into consideration the aim and the nature of studies direction of the department. The voice of the customer was validated within the focus group and analysed to specify the most desirable learning outcomes. The focus group comprised of students, professors and potential employers, who cooperate with the university's practice programmes. We employed affinity diagrams to group learning outcomes. The result was a classification into three main categories: Subject based Knowledge, Generic Academic Skills and Key Transferable Skills. Subject-based knowledge is divided into two branches Theory-based knowledge and Practical-based knowledge. Analytical, synthetic, and critical thinking skills are under the umbrella of Generic Academic skills, while key transferable skills consisted of communication skills, IT skills, problem solving and decision making skills, planning-organizational and time management skills, teamwork-leadership and negotiation skills and information gathering-research skills. The final list comprised the following learning outcomes: Subject based Knowledge, Practical Knowledge, Generic Academic Skills and Key Transferable Skills.

The survey instrument was self-administered questionnaires with short, clear and easy to understand questions. A total of 6 questions covering the four categories of the learning outcomes were prepared. All questions required students to make pair-wise comparisons among learning outcomes. Students were given verbal and written instructions in case they required further clarifications. The questionnaires were distributed to first and fourth-year students, so as to provide a spherical viewpoint about the learning outcomes and to highlight the potential differences in the way students of different academic years evaluate and rank learning outcomes. Students' participation was voluntary and completely anonymous and in total, 60 questionnaires were answered. Due to the fact that questionnaires were completed in the researchers' presence, invalid responses were avoided.

Deriving importances

After the collection and evaluation of data, the completion of the HOQ followed. The students' groups are shown on the left side of the HOQ in the first column, while the learning outcomes are shown in columns 2-5 of the matrix. Figure 2 depicts the completion using QFD-AHP methodology, while Figure 3 presents the completion using QFD- LP-GW-Fuzzy-AHP methodology.

Students	1	2	3	4	5
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groups	Market Mix %	Theory-based Knowledge	Practical-based Knowledge	Generic Academic Skills	Key Transferable Skills
First-year students	0.5	0.1257	0.2901	0.2654	0.3188
Fourth-year students	0.5	0.0852	0.2937	0.2552	0.3659
Importances %		0.4889	0.2919	0.2603	0.3423
Normalized importances %		0.3534	0.211	0,1882	0.2474

Figure 2. The House of Quality (QFD-AHP methodology)

Students groups	1	2	3	4	5
	Market Mix %	Theory-based Knowledge	Practical-based Knowledge	Generic Academic Skills	Key Transferable Skills
First-year students	0.5	0.1287	0.2895	0.2650	0.3168
Fourth-year students	0.5	0.0879	0.2947	0.2567	0.3606
Importances %		0.1083	0.2921	0.2609	0.3387

Figure 3. The House of Quality (QFD-LP-GW-Fuzzy-AHP methodology)

The relative importance ratings of the relationship matrix are computed using AHP and LP-GW-Fuzzy-AHP respectively. In particular, AHP and DEAHP are employed in order to prioritize learning outcomes with respect to each group of students (first-year and fourth year students). The analytic description of how to integrate AHP with QFD is beyond the scope of this paper since it has already been addressed in the relevant literature (Partovi, 2001; 2006; Partovi and Corredoira, 2002; Andronikidis et al. 2009), while relevant details of how to combine LP-GW-Fuzzy-AHP with QFD are illustrated below step by step. DEA replaces the eigenvalue method in Fuzzy-AHP. Six steps are essential when DEA is embedded in Fuzzy-AHP (LP-GW-Fuzzy-AHP) in order to solve a decision problem and subsequently to complete the Relationship Matrix of the HOQ. It should be noted that steps 1, 2 and 3 are the same in both methodologies.

Structure the decision hierarchy.

Both the integrated processes, QFD-AHP and QFD- LP-GW-Fuzzy-AHP, decompose a decision problem into a hierarchy with three clusters: a goal cluster containing the goal element, which is “an academic course of high quality”, a criteria cluster containing students’ groups elements and an alternatives cluster containing learning outcomes elements.

Collect input data by making pair-wise comparisons of decision elements by using linguistic data

The input data collected from the field survey are required for completing the relationship matrix of the HOQ. Students were asked to express their preference between each pair of learning outcomes by using linguistic variables (Table I). Then, these linguistic data were translated either in crisp number sets -the traditional nine-point AHP scale (AHP method) or in fuzzy sets (Fuzzy AHP method). In this paper we adopt triangular fuzzy numbers (TFNs) in the Fuzzy AHP to model the imprecise preference relations between learning outcomes (Table I). TFNs are often more convenient to be used in applications due to their computational simplicity (Yang and Wang, 2008; Giachetti and Young, 1997; Moon and Kang, 2001). The definition of TFNs and their algebraic operations are described in the following subsection.

Linguistic variables	AHP	Fuzzy AHP Scale	
	Scale	TFNs	Recipr. TFNs
Equally important	1	(1,1,1)	(1,1,1)
Intermediate	2	(1,2,3)	(1/3,1/2,1)
Moderately more important	3	(2,3,4)	(1/4,1/3,1/2)
Intermediate	4	(3,4,5)	(1/5,1/4,1/3)
Strongly more important	5	(4,5,6)	(1/6,1/5,1/4)
Intermediate	6	(5,6,7)	(1/7,1/6,1/5)
Very strongly more important	7	(6,7,8)	(1/8,1/7,1/6)
Intermediate	8	(7,8,9)	(1/9,1/8,1/7)
Extremely more important	9	(8,9,9)	(1/9,1/9,1/8)

Table I

Triangular Fuzzy number

According to Chang (1996) a fuzzy number M on R is a triangular fuzzy number if its membership function $\mu_M: R \rightarrow [0,1]$ is defined as:

$$\mu_M(x) = \begin{cases} \frac{x-l}{m-l} - \frac{l}{m-l}, & x \in [l, m] \\ \frac{x}{m-u} - \frac{u}{m-u}, & x \in [m, u] \\ 0, & \text{otherwise,} \end{cases}$$

Where l and u stand for the lower and upper value, respectively, of the support of M , and m is the modal value of M . The triangular fuzzy number M can be denoted by a triplet (l, m, u) . The support of M is the set of elements $x \in R/l < x < u$. When $l=m=u$ by convention it is not a fuzzy number.

By using the interval of confidence at a given level of confidence coefficient α , a TFN can be characterised alternatively as (Kwong and Bai, 2002):

$$\forall \alpha \in [0, 1] \quad \left\{ \begin{array}{l} a = \frac{l^\alpha - l}{m - l} \\ a = \frac{u - u^\alpha}{u - m} \end{array} \right\} \Leftrightarrow \left\{ \begin{array}{l} l^\alpha = (n - l) \underline{a} + l \\ u^\alpha = -(u - m) \underline{a} + u \end{array} \right\} \Rightarrow$$

$$\tilde{M}_\alpha = [l^\alpha, u^\alpha] = [(n - l) \underline{a} + l, -(u - m) \underline{a} + u] \quad \forall \alpha \in [0, 1] \quad (1)$$

Given any two positive triangular fuzzy numbers $\tilde{M} (l_1, m_1, u_1)$; $\tilde{N} (l_2, m_2, u_2)$ and a positive real number λ , their main algebraic operations can be expressed as follows (Chang, 1996):

1. $(l_1, m_1, u_1) \oplus (l_2, m_2, u_2) = (l_1 + l_2, m_1 + m_2, u_1 + u_2)$
2. $(l_1, m_1, u_1) \otimes (l_2, m_2, u_2) \approx (l_1 l_2, m_1 m_2, u_1 u_2)$
3. $(l, \lambda, \lambda) \otimes (l_1, m_1, u_1) = (l l_1, \lambda m_1, \lambda u_1)$
 $\lambda > 0, \quad \lambda \in R$
4. $(l, m, u)^{-1} \approx (1/u, 1/m, 1/l)$

The parameter δ expresses the judgment's degree of fuzziness, where $\delta = u^\alpha - l^\alpha = 1^\alpha - u^\alpha$ (Kwong and Bai, 2003; Felix *et al.*, 2003). Evaluators can choose the suitable degree of fuzziness for their judgments. A larger value represents a higher degree of fuzziness. Particularly, $\delta=1$ implies moderate fuzziness, $\delta=2$ significant fuzziness while $\delta=0$ that it is not a fuzzy number (Felix *et al.*, 2003). In other words, crisp AHP is a special case of Fuzzy AHP when $\delta=0$. Zhu *et al.* (1999) claimed that δ should be equal or larger than one-half. The chosen value of δ for this implementation was decided to be equal to 1.

In the case of a nine-point scale by setting $\delta=1$ and using equation (1) the linguistic variables are translated in the following triangular fuzzy numbers:

$$\begin{array}{ll} \tilde{1}_\alpha = [1, 2-\alpha] & \tilde{1}_\alpha^{-1} = [1/2-\alpha, 1] \\ \tilde{2}_\alpha = [1+\alpha, 3-\alpha] & \tilde{2}_\alpha^{-1} = [1/3-\alpha, 1/1+\alpha] \\ \tilde{3}_\alpha = [2+\alpha, 4-\alpha] & \tilde{3}_\alpha^{-1} = [1/4-\alpha, 1/2+\alpha] \\ \tilde{4}_\alpha = [3+\alpha, 5-\alpha] & \tilde{4}_\alpha^{-1} = [1/5-\alpha, 1/3+\alpha] \\ \tilde{5}_\alpha = [4+\alpha, 6-\alpha] & \tilde{5}_\alpha^{-1} = [1/6-\alpha, 1/4+\alpha] \end{array}$$

$$\begin{aligned}
\tilde{6}_\alpha &= [5+\alpha, 7-\alpha] & \tilde{6}_\alpha^{-1} &= [1/7-\alpha, 1/5+\alpha] \\
\tilde{7}_\alpha &= [6+\alpha, 8-\alpha] & \tilde{7}_\alpha^{-1} &= [1/8-\alpha, 1/6+\alpha] \\
\tilde{8}_\alpha &= [7+\alpha, 9-\alpha] & \tilde{8}_\alpha^{-1} &= [1/9-\alpha, 1/7+\alpha] \\
\tilde{9}_\alpha &= [8+\alpha, 9] & \tilde{9}_\alpha^{-1} &= [1/9, 1/8+\alpha]
\end{aligned}$$

TFNs are utilized at various α levels ($0 \leq \alpha \leq 1$). Setting $\alpha=0$ the nine-point fuzzy scale for pairwise comparisons is given in table I and their membership function in figure 4 (Kwong and Bai, 2003; Promentilla, 2006; Yang *et al.*, 2008; Lin, 2010).

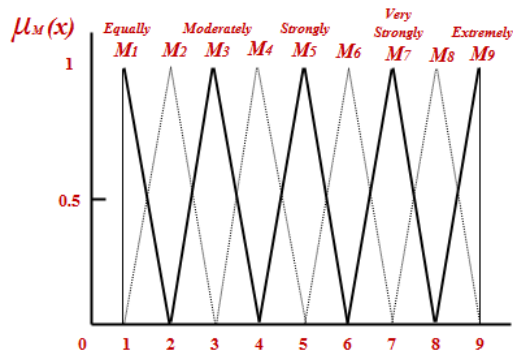


Figure 4. The membership function of the TFNs

Construct comparison matrices.

The judgment matrices are formed using pair-wise comparisons that were made from students. Since there are two groups of students (first-year and fourth-year students), each having 30 decision makers (students) respectively, it is necessary to incorporate the preferences of each group into one judgement matrix. Each row and each column of a judgment matrix correspond to a learning outcome. As a result two judgment matrices are formed, one for each group. After converting all the linguistic variables of pairwise judgements into crisp numbers (conventional AHP) and into fuzzy triangular numbers (Fuzzy AHP), geometric mean method is applied to incorporate individual subjective judgments and to structure comparison matrices (Kwong and Bai, 2002). Saaty (1980) stated that the geometric mean is more effectual in representing the consensus opinions of multiple decision makers.

$$\tilde{a}_{ij}^n = \left(\prod_{j=1}^n a_{ijn} \right)^{\frac{1}{n}} \quad (2)$$

The comparison matrices for both integrated methodologies can be seen in Figures 5 and 6.

First-year students	Theory-based Knowledge	Practical-based Knowledge	Generic Academic Skills	Key Transferable Skills	Fourth-year students	Theory-based Knowledge	Practical-based Knowledge	Generic Academic Skills	Key Transferable Skills
Theory-based Knowledge	1,000	0,467	0,433	0,399	Theory-based Knowledge	1,000	0,271	0,368	0,226
Practical-based Knowledge	2,141	1,000	1,145	0,937	Practical-based Knowledge	3,696	1,000	1,091	0,790
Generic Academic Skills	2,311	0,873	1,000	0,796	Generic Academic Skills	2,717	0,917	1,000	0,727
Key Transferable Skills	2,505	1,067	1,256	1,000	Key Transferable Skills	4,420	1,265	1,376	1,000

Figure 5. QFD-AHP comparison matrices

First-year students	Theory-based Knowledge	Practical-based Knowledge	Generic Academic Skills	Key Transferable Skills
Theory-based Knowledge	(1,1,1)	(0,4082 , 0,4670 , 0,5566)	(0,3604 , 0,4328 , 0,5284)	(0,3405 , 0,3992 , 0,4778)
Practical-based Knowledge	(1/0,5566 , 1/0,4670 , 1/0,4082)	(1,1,1)	(1,0181 , 1,1450 , 1,2783)	(0,8143 , 0,9369 , 1,0714)
Generic Academic Skills	(1/0,5284 , 1/0,4328 , 1/0,3604)	(1/1,2783 , 1/1,1450 , 1/1,0181)	(1,1,1)	(0,6957 , 0,7959 , 0,9112)
Key Transferable Skills	(1/0,4778 , 1/0,3992 , 1/0,3405)	(1/0,0714 , 1/0,9369 , 1/1,8143)	(1/0,9112 , 1/0,7959 , 1/0,6957)	(1,1,1)

Fourth-year students	Theory-based Knowledge	Practical-based Knowledge	Generic Academic Skills	Key Transferable Skills
Theory-based Knowledge	(1,1,1)	(0,2327 , 0,2705 , 0,3318)	(0,3117 , 0,3681 , 0,4449)	(0,1979 , 0,2263 , 0,2685)
Practical-based Knowledge	(1/0,3318 , 1/0,2705 , 1/0,2327)	(1,1,1)	(0,8944 , 1,0908 , 1,2980)	(0,6497 , 0,7904 , 0,9724)
Generic Academic Skills	(1/0,4449 , 1/0,3681 , 1/0,3117)	(1/0,2980 , 1/1,0908 , 1/1,8944)	(1,1,1)	(0,5976 , 0,7269 , 0,8994)
Key Transferable Skills	(1/0,2685 , 1/0,2263 , 1/0,1979)	(1/0,9724 , 1/0,7904 , 1/0,6497)	(1/0,8994 , 1/0,7269 , 1/0,5976)	(1,1,1)

Figure 6. QFD- LP-GW-Fuzzy-AHP comparison matrices

Estimate the index of optimism

The fuzzy subjective preferences of the fuzzy pairwise judgements matrices are converted to crisp values by estimating the degree of optimism of the decision makers (students) (Kwong and Bai, 2002; Promentilla, 2006; Yang *et al.*, 2008). The index of optimism μ is used to measure the degree of optimism. The index of optimism μ is a linear convex combination (Lee, 1999):

$$\hat{\alpha}_{ij}^a = \mu \alpha_{iju}^a + (1 - \mu) \hat{a}_{ijl}^a, \quad \forall \mu \in [0, 1] \quad (3)$$

A higher value of μ corresponds to a higher degree of optimism. Setting $\mu=0.5$ the fuzzy comparison matrices are transformed to the following crisp by using equation (3) (Figure 7):

First-year students	Theory-based Knowledge	Practical-based Knowledge	Generic Academic Skills	Key Transferable Skills	Fourth-year students	Theory-based Knowledge	Practical-based Knowledge	Generic Academic Skills	Key Transferable Skills
Theory-based Knowledge	1,000	0,482	0,444	0,409	Theory-based Knowledge	1,000	0,282	0,378	0,233
Practical-based Knowledge	2,073	1,000	1,148	0,943	Practical-based Knowledge	3,544	1,000	1,096	0,811
Generic Academic Skills	2,250	0,871	1,000	0,803	Generic Academic Skills	2,643	0,912	1,000	0,749
Key Transferable Skills	2,444	1,061	1,245	1,000	Key Transferable Skills	4,288	1,233	1,336	1,000

Figure 7. The crisp comparison matrices of the LP-GW-Fuzzy AHP methodology

Use a linear programming method based on DEA (LP-GW-AHP) to estimate the relative weights of the decision elements.

In the conventional AHP the eigenvalue method (EV) is used to generate the relative weights of the learning outcomes. In the new integrated QFD methodology the LP-GW-AHP method proposed by Hosseini *et al.* (2009) is used to derive relative importances. The proposed linear programming model for the local weights derivation from a pairwise comparison matrix is the following:

$$\text{Max } Z, \quad \text{Subject to } \left\{ \begin{array}{l} x_i \geq Z, \quad i = 1, \dots, n, \\ \sum_{j=1}^n a_{ij} y_j - x_i = 0, \quad i = 1, \dots, n, \\ \sum_{i=1}^n x_i = 1, \\ y_i - \frac{1}{\beta} x_i \geq 0, \quad i = 1, \dots, n, \\ y_i - \frac{1}{n} x_i \leq 0, \quad i = 1, \dots, n, \\ x_i \geq 0; \quad y_i \geq 0, \quad i = 1, \dots, n, \end{array} \right. \quad (4)$$

Where, x_i ($i = 1, \dots, n$) are the local weights for criteria (learning outcomes), y_j ($j = 1, \dots, n$) are the outputs weights which are determined by linear programming model and a_{ij} ($i, j = 1, \dots, n$) are elements of pairwise comparison matrix. In this linear programming model, the constraints $y_i - (1/\beta)x_i \geq 0$ and $y_i - (1/n)x_i \leq 0$ for ($i = 1, \dots, n$) are assurance regions (AR) (Wang *et al.*, 2008a) and β is determined by the following equation:

$$\beta = \min \left\{ \max_i \left(\frac{1}{r_i} \sum_{j=1}^n a_{ij} r_j \right), \max_i \left(\frac{1}{c_i} \sum_{j=1}^n a_{ij} c_j \right) \right\} \quad (5)$$

Where r_1, \dots, r_n and c_1, \dots, c_n are respectively the row sums and column sums of the pairwise comparison matrix $A = (a_{ij})_{n \times n}$.

Get overall weights

The final importance ratings of learning outcomes are the sum of the product of the local weight of each learning outcome corresponding to first and fourth-year students and the weight of each group of students. The final weights become the last row of the HOQ (see figures 2, 3).

Discussion and concluding remarks

The two methodologies QFD-AHP and QFD-LP-GW-Fuzzy AHP estimated diverse priorities (importance weights) for the learning outcomes. In addition, the ranking of learning outcomes differs for both methodologies (see figures 2, 3). In the QFD-AHP

methodology the prioritization of learning outcomes is as follows (normalized importances in parentheses): (1) theory-based knowledge (0.3534), key transferable skills (0.2474), (3) practical based knowledge (0.211), and (4) generic academic skills (0.1882). The LP-GW-Fuzzy-AHP methodology provided rather diverse results. Specifically, the ranking is as follows (1) key transferable skills (0.3387), practical based knowledge (0.2921), (3) generic academic skills (0.2609) and (4) theory-based knowledge (0.1083).

A number of conclusions emerge from this study. In a student oriented academic course the learning and teaching activities should be in alignment with learning outcomes. The two methodologies lead to different appreciation of students' requirements, suggesting different priority areas for attention and thus different course design and delivery activities. In the QFD-AHP methodology theory-based knowledge is found to be the learning outcome with the highest preference, while in QFD-LP-GW-Fuzzy AHP key transferable skills are found to be the most important learning outcome. Second in ranking are key transferable skills for QFD-AHP and practical-based knowledge for QFD-LP-GW-Fuzzy AHP. QFD-LP-GW-Fuzzy AHP methodology provides a prioritization that expresses students desire to escape from the narrow boundaries of theory-based knowledge and to articulate other important skills. Key transferable skills in combination with practical-based knowledge are regarded as an essential feature of educational process, since their development enhances students' employability. On the other hand, QFD-AHP ranking of learning outcomes underlines students' preference on developing core academic subject knowledge in conjunction with key transferable skills. It can not be denied that the development of transferable skills beyond the good subject knowledge should be a key learning objective in higher education. However, attention should be paid when designing a course in order to be balance between them. Hence, a proper ranking method will help the instructor to reveal students' learning expectations and to design a course in order to facilitate their achievement.

In this paper, a methodology based on concepts from fuzzy theory and linear programming was introduced to deal with the reported shortcomings of AHP in order to prioritize customer preferences and determine proper importance levels in a QFD framework. With the intention to overcome the inherent subjectivity of human judgements and to replace the eigenvalue method (EV), whose superiority has been questioned, the Fuzzy-AHP and the linear programming method (LP-GW-AHP) into QFD were utilized (LP-GW-Fuzzy-AHP). In the literature there is no evidence about the joint use of QFD with the Fuzzy-AHP and LP-GW-AHP method (LP-GW-Fuzzy-AHP).

Customers' preferences are characterized by vagueness and diversity of meaning due to the fact that different people may give different interpretations to a particular linguistic description. Moreover, precise numbers fail to express the subjectivity and elusiveness of decision-making. A Fuzzy AHP approach is possible to accommodate the potential uncertainty in the subjective judgements of customers and this is probably the reason that accounts for the different prioritization results.

Derived priorities from LP-GW-Fuzzy AHP methodology are far from Saaty's eigenvector weights and ranks from two methodologies are different in all matrices. Further research should be initiated to investigate the underlining reasoning for the reported differences. In particular, to examine the individual and/or the common effect

of the joint utilization of Fuzzy AHP and linear programming model on the prioritization results.

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Co-opetition Strategy in Business Excellence: Confronting the Economic Crisis

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Introduction

Nowadays, the unsteady and fragile economic, social and business environment strongly imposes new approaches in management for companies and organizations that wish to better understand and more efficient manage their key business processes. Within this new external environment, companies should look up and adopt new approaches, in order to achieve their strategic goals, satisfy their customers and continue to operate.

Even though the external business circumstances are demanding and difficult for many countries in Europe and worldwide, managing and measuring Business Excellence is increasingly important for the attainment of an efficient and continuous business operation. The current, new situation, though, underlines also, the need for developing and establishing better partnership relationships with stakeholders and even competitors, when the common goal is better quality and satisfied customers.

This reality, that today's companies face, gave the authors the inspiration to combine basic concepts from two apparently different management areas, i.e. Strategic Management and Total Quality / Business Excellence Management and suggest an integrated approach for utilizing good practices for partnership and value added processes in the context of Business Excellence Models.

Therefore, in this paper the authors present the basic idea of the "Co-opetition Strategy" and interrelate that with the most known and widely used Business Excellence Framework in Europe, the European Business Excellence Model (EBEM). This way the arisen by this study approach will help organization understand that Business Excellence and Strategic Management can be interlinked and new partnerships and networks establishments can be used and contribute to continuous improvement.

Literature Review

Co-opetition Strategy

Cooperation between different independent organizations to achieve mutual goals is a prerequisite for global competitiveness and innovativeness. Organizations have

increasingly formed alliances with other parties to gain a better position in the market and create competitive advantages. Drucker (1996) stated that *“The greatest change in corporate culture, and the way business is being conducted, may be accelerating growth of relationships based not on ownership, but on partnership”*.

The question whether a firm should choose to either cooperate or compete, or if it should try to combine both competition and cooperation, has become a strategically important issue. According to Harbison & Pekar (1998) at least 50% of all new alliances are alliances between firms in the same industry. Therefore, organizations collaborate with their stakeholders, even competitors, in order to develop collaborative networks and have access to complementary resources and capabilities. This new mindset is called Co-opetition. The term “Co-opetition” was first used by Raymond Noorda (1993), the founder and first CEO of Novell and it was developed by Brandenburger and Nalebuff (1996), the authors of the book “Co-opetition”. Brandenburger and Nalebuff (1996) defined Co-opetition as *“cooperation when it comes to creating a pie and competition when it comes to dividing it up”*.

Co-opetition is based on game theory where business is a game with multiple players who play multiple roles and there are multiple winners. According to game theory, organizations have to understand the position of other organizations in the market as well as their own position. The philosophy of Co-opetition is that the success of an organization does not necessarily mean the failure of others. Instead, competing organizations may obtain more benefits at the end and generate positive-sum games. According to Brandenburger & Nalebuff (1996), there are five PARTS of a business game:

- Players
- Added value of each player
- Rules of the game (such as laws and contracts)
- Tactics which the players follow to change the perceptions of other players and
- Scope of the business game in which there are no actual boundaries.

Furthermore, Brandenburger & Nalebuff (1996) developed a framework which is called “Value Net” in order to depict the interdependence among different players of a business game:

- The focal firm,
- Its suppliers,
- Its customers,
- Its complementors and
- Its competitors.

This framework includes a network of co-opetitive relationships in which organizations “play” multiple roles and look for complementary partners to create value (Figure 1). Brandenburger & Nalebuff (1996) define complementors as players whom their products are valued more when they combine them. For example, a software company needs a hardware company to improve and market its products or services.

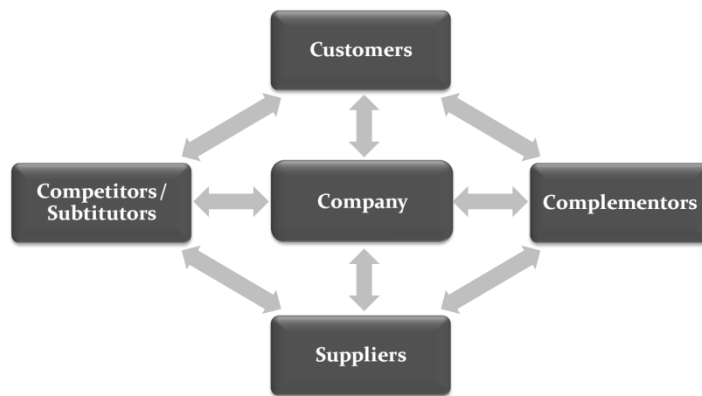


Figure 1: The Value Net - Source: Brandenburger & Nalebuff (1996), p. 16.

Bengtsson & Kock (2000) defined co-opetition as collaboration between two direct competitors in activities far from the customer and at the same time competing for market share. For example, the manufacturing departments of two organizations may cooperate and at the same time the marketing departments may compete. The reason why organizations involve in such a complex and dynamic relationship is that they cannot generate and develop products or services by themselves due to increasing R&D costs, high risks and limited resources and capabilities. Thus, competing organizations possess relevant resources and capabilities, face similar challenges and have market commonality (Gnyawali & Park, 2009). Therefore, it is crucial for them to cooperate not only with suppliers, customers and complementors, but also with competitors.

But, co-opetitive relationships have benefits and costs. According to Gnyawali & Park (2009), the benefits from a co-opetitive relationship are:

- Scale economies
- Uncertainty and risk reduction
- Product development acceleration

On the contrary, the costs from a co-opetitive relationship are technological risks, management challenge and loss of control.

Organizations cooperate through knowledge and resource transfer to create value, which is considered to be a collective action and compete to exploit and appropriate the created value, which is considered to be an individual action. Hence, they have common interests when it comes to value creation and diverse interests when it comes to value appropriation:

- Value creation arises from cooperative activities and is *“The total sum of value that is created collectively in joint innovation efforts, combining the assets of different stakeholders”*.
- Value appropriation arises from competitive activities and is *“The individual share of the value that a firm can capture from the generated value-knowledge”* (Ritala & Hurmelinna-Laukkanen, 2009).

Co-opetition is considered to be a multifaceted and multidimensional strategy. Dagnino & Padula (2002) support that co-opetition is the integration of cooperation and competition where organizations have partially convergent interests in order to create

new value. Thus, they term the interdependence among different organizations as a “Co-opetitive system of value creation”. Through this system, organizations exchange and create value to become more competitive and gain competitive advantages over other competitors.

Moreover, according to these authors (Dagnino & Padula, 2002), there are two kinds of co-opetitive relationships for value creation:

- Dyadic that is referred to the relationship between two competing business organizations whether on one or more levels of the value chain.
- Network that is referred to the condition that more than two organizations cooperate and compete at the same time along one or more levels of the value chain.

An example of dyadic co-opetition is the joint venture between Sony and Samsung for the development and production of 7th generation liquid crystal display (LCD) panels for flat screen TV's. This partnership was critical for both firms because they could not develop LCD technology in isolation. The bottom-line was a win-win scenario as the two firms combined their strengths in order to extend the flat-screen industry (collective action) and increase their market share (individual action) (Gnyawali & Park, 2011).

An example of network co-opetition is the case of SAP, an ERP software provider, which has developed a business ecosystem with vertical, transversal and horizontal relationships in order to create synergies. The business ecosystem was composed of different players, such as clients, providers, research institutions and other companies and it was beneficial for all participating players (Gueguen & Pelleguin-Boucher, 2004).

Summing up, Co-opetition strategy implies that organizations perform better when they are involved in competitive and cooperative relationships at the same time and combine their complementary strengths to create synergies. As Afuah (2000) stated, “*Co-opetitors are considered as critical sources of innovation, organizational learning and complementary resources and capabilities*”.

According to the above, it is obvious that the key objective of Co-opetition synergies is the value creations for all stakeholders. Therefore, it is crucial to present at this point some definitions of value adding processes, before continuing with the integrated suggested approach of Co-opetition and EBEM.

Value Adding Processes

According to Davenport & Short (1990) a business process is, “*a set of logically related tasks performed to achieve a defined business outcome. Also, business processes normally occur across or between organisational sub-units. Processes are generally independent of formal organisational structure*”, while Lin et al. (2002) define a business process as “*a series of activities, often involving several organisational units and operated by actors (humans or machines) that are aiming to create value for customers*”.

More specifically, in the context of Business Excellence and particularly EBEM, the development of a framework of key processes, in order the organization to focus on the

vital few and important processes (EFQM Assessor Scorebook, Criteria 2 & 5) is supported.

Value, on the other hand, according to Ilyas *et al.* (2006), is “any activity that increases the market form or function of the product or service; and there is a need to maximise the value of every process in a business”.

Today’s organizations create and manage a framework of key processes, so to deliver their strategy in a way that adds value for their stakeholders. Therefore, what it’s really important is the recognition of the value added processes. According to Normann & Ramirez (1993) “Strategy is the art of creating value and allows a company’s manager to identify opportunities for bringing value to customers and for delivering that value at a profit”.

Thus, a “Co-opetition Strategy” approach in accordance with EBEM’s fundamental concepts and criteria could be the answer in the development of a key value added process framework, through collaboration, networks establishments and partnerships even in some cases with competitors.

The European Business Excellence Model

Over the last years organizations in Europe have shown an increasing focus on evaluating their business performance by deploying Business Excellence concepts and frameworks. Of the Business Excellence Frameworks available, the European Business Excellence Model is one of the most known ones (Figure 2).

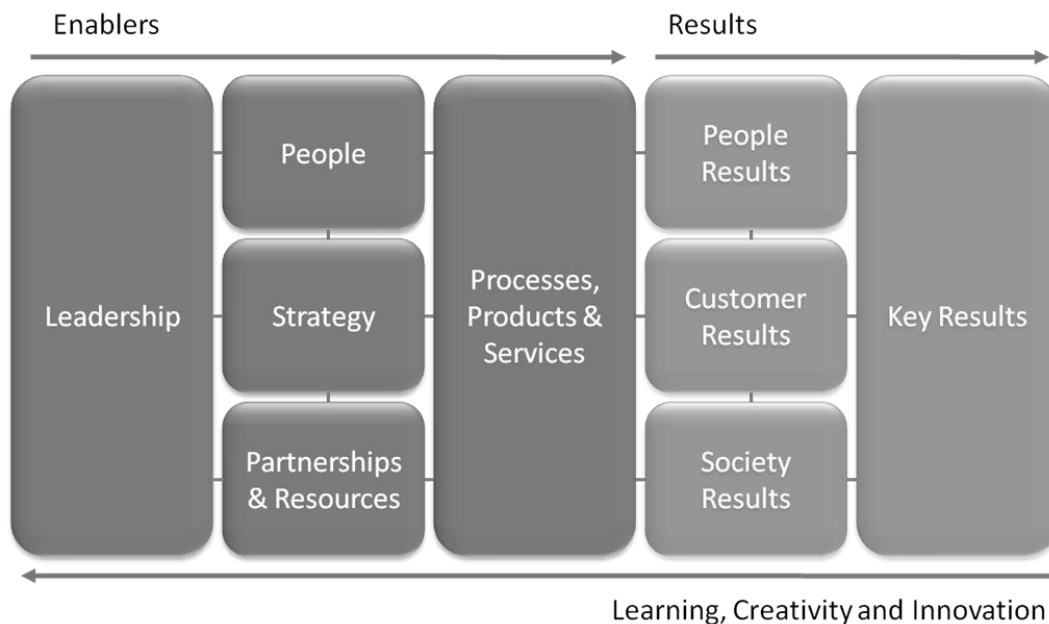


Figure 2: The European Business Excellence Model (EFQM®) - Source: [http://ww1.efqm.org/en/PdfResources/EFQM Ex Mod Teaser.pdf](http://ww1.efqm.org/en/PdfResources/EFQM_Ex_Mod_Teaser.pdf)

As it shown on Figure 2, it is based on 9 Criteria. The first five of these are the “Enablers” Criteria and the last four are the “Results” Criteria (business results for shareholders, customer satisfaction, people satisfaction and impact on society). It can be considered to be proactive model, because it defines five Enablers of the above results: Leadership, People Management, Strategy, Partnerships & Resources and Processes, Products and Services. It is also considered as a holistic and integrative approach, where strategic, managerial and operational control processes are integrated in the model (Vorria & Bohoris, 2009).

Co-opetition Strategy and Business Excellence: The EBEM

Many people believe that it is either too expensive or even impossible to implement such frameworks and especially in countries that are facing economic and social changes. This paper aims to prove that this statement is not true. When companies truly understand their own needs, goals and objectives, adapt easier in the new environment by establishing partnerships and by enriching their strategic plans with Business Excellence requirements.

As previously mentioned, the “Co-opetition Strategy” approach is based upon building partnerships with stakeholders, and even competitors, as to create value for customers. Moreover, the process of collaboration between co-opetitors is considered as critical source of innovation, organizational learning and complementary resources and capabilities.

In more detail, organizations applying the “Co-opetition Strategy” approach develop and maintain trusting relationships with various partners, including stakeholders within and beyond the supply chain (suppliers, buyers, competitors, research institutes, etc.). These collaborative relationships aim at the development of win-win situations for all co-opetitors and the creation of value for customers. The process of value creation is based on accessing complementary resources and capabilities and developing innovation within collaborative networks.

The Value Creation Network is presented in Figure 3:

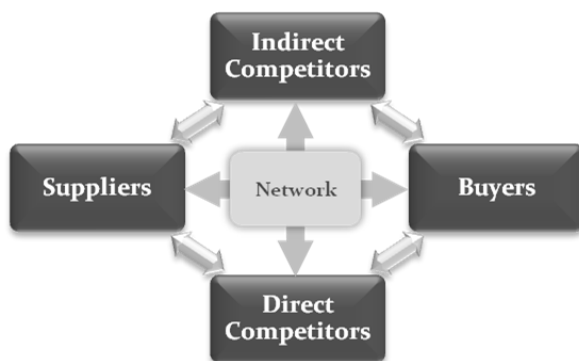


Figure 3: The Value Creation Network - Source: Adapted from Brandenburger & Nalebuff (1996)

Stakeholders within and beyond the value chain are cooperating in order to create value for the customer. It includes the interactions of suppliers, buyers, direct competitors (competitors and substitutors) and indirect competitors (complementors, research institutes, etc.). This collaboration is originated from the organizations’ co-opetition

strategy, enhanced with the value creation process. Value is created through accessing complementary resources and capabilities and developing innovation within the collaborative network. The co-opetitors' objective is to create a new market or expand a current one.

As an attempt to combine the literature review of the “Co-opetition Strategy” approach with EBEM Criteria and Concepts, it is obvious that:

- Two (2) ‘Enablers’ Criteria strongly underline the importance of the existence of strategic approach of collaboration as “Co-opetition Strategy” approach:
 - Criterion 2: Strategy
 - Criterion 4: Partnership and Resources.
- Four (4) of EBEM’s Fundamental concepts support this “Co-opetition Strategy” approach:
 - *Adding Value for Customers*: The main mission of all is the sustainable customer value.
 - *Building Partnerships*: Main objective is the development of a win-win situation with all partners and the maintenance of value adding partnerships. These partnerships may be formed with customers, society, key suppliers, educational bodies or Non-Governmental Organizations (NGOs).
 - *Management by Process*: The value added management depends on independent and interrelated systems, processes and facts.
 - *Nurturing Creativity and Innovation*: Main objective is value creation through innovation by harnessing the creativity of their stakeholders (<http://www.efqm.org/en/Home/aboutEFQM/TheEFQME ExcellenceModel/FundamentalConcepts/tabid/169/Default.aspx>).

The alignment of the “Co-opetition Strategy” approach and EBEM Criteria is presented in Figure 4. Organizations that are using both the “Co-opetition Strategy” approach and EBEM, focus on the Strategy, Partnership & Resources and Processes, Products & Services Criteria, concluding in Customer, Society and Key Results improvements. These improvements come from the implementation of the Value Creation Network, which leads to learnability, creativeness and innovability, and sustainable competitive advantages. Moreover, the importance of Strategy and Partnership & Resources Criteria is also stressed out in the revised EBEM 2010, in which these Criteria’s weights have been increased (Criterion 2 from 90 to 100 and Criterion 4 from 80 to 100).

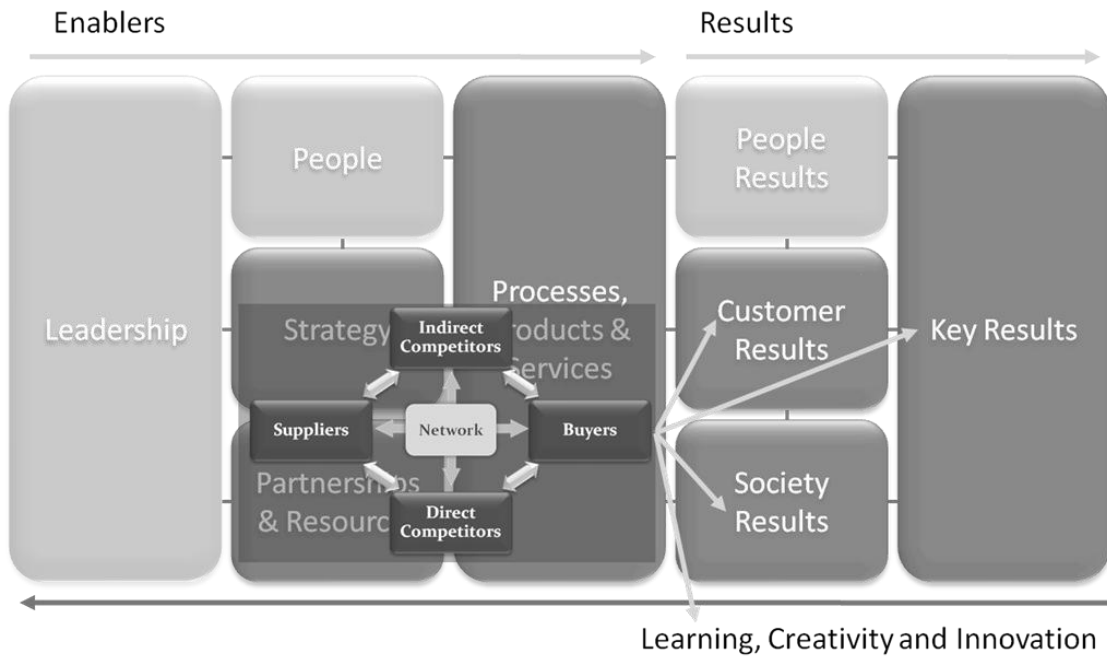


Figure 4: Co-opetition & EBEM alignment

It is also true that as the fundamental concepts of excellence affect each criterion of EBEM, these previously mentioned EBEM’s fundamental concepts affect Co-opetition, as well (Figure 5):

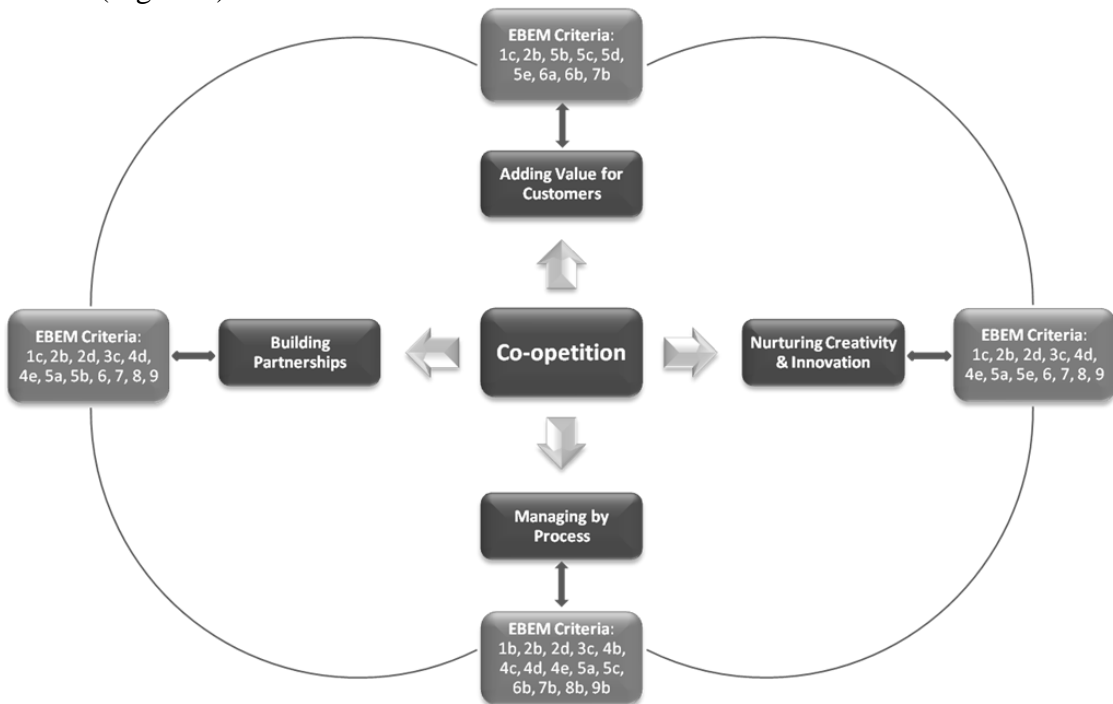


Figure 5: Co-opetition, EBEM’s Fundamental Concepts & EBEM’s Criteria

As it is shown, “Co-opetition Strategy” approach is based on these concepts and through the logic of the red thread (the sub-criteria of EBEM that these fundamental concepts affect directly or indirectly) in EBEM, it becomes obvious that these two approaches are strongly interrelated.

Conclusions and Further Research

The unsteady economic business environment has forced companies and organizations to act towards a direction with more collaborations and partnerships. Within this climate, companies should decide their strategic planning with focus on stakeholders adding value. This paper presented the concept of “Co-opetition Strategy” in alignment with EBEM’s Criteria requirements.

“Co-opetition Strategy” approach can be used by organizations to create value through collaboration with their stakeholders, even competitors, in order to develop collaborative networks and have access to complementary resources and capabilities. “Co-opetition Strategy” approach is based on the same fundamental concepts EBEM is based on, and can be aligned with EBEM for organizations to gain sustainable competitive advantages. These co-opetitive relationships can be either dyadic or network and aim at the development of win-win situations for all co-opetitors and the creation of value for customers. The process of value creation is based on accessing complementary resources and capabilities and developing synergies through collaborative networks.

This paper is only a part of the authors’ attempt to study through literature and under the prism of Business Excellence the implications of “Co-opetition Strategy” approach with Business Excellence Models. Another future aim is to examine whether “Co-opetition Strategy” can be applied in alignment with other Business Excellence Models, and whether co-opetition through Business Excellence Models is more effective than being applied completely separate. Moreover, the authors suggest that further examination of the above theoretical approaches with empirical data is required, in order to establish the previously arisen concepts.

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Knowledge Management in Pakistani SMEs

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Key words: Developing economies, Knowledge management, SMEs.

Introduction

SMEs have a huge share in country's industrial employment and manufacturing exports [1]. The share of this sector in total in value addition is 28% and it is estimated that the more than 3.2 million SMEs of Pakistan constitute about 99% of total businesses in Pakistan. There is a "virtual non-existence" of scientific data about SMEs in Pakistan [2] which is the biggest frustration for researchers. Performance of SMEs has been reported to be on a decreasing trend with SMEs showing little optimism about the future of their businesses. About 71% of SMEs believe that business will either stagnate or will go down in next one year. Only 5% of the SMEs export their products and businesses in general perform poorly if they supply only in the domestic markets. With Economic Survey of Pakistan and Small & Medium Enterprises Development Authority (SMEDA) offering little scientific information on SMEs, [2] seems to be the only reliable scholarly publication addressing SME sector globally.

TABLE I. PAKISTANI SMES - OVERVIEW

<i>SME Sector of Pakistan</i>
Total number: 3,200,000
As percent of total businesses: 99%
Share in industrial employment: 78%
Share in value addition: 28%
Manufacturing exports earning: 25%
Contribution to GDP: over 30%
Exports value: Rs. 140 billion
87% SMEs employ less than 5 people
98% SMEs employ less than 10 people

Comparing the reported increase in number of SME businesses in Pakistan (from approximately 40,000 to 3.2 million between 1988 and 2007 [1] and [3]; and considering it with the reported performance of SMEs, the high rate of business closure and a higher number of sick or low performing business is vindicated.

KM is fast growing as a distinct source of competitive advantage among businesses. KM usually requires allocation of significant resources which are utilized through a greater focus on definite knowledge assets and the cultivation and development of channels through which knowledge flows.

While such resource allocations and subsequent effective utilization can be associated with larger businesses; Small and Medium Enterprises (SMEs), being resource constrained by their very nature find it difficult to undertake and institutionalize KM. It can also be argued that among all the resources required for successful running of a business, SMEs can possibly mobilize and manage the Knowledge resource most effectively. This situation can be particularly crucial when we consider that SMEs form

more than 90% of businesses in most countries; therefore SME sector doing effective KM can make significant contribution to any national economy.

For a developing economy like Pakistan, the importance of KM can not be over-emphasized. However, due to the non-availability of scholarly data on working practices of SMEs, there is a need to establish a datum of current KM practices by SMEs before any further scholarly analysis on the issue can be carried out. This paper provides the required datum.

Literature review

The concept of KM is not new [3]. Institutions have always used KM and KM practices to make decisions, and to produce goods and services, however, with the rise of KM process [4], it is established that the organizations that use the KM practices without knowledge and awareness of it will not reap the benefits to its full, if any at all. KM has also been related to culture by several studies, and it is prominent that culture has a strong effect on KM and knowledge sharing.

In Pakistan's context, the literature on SMEs practices remains limited. There have been several studies on their quality management. However, there is an extreme dearth of works on KM in Pakistani SMEs.

In context of the SME's described above, there is a need for much deeper scholarly analysis of the working practices of SMEs in developing economies, particularly Pakistan. A focus is required to identify interventions that are least costly and thus can achieve a higher degree of direct adaptability by private business entities. In particular, the management of their knowledge assets requires attention since this gives them the crucial competitive advantage in the background of being resource constrained and thus competition on bases such as technology, human resource, IT etc may not be feasible for them. SMEs generally compete on the basis of their know-how and do not possess resources to acquire resources such as land, labor and capital.

It must also be emphasized that the start of an SME business is on a presumption by the entrepreneur that he possesses knowledge about that business. The knowledge asset of an SME therefore has to be preserved and used to leverage advantage. Moreover, SMEs generally cannot spare resources for high cost formal trainings and thus the working knowledge must be transferred from experts (entrepreneur) to (mostly unskilled) workers.

Similarly, the workforce hired by SMEs is not the brightest university minds as their costs are not affordable by SMEs. Assuming perfect markets where high paid jobs go on fair competition, the workforce coming to an SME will, in all probability, be the left-over, who have not been adjusted in higher paid LME jobs. This again calls for in-house training of the workforce, and thus effective KM comes in. In cases where SMEs plan expansion, the entrepreneur must train his protégés for years until he can open another outlet or unit.

SMEs are judged by the external world, such as lending institutions, investors, suppliers, and customers, on their knowledge and knowledge-exploitation capabilities.

Building upon the most common paradigm in KM literature, the knowledge hierarchy [5], [6] & [7] have proposed a five tier hierarchy. The following table shows the concept with the volume and action-ability of the tiers.

They have defined Individual knowledge as “knowledge contained only in the mind of a person”; Facts as “atomic attribute values about the domain.”; Influences as “data in context that has been processed and/or prepared for presentation.”; Solutions as “clear instructions and authority to perform a task.”; and Innovation as “the exploitation of knowledge-based resources.”

In their empirical research of KM in Finnish SMEs, [8] have found that while most of the firms have KM know-how, only a small proportion has been able to leverage it to their growth advantage.

In their qualitative and quantitative work on comparing KM perceptions and practices among large businesses and SMEs, [9] have found that SME sector is less advanced with a mechanistic approach to knowledge and lack of investment in KM approaches and systems.

In their seminal qualitative work on KM practices of SMEs, [10] have outlined five peculiarities of SME in the way they manage their knowledge, compared to larger firms. Larger organizations use technology to manage knowledge. Generally, huge data bases are used to store and disseminate knowledge. In SMEs, however, KM seems to be a people centered issue. Knowledge is “created, shared, transferred and applied” through people.

Several works have focused on different strategies used by organizations to manage their knowledge assets. Many organizational actions such as retention incentives, incentives for knowledge enhancement and management etc are widely used by larger organizations. To manage the knowledge itself, strategies can be either push-systems (Codification approach to KM, [11]) where individuals code their knowledge into a repository or data base and the organization later uses this knowledge; or pull-systems (Personalization approach to KM, [12]) that are based on individual interactions for transfer of knowledge.

However, such formal systems have not been explored for SMEs of developing economies in detail. An initial attempt has been made to include this aspect in the current work.

Survey

A survey was conducted to gauge the current KM know-how, use and effectiveness in the SMEs. The survey was mailed to 710 managers of registered SMEs. In parallel, attempts were made to administer the same survey in scheduled personal meetings/interviews. A total of 140 such requests were made where as 62 of the interview requests were accepted. The whole exercise yielded a total of 159 usable responses; including 68 from structured interviews (yielding a response rate of 48.5%) and 91 from e-mails responses (yielding a response rate of 12.8%). The overall response rate came at 18.7%. Not all questions were answered by all respondents; therefore

replies have varying N value. The data was collected in 2010 after up gradation on the questionnaire.

Approximately 84% of the SMEs represented manufacturing sector. (Capital Goods Manufacturing 46%, Textile Manufacturing 16%, Food related manufacturing 19% and Other manufacturing 19%)

Approximately 92% percent of the respondents' firms were operating in Private Sector. Approximately 86 percent of the respondents' firms had gross annual sales of less than Rs. 100 million, thus providing a high degree of fit to SME definitions. Similarly approximately 84% of the respondents' firms had 100 or less employees and approximately 100% of the respondents had 250 or less employees. This again represents a high fit to SME definitions.

While no direct relation exists between the percentage of female employees in the work force with quality performance and practices, it might be of interest to note that approximately 81% of the respondents' firms had 5% or less female employees in their workforce while 98 percent had 20% or less female employees in their workforce. This is not, by any means un-typical of manufacturing sector SMEs. Minitab 15 Statistical software was used to analyze the results.

Results

Table II is a brief statistical summary of the awareness of KM among the owners/manager of sample SMEs. KM has a low perceived awareness among owners/manager of SMEs. With approximately 76% respondents indicating average or below understanding of it, the mean is at 2.92 on a scale of 5.

Pearson Correlation Analysis with firm data:

The Pearson correlation analysis in Table III shows a strong positive correlation between a firms revenues and the knowledge of this technique. A relatively weaker correlation is shown between number of employees and knowledge of this technique. There seems to be no relationship between the number of female employees and either of KM knowledge, revenue or total number of employees.

Use of KM

KM does not seem to have a pervasive adoption in Pakistani SMEs. Only about 32% of the respondents use KM formally in their organizations.

TABLE II. KM AWARENESS- STATISTICS

Mean: 2.92	Variance: 1.58	Sum of Sq: 1604
SE Mean: 0.099	Coef Var: 43.1	MSSD: 1.386

TABLE III. CORRELATION ANALYSIS

Correlation among variables			
	KM Awareness	Revenue	Employees #

Revenue	0.627 0.000	-	-
Employees #	0.467 0.000	0.461 0.000	-
% Female Employees	-0.052 0.618	0.056 0.482	0.020 0.807
Cell Contents: Pearson's Correlation Value / P-Value			

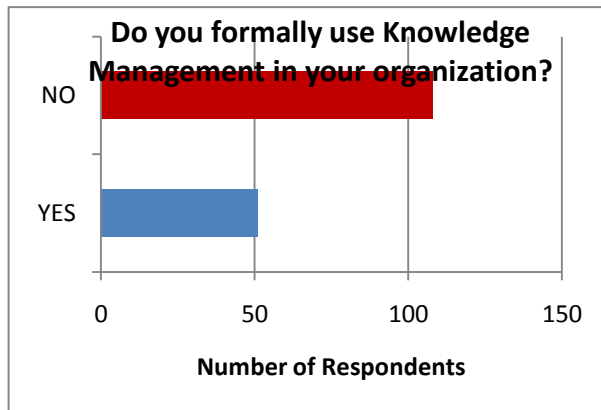


Figure 1: Formal Use of KM.

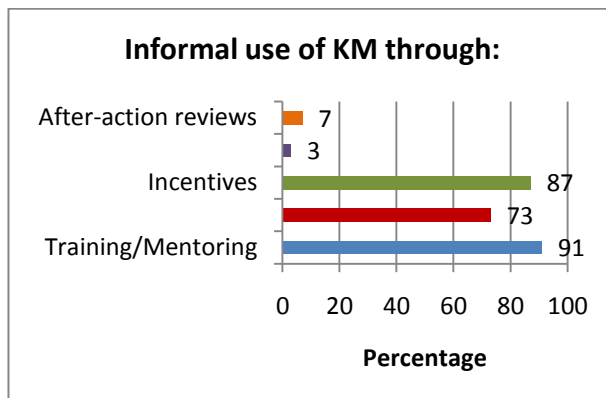


Figure 2: Informal Use of KM.

However, more than 90% of the respondents who initially said they do not formally use KM replied in positive when they were asked if they use KM in “some” informal way. The term “some” was explained in detail and included actions such as; training/mentoring of new employees by experienced employees (91%), retention of experienced employees (73%), incentives to avoid turn-over of experienced employees (87%), use of IT assets for knowledge databases (3%), after action reviews (7%) etc. Several others strategies were investigated for use besides those mentioned above, none returning a response above 1%.

The effectiveness of KM was investigated only among respondents who responded positively to formally using KM techniques (51 respondents). The graphical summary in Figure 3 indicates that a huge majority of KM adopters found it effective or highly effective. There is also a strong correlation (Pearson Value 0.610, P-Value 0.000) between knowledge of KM among employees and the effectiveness of adoption of KM techniques.

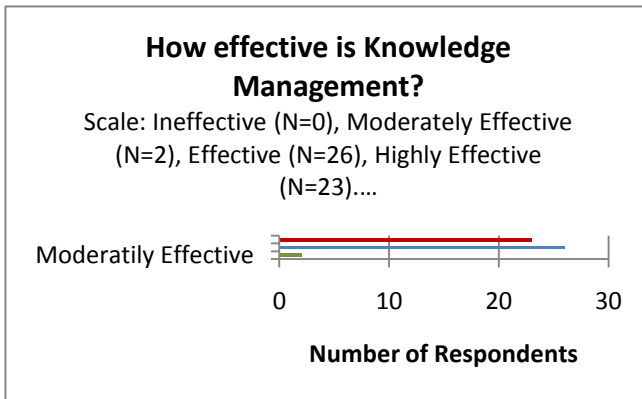


Figure 3: Effectiveness of using KM.

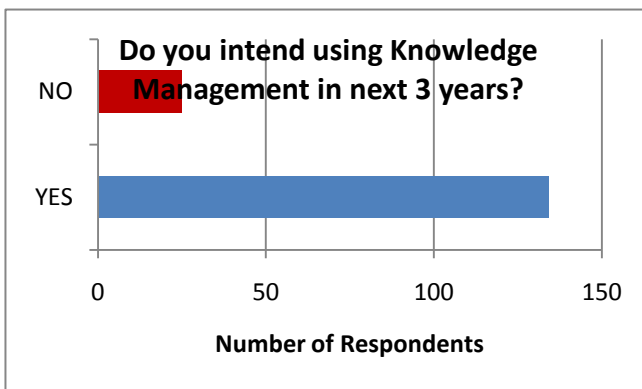


Figure 4: Expected Future Use of KM.

The term “Effectiveness” was not explained or expanded. It was not related to a firm’s financial performance or any other metric. The same will be investigated in a future work. Therefore, “Effectiveness” corresponds to “Perceived Effectiveness” of the respondents.

More than 82% of the respondents said their firms are likely to adopt (or continue using) this technique in the coming three years while they remaining did not expect its adoption.

Discussion

Better decision making, faster response time, increased profit and improved productivity have been reported for firms that have adopted KM (KPMG, 1998). Realizing its importance, larger organizations have institutionalized KM into their systems, and attempts are made to leverage KM for higher productivity and competitiveness. SMEs however have a distinct profile when it comes to KM practices. Their practices are attributable to their lack of resources, peculiar management structures, low employee turn over rates, strong personal bondages among employees and other factors.

The results apparently do not conform to [11] where as strong conformance is observed to [10]. This is understandable since KM has a strong cultural context and the higher

degree of socialization in SMEs also indicates a strong reliance on culture for knowledge generation, sharing and diffusion.

This study was limited to the awareness of KM, its use and effectiveness and use in Pakistani SMEs. For further research, deeper investigations such as case studies of KM in SMEs, analysis of reasons behind KM adoption or otherwise and effectiveness may be looked into. Moreover, long and short term effects on the growth and performance of business who undertake KM initiatives can be investigated.

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Innovation Quality

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Key Words: Innovation Quality, Innovation Maturity Model (IMM), Management Processes, IsyProM, Innovation Funnel, Maturity Level.

Category: Research paper

Introduction

Innovations and its application in product development process must be traceable and assessable in order to minimize the associated risks. The planning of preventive quality measures for the prevention of unnecessary iterations and interface problems, during the innovation and product development process, are the activities that dramatically shorten the development time. It is not the shortage of innovative ideas, but its implementation and marketing in the form of innovative products, services and processes. For example, in Germany each fourth patent of a patenting enterprise is not appearing in the market – thus there exists an untapped net asset of at least 8 billion Euros underneath the German economy.

The consequences of a sub-optimal innovation process can be dramatic: One who has not been changed is often found itself amongst those above average that have been eliminated from the market.

Approach

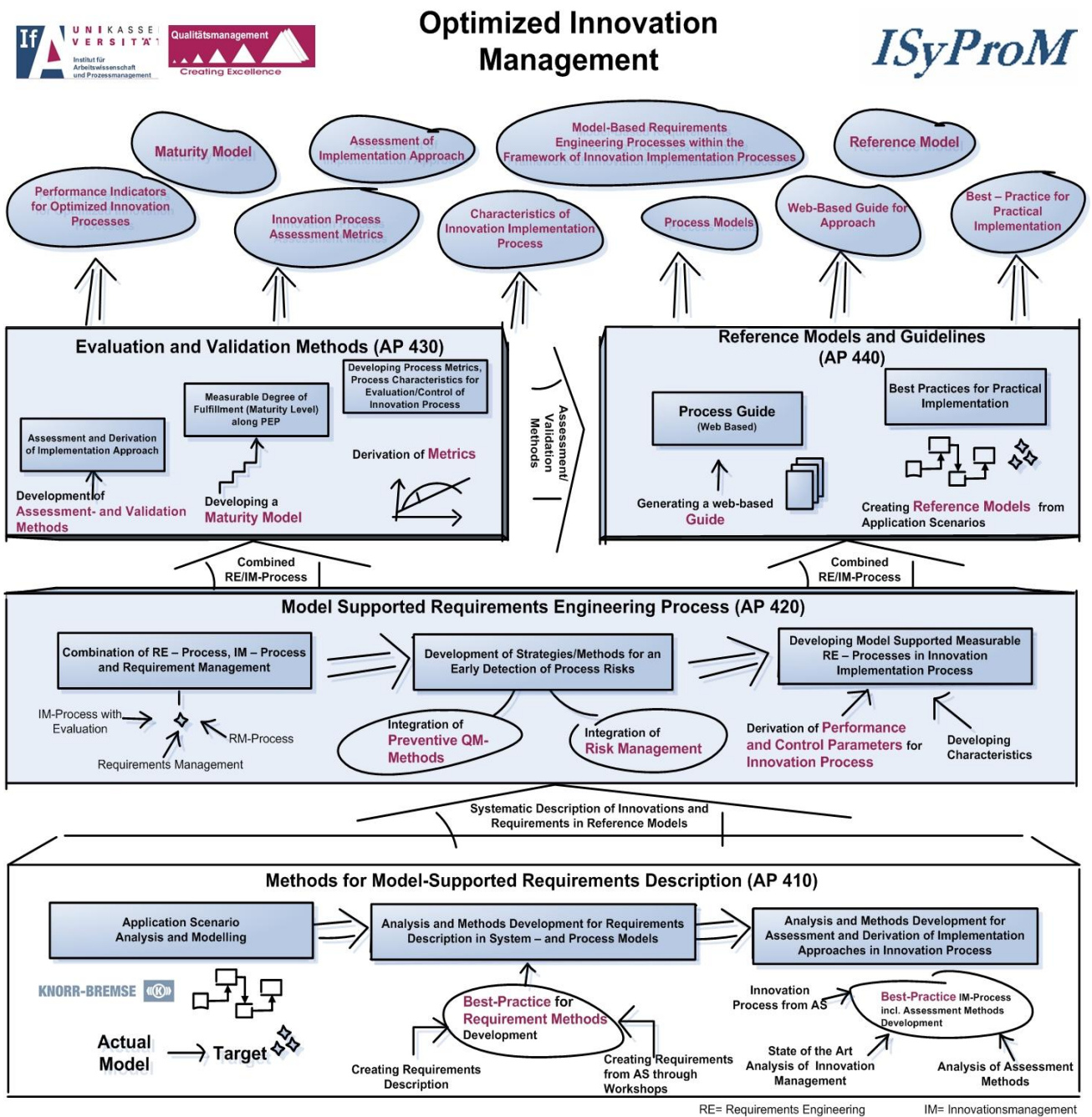
The integration of innovation processes in product lifecycle management aimed at documenting and storing the required newly created knowledge in the innovation process wherever it originates in the system engineering process. As PLM is the only software that basically manages a product throughout its life cycle, thus this knowledge should be integrated at this point i.e. embed the innovation process in "normal" development and business processes.

So far, the knowledge lies in innovation and engineering processes, for example, why a solution is dropped in the concept phase or how the requirements from the concept phase are followed and implemented mostly by individual designers and developers. The comprehensive view and knowledge of the product and the experience gained from its development is limited only to the project participants. To what extent this knowledge and requirements established will be disseminated and re-used for new product development is largely depend on the communication and the informal employees networks within a company.

The aim is therefore to optimize the innovation implementation process for increasing the innovation speed and quality through model-based integrated engineering systems in product development process. The Innovations must be described formally systematically and its degree of completion (maturity level) along the production development process should be measurable. It contributes significantly to raise the

innovation quality and in cost reduction benefits (e.g. eliminating the need for additional prototypes through utilizing the experience of a documented model). For this matter, an evaluation/maturity level model (Innovation Maturity Model – IMM) and an integrated description and measurement of the static and dynamic process parameters are developed. Furthermore, methods for validation of innovations based on quality goals (quality gates) in the innovation implementation process are developed. This can for example be made on the basis of process metrics. Moreover, the reference models and a guide for implementation procedures including "best practices" are developed (see Figure 1).

Figure 1: Project Approach



The Innovation Management Process

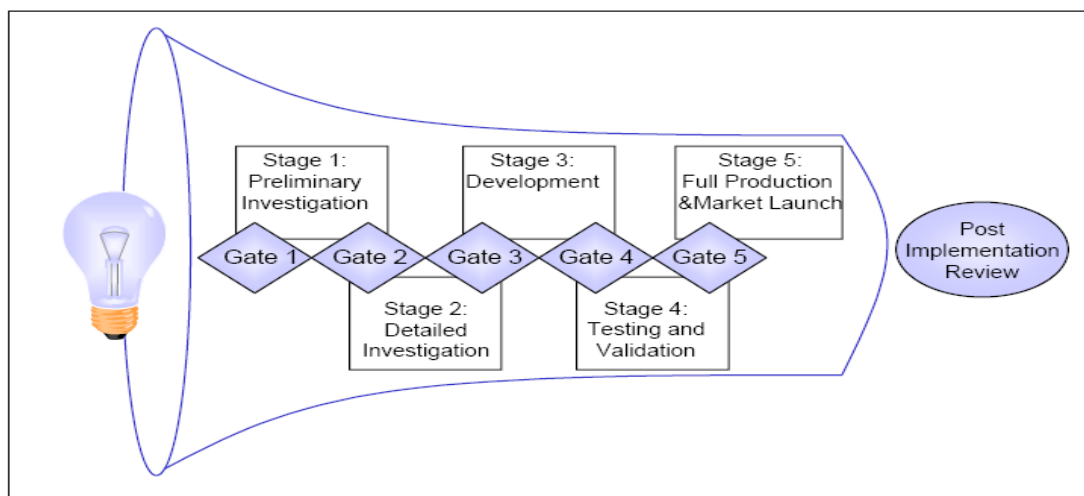
The innovation process encompasses all phases from idea conception to product design. The various classifications of phases at different detail levels are described in the literature (Giebel et al., 2008; Cooper, 1998; Cooper, 2000). In principle, the innovation process can be distinguished into the following phases:

- Idea generation, development, evaluation and selection,
- Idea selection and kick-off for realization of a (Pre-/Technology) development project,
- Preliminary-/Technology development, feasibility proof (prototype) and kick-off for product development,
- Product Development Process,
- Production and Market launching

These phases are widely described in the form of an innovation funnel (as shown in Figure 2), where variety of ideas enter into the funnel out of which a small portion is chosen, a much smaller number of those ideas are put into product development and finally, a very few are marketed in the form of new products.

Within the specific innovation projects, there are so-called quality gates between the individual phases as special milestones which depend on the outcome of the previous

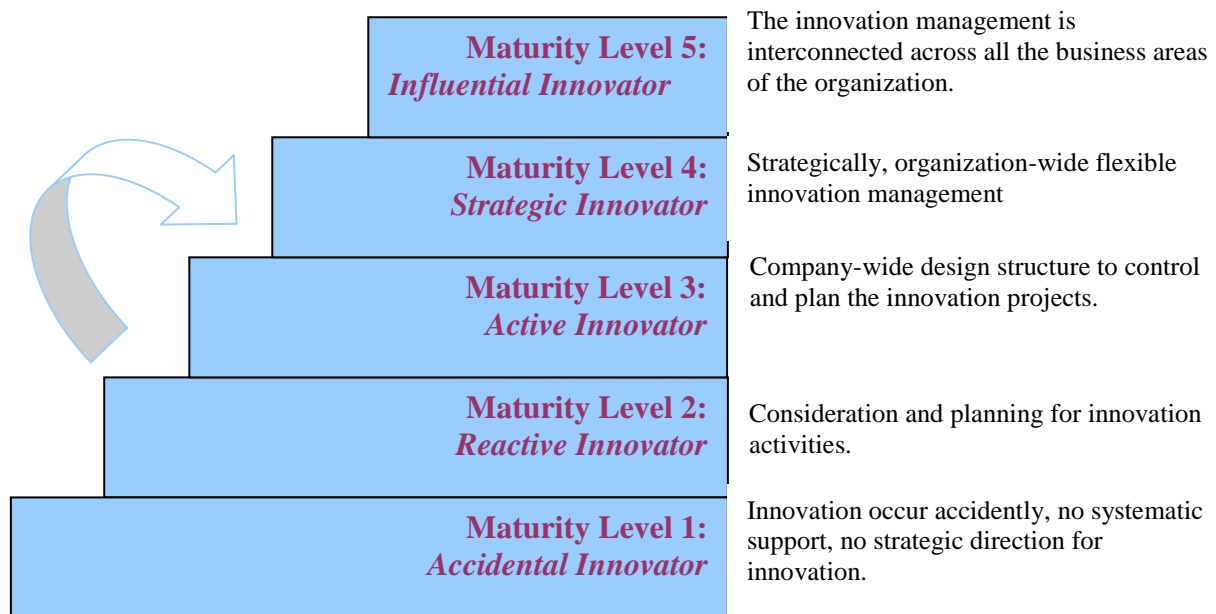
Figure 2: Cooper's Innovations Process (Cooper, 2000)



Measurement of Innovation Capability via Maturity Models

The design of the innovation process of a company determines its ability to innovate. The Process success factors and indicators are determined on whose basis the innovative ability evaluation is made possible with the help of so-called maturity models. In such a maturity model, the companies are classified on the basis of their maturity stage. The maturity model distinguishes five stages of innovation as shown in Figure 3. All companies can be placed into one of these five stages starting from "accidental innovator" to the most innovative stage of "influential innovator". This ensures the evaluation of all companies on the same fixed base.

Figure 3: Maturity Level for Innovation Capability



The method efficiency is improved through standardized and specified number of success factors and indicators. And both time and costs are saved by eliminating the need for the developments of success factors time and again, through their standardization.

The definition of maturity levels, maturity stages and maturity models are treated differently in the literature (Wagner, Dürr, 2008) (Wallmüller, 2007) (Hogrebe, Nüttgens, 2009) (Jugdev, Thomas, 2002) (Carnegie Mellon, 2006) (Mackie, 2007).

The origin of using maturity levels and maturity models for process quality assessment is rooted in the findings of American quality gurus Juran and Crosby. Juran proposed a systematic approach with different levels of maturity for quality improvement and control that emphasized the quality management in all phases of product life cycle (Wagner, Dürr, 2008). In 1979, Crosby defined one of the first maturity models - Quality Management Maturity Grid (QMMG). Crosby's goal was to improve and develop businesses quality through assisting managers in decision-making and problem-solving processes (Daniel, 2008).

Depending on the context and model, the concepts have a specific meaning. Proven approaches of maturity models can be found in software development and knowledge management (Kneuper, 2005).

The idea of Innovation Maturity Model (IMM) is developed to make the various companies or different parts of company comparable. In addition, the maturity model can be used as an analytical tool to evaluate and improve the innovation capacity. The stepwise, evolutionary process by making use of an appropriate criteria catalogue of the company's development helps to increase the innovation output.

Defined numbers of success factors are determined. These are collected with the help of data and indicators. Furthermore, qualitative and quantitative indicators are also

included in the evaluation. The strength or degree of influence of the success factors are determined by assigning them with a number between 0 and 1, whereas 1 means the success factor contribution towards the performance is maximum. Subsequently, the use of an average value may lead to the classification of the model into one of the five maturity levels.

It should be noted that the structure and professionalism increases with achieving the next maturity level (Spath et al., 2006). The division into different maturity levels describes the innovative ability of the company and highlights the actionable measures and proposals for improvements to achieve the next level. A number of conducive methods and measures are assigned to every success factor for its development and improvement. The lower maturity levels have smaller number of success factors and indicators to compliance with in order to achieve the next higher level than those required by levels 3, 4 and 5. This fact lowers the efforts on part of the companies with weak innovations capabilities.

In order to achieve a higher next level, the suggested measures to increase the respective success factor should be endorsed by the management. So that the clear signals can be sent to the employees and the support for an innovative culture may be secured. The innovation card application of the maturity model enables the innovation controlling.

The different maturity levels are explained herein:

Maturity Level 1: The Accidental Innovator

The first maturity level is characterized by above all an innovations hampering corporate culture. The "everyday business dominates the workflow (Spath et al., 2006), and offers a very little room for creative and innovative ideas. It prevails mainly in rigid structures and process organizations. The innovative projects undertaken have a little autonomy as compared to line organization. In this environment, successful innovations rather happen accidentally, also fragmented and unstructured documentation of the innovation process are usually not compiled properly. Knowledge repository and a general mechanism of knowledge exchange are not defined; as a result the existing knowledge of employees is non-retrievable. Mostly the knowledge is passed over orally. All processes are chaotic and unstructured. The lack of market orientation leads to the production of customer's unwanted product; hence the existing market potential went unexploited. Furthermore, no technology screening is used to discover the latest technology trends and to exploit them. Therefore, the production is based on existing and proven technologies. Companies falling in this maturity level have little pressure to change, therefore generally, innovations does not carry a great importance.

Maturity Level 2: The Reactive Innovator

This maturity level is characterized by a propagated, but not consistently enforced Innovation policies. There exists reluctance for idea generation and realization. The organization had a very clear and explicit objectives attached to the innovation projects. Therefore, a systematic knowledge sharing is encouraged within the organization, however the knowledge from already completed innovation projects can not be retrieved. Moreover, there is no appropriate tool for the exchange of existing knowledge

with the external partners. The organizational structure is flexible and innovative projects will receive autonomy (Spath et al., 2006). A network formation with other innovative companies is encouraged with the aim to speed up the innovation projects. Though technology trends reveal lately, but then followed consistently. The market is not adequately monitored, so that customer needs and requirements are not optimally recorded and the company rather responds to the success of the competitors, so innovation brings therefore only a partial market success. Another criterion for this level of maturity is that "[...] the typical innovation activities and processes are recorded and systematized" (Spath et al., 2006).

Maturity Level 3: Active Innovator

Maturity level of these companies is characterized by innovation friendly organizational structure. The employee's ideas are carefully registered and gradually employed in new innovative products and processes. The "[...] knowledge of the creative process [of innovation] is neither standardized through documentation nor widely accessible [...]" (Spath et al., 2006). Not all employees have access to knowledge and knowledge transfer between the various innovation projects that are followed up to a slight extent. Therefore the past failures are mostly repeated time and again.

The intended objectives of the innovation projects and processes are clearly defined and strategically planned. This includes the expansion of the network with cooperating partners in addition to the development of competence necessary to boost innovation.

The technological orientation of the company depends on technologies with the highest innovation potential. A Technology-Benchmarking is used and maintained for this purpose. Furthermore, the market is continuously monitored and analyzed so that the customer wishes and requirements are built into new products and services.

The innovation processes are standardized and focused on the goal of building the company's innovative capacity (Spath et al., 2006). The flexible organizational structure facilitates the project-related activities.

Maturity level 4: Strategic Innovator

Employees are encouraged to be creative and generate ideas. The management leads from the front to emphasize and demonstrate the significance of innovations for corporate success. The strategies for research and development and introduction of innovations in the market are planned (Spath et al., 2006). For this purpose, the existing knowledge is applied that is accessible to all employees and taken care of through knowledge management. All innovations are market oriented and include the customers early in the innovation process. In addition, competitors are closely monitored, technology screening and benchmarking is carried on systematically. The systematic application of technology management filters out the technologies with the greatest potential for innovation (Spath et al., 2006). Thus the company produces successful innovative products and services that can be steadily improve and in turn achieve success in the market place.

The innovation processes are standardized, and are monitored by using appropriate metrics "[...] and checked for compatibility with other business or non-business processes" (Spath et al., 2006). The project-related activities and flexible deployment of personnel and material resources is made possible through organizational structure. The

innovation collaborations with suppliers and technology partners are coordinated through cooperative management and the relevant objectives are planned. The project organization is largely concerned with the important tasks of innovation projects.

Maturity Level 5: Influential Innovator

The organization requests the concern personnel to develop ideas and transform them into new products and services. The company is primarily focused on the strategy of growth through innovations. Thus, the main objective is to strengthen the market position by overtaking the competitors. The organization has a great willingness to take risks, try and develop new things. All employees have the opportunity to access the "[...] information about the latest knowledge within the company, to use this knowledge and to generate the new one" (Spath et al. 2006). The abandoned innovation projects are retained and used as a source of ideas for future projects. This forms the basis of employee's high level of acceptability for the system. The current technological developments are constantly spotted, analyzed and evaluated. It is ensured that the key technologies for the company are attainable and implementable. The innovation processes are designed adequately flexible to adapt any change in technology or target within a short time. The interface problems with other processes are largely resolved and the use of resources is targeted and efficient (Spath et al. 2006). The innovation process delivers reproducible and continuous innovative products and services. The company has a network that connects all the key partners that are important for its ability to innovate. Moreover, strategic alliances with the cooperating companies are established to improve the competitive position further.

The innovative projects are implemented in a project organization which are independent structural units and are provided with their own project monitoring and control mechanisms (Spath et al., 2006).

The production of many innovative products and services is efficient and effective because customer knowledge (also known as "Customer Knowledge Management"), requirements, and desires are systematically collected and incorporated into the innovation process. Additionally, the company has a competitor screening and benchmarking process, which monitor and evaluate the developments and technology trends of the competitors.

Summary and Outlook

It has been shown that the innovation capability of a company can be determined through a maturity model, and as a result the measures to support the innovation initiative may be derived through carrying out the innovation process assessments. The tools presented here to evaluate and manage the innovation capacity can also serve for a systematic and efficient innovation controlling, for example, the implementation of Innovation Card on the basis of Innovation Maturity Model (IMM).

The future efforts are focus on the development of reference models and guidelines for the implementation procedures that have to be "Best Practices". A Web-based manual that contains reference models as well as recommendations for actions and descriptions of Best Practices should be developed and put at the user disposal. The guide should

support in practical implementation of the concept. It not only describes the Best-Practice-Solutions but also develop a link between the process evaluation through maturity model and the web-based procedure guidelines.

Finally, the evaluation of the developed tools, methodologies and models, on the basis of industrial application practices, should be performed.

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Putting Appreciative Design into Practice: A Case Study of a Course Evaluation and Design Process

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Introduction

The handling of how to implement, observe, manage, change and monitor the quality of higher education degree programs and institutions has gone through a major shift in Europe since the 1980s. A shift from direct state control to other forms resulting in several European countries struggling with work hanging over the higher education institutions as well as accreditation and evaluation institutions, as noted by Schwarz & Westerheijden (2004). In the wake of this shift many institutions are in search for efficient and effective assessment procedures, where assessment refers to the two very different activities: (a) the simple measurement and gathering of information and (b) the utilization of that information for institutional and individual improvement (Astin, 1991).

From a quality perspective this shift can be seen as a major opportunity to search for new procedures, procedures that both involve students more effectively and efficiently as well as ensure that the assessment does not stop at measurement alone but also is utilized for improvement.

Today, the common praxis for “involving” the students is typically the use of end-of-course-evaluations. But the extent to which the faculty actually uses the measurement for improvement is often questionable. As already seen by Marlin (1987), students also have little confidence in these evaluations “even though the machinery exists and is used to inform the faculty and administrators of student opinion, nobody pays much attention nor does much as a result of the outcome of the evaluation process” (Marlin, 1987, p.714). Students frequently have little confidence in the use of the end-of-the-course-evaluation forms as they are not typically involved in the following analysis and improvement activities.

It can furthermore be noted that the common praxis typically focuses on what is wrong with programs and courses as stated by Norum et al. (2004). We engage in a search for what we want less of, with no assurance we will get more of what we do want (Ackoff, 1999). Simply put, common praxis tends to make programs and courses “less wrong” but hardly “more right”.

In this paper, we will seek to introduce a different way of doing it as we will introduce a process for Appreciative Design to be used in the development of higher education together with insights from applying it in practice. The process introduced is referred to as Appreciative Course Evaluation and Design (ACED).

Setting the context

In Autumn 2008, Mid Sweden University launched a new one-year educational program called “Skarp Åre”. The program was created to suit the needs of skilled product and business developers within the sports, tourism, and outdoor industry with a focus on innovation management. At this point, Mid Sweden University had no similar educational program so there was obviously a need for substantial evaluation and improvement. The program was furthermore managed by personnel from the Department of Quality Technology and Management with high ambitions when it comes to quality and continuous improvement.

As a measure, it was decided that course evaluation should be conducted on a weekly basis, all through the first year. In line with common praxis, the evaluation was furthermore focused on finding out what was wrong, what needed to be fixed. Every Monday morning, half an hour was dedicated to common “bug reporting” in the class. These sessions were complimented by common end-of-the-course-evaluation forms after each of the four courses during the year.

As a result, the institution ended up with an extensive list of “bugs” to be fixed and more interestingly the class developed what could be described as a “culture of complaint” where the students extensively got drilled to highlight problems and things that didn’t work perfectly. Another observation was that the students became peripherally involved in the actual improvement process as their role naturally became to “report the bugs” and the institutions role became to “take care of the bugs”. Such a relationship was far from the co-producer perspective that the institution had strived for.

In sum, the institution perceived several shortcomings with this procedure.

Firstly, the students became passive receivers, or even skeptical opponents with a role limited to reporting bugs rather than being involved and taking part in the actual process of improving and designing better solutions. As seen in Figure 1, the involvement of the students became limited to what can be seen as the “early phases” of the evaluation and design process. The process is illustrated in Figure 1 by the five generic phases “give the course”, “evaluate”, “analyze”, “redesign”, and finally “realize” the new design.

Secondly, the commitment among both students and teachers dropped substantially as a result of the “culture of complaint” that developed. Even though the educational program evidently had some unique and successful aspects and dimensions, no one highlighted them and no one felt appreciated as a consequence of the focus on “bugs”.

Thirdly, the course started off with a highly visionary ambition including innovative teaching methods and a top of the line content that wasn’t at all supported by the evaluation and improvement procedure. There was a need for evaluation and improvement procedures that were more visionary and could support the fulfillment of the ambition of being innovative.

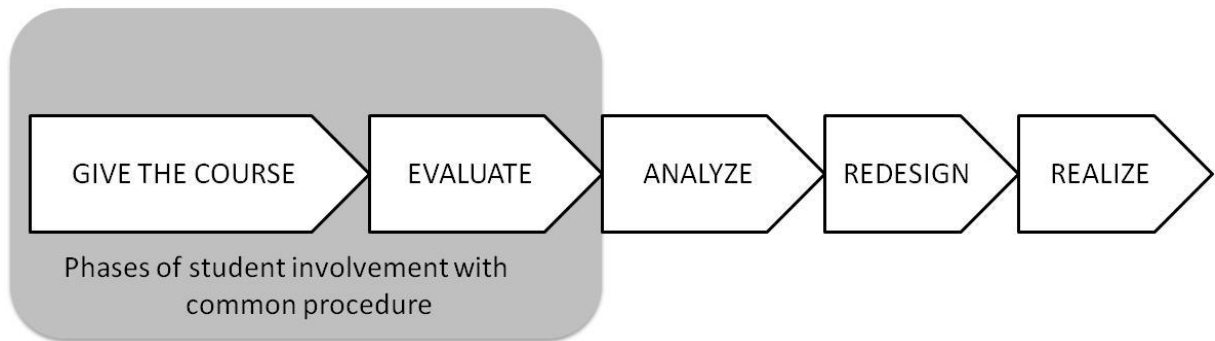


Figure 1: The phases of student involvement with common procedure for course evaluation as applied during the first year of the “Skarp Åre” education.

The situation called for new approaches and procedures to evaluation and improvement of the program and courses at hand. Pretty soon we found that an organizational development and change process called Appreciative Inquiry (AI) seemed to bring a lot of what we were searching for.

Appreciative Inquiry as a new perspective

Appreciative Inquiry (AI) can be referred to as an organizational development and change process, and it was initially developed by David Cooperrider and colleagues at Case Western Reserve’s School of Organization Behaviour in the 1980s. As stated by Cooperrider & Whitney (2005) Appreciative Inquiry (AI) has been described in a myriad of ways ranging from a new paradigm to a methodology and a philosophy, see e.g. (Cooperrider et al., 2008; Cooperrider & Whitney, 2005; Watkins & Cooperrider, 2000).

However, one simple way of describing it is as done by Macdonald & Joughin (2009) “The approach is based on the premise that organizations change in the direction in which they inquire, so that an organization which inquires into problems will keep finding problems but an organization which attempts to appreciate what is best in itself will discover more and more that is good. It can then use these discoveries to build a new future where the best becomes more common” (p.207). Appreciative Inquiry (AI) is “...the cooperative, coevolutionary search for the best in people, their organizations, and the world around them” (Cooperrider & Whitney, 2005, p.8)

Applying Appreciative Inquiry in Design Processes

Applying AI at the start of a design process then gives you a process that is very different from traditional design approaches. Simply put, you obtain a design process that has as its point of departure identified strengths: “the best of what is”. This is in sharp contrast to traditional design or change processes that typically starts from identified problems. The traditional approach to change is as put by Hammond (1998, p.6-7) “...to look for the problem, do a diagnosis, and find a solution. The primary focus is on what is wrong or broken; since we look for problems, we find them. By paying attention to problems, we emphasize and amplify them.”

By contrast, when using Appreciative Inquiry at the start of the design process you focus on the positive aspects of the system that you want to improve and leverage them

to correct the negative. You obtain what can be seen as an opposite of problem-solving, in other words you achieve what Norum (2001) refers to as “Appreciative Design”.

Putting Appreciative Design into Action (ACED)

Based on the experienced shortcomings of the traditional program and course evaluation as applied during the first year of the “Skarp Åre” course together with the perception that Appreciative Inquiry (AI) seemed to bring a lot of what we were searching for, the institution decided to develop and apply an appreciative approach to the evaluation process during the second year. The resulting approach developed and applied is from here referred to as Appreciative Course Evaluation and Design (ACED).

The ACED Process

In its common form Appreciative Inquiry asks organization members to participate in an iterative development process often called the “4-D” model or cycle including the four phases of Discover, Dream, Design and Destiny as seen in Figure 2.

It starts with selecting a topic in focus for the process: affirmative topic choice. With help of appreciative questions organization members are then asked to participate in processes of inquiring, imaging, innovating and implementing ways of making things work particularly well.

Examined in more detail, the affirmative topic choice is followed by *Discovery* of what has been working particularly well in the past and in the present and then the participants *Dream* and envision what it might be like if "the best of what is" occurred more frequently. Based on their images of what can be - the dreams and visions for the future-, which were awakened from the discovery of “the best of what is”, participants are asked to *Design* things and processes that work particularly well, and finally in *Destiny*, follow up and implement their desired designs and changes.

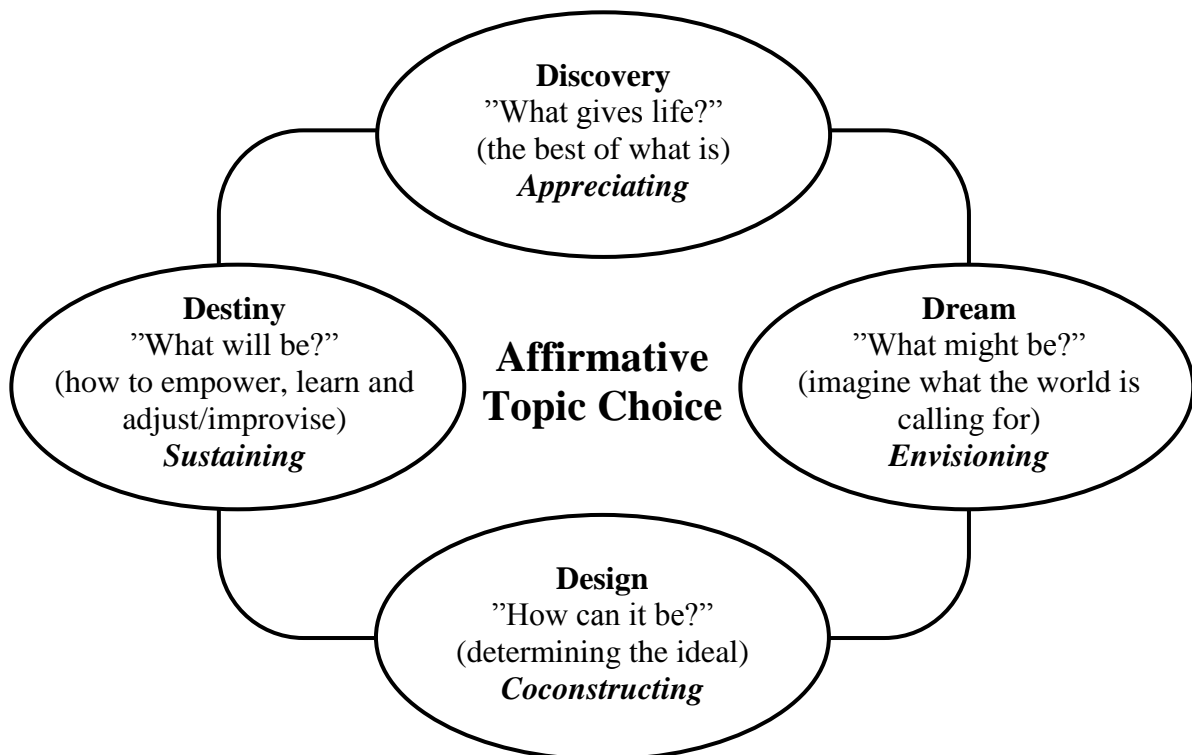


Figure 2: The 4-D Cycle of Appreciative Inquiry with the four phases of Discovery, Dream, Design and Destiny (From: Cooperrider et al., 2008, p.5) .

From a designer’s or product developer’s point of view this 4-D model, or cycle, varies little from common design processes at a first glance, typically involving activities of analysis, synthesis, and evaluation or decision about realization as discussed i.e. by Lawson (2006). However, in the details, it varies on some important points where the most obvious is that the 4-D model or cycle focuses on the positive aspects of the system that you want to improve and then systematically leverages them to correct the negative.

The ACED components

Appreciative Inquiry borrows from the strengths of many other practices in the field of organizational development. As stated by Preskill & Catsambas (2006) these include Open Space Technology (an approach to self-organizing), whole-scale change (facilitating large-scale meetings), organizational learning (valuing inquiry, dialogue, and reflection), and Future search (bringing stakeholders together to create the future). Whitney and Trosten-Bloom (2010) furthermore stress that AI is improvisational meaning that each Appreciative Inquiry initiative is a new creation that could be done with endless variation.

The ACED process borrows components from design methodology and design approaches such as visualization by Storyboards, prototyping as an accelerator, systematic brainstorming and creative principles for ideation as seen in the timetables for the ACED process in Table I and Table II.

Table I: Day one of the ACED process, with a duration of six hours plus one hour lunch.

Duration	Session	Content
DAY 1 10:15-10:30	Dream and vision mingle	Two minute encounters standing in the room supported by three questions to answer about future plans, achievements, and inspirations
10:30-10:45	Inspiring Introduction of the day to come	Introduction of the day and its supposed value creation, to support the ‘buy in’, the win-win and to secure engaged participation of everyone together with Affirmative Topic introduction
10:45-11:25	One-on-one interviews with circle-mapping	One-to-one interviews for 20 minutes each supported by a prepared interview guide. What Peak Experiences? What do you value about the program/course? What do you wish for?
11:25-11:30	Collection of strength enablers “root-causes-of-success”	Collection of identified enablers on a big white-board using “the egg” for circle mapping on three levels, see Figure 3
11:30-11:45	Brief Narrative Analysis	What do we value the most? What insights do we bring with us? ...from what we have heard
11:45-12:00	Start sharing of stories around the table	The participants share their stories in groups of four to six. Notably, participants do not share their own but their interview partner’s story.

12:00-13:00	LUNCH	
13:00-14:15	Continue sharing of stories and pick a 'best of' story for presentation	The participants continue sharing their stories and are instructed to choose the one most illustrative for visualization with Storyboard and presentation in front of the whole group
14:15-14:50	Presentation of "best of stories" from each table	Each table present their "best story" in front of the group and a video camera together with the related "root-causes of success"
14:50-15:00	Brief narrative analysis	Common reflection concerning what do we value the most? What insights do we bring with us? ...from what we have seen and heard
15:00-15:15	Brief introduction to ALUMNI and common dreaming	Whole group brainstorming session focusing on what the "best Alumni activities" for you would look like in the future?
15:15-15:45	ALUMNI brainstorming round the table	Back to groups of four to six with the assignment to generate as many Alumni ideas as possible and present the three best in front of the whole group
15:45-16:15	Selling your ideas with public voting	Each table presents three ideas and then the whole group vote for which three to four to build
16:15-16:45	ALUMNI Open Space Design with the emphasis on "Build to think"	From the prioritized ideas, the participants are asked to 'follow their heart and passion' for the idea that they want to see realized. Three to four design tables are set up, and the Open Space "rules" are used as guidelines
16:45-17:00	ALUMNI Actionplans	Each design table is asked to plan for the realization of their designed ALUMNI solutions in detail
17:00-17:15	Presentations of new ALUMNI solutions	Each table presents their result in terms of their ALUMNI solutions together with their action plan for realization

Table II: Day two of the ACED process, with a duration of three hours.

Duration	Session	Content
DAY 2 10:15-10:45	Finding the factors that give life to the affirmative topic choice	Common analysis and identification of factors that give life to the affirmative topic choice based on the enablers previously identified using "the egg" for circle mapping on three levels, see Figure 3
10:45-11:00	Public voting for factors in focus of dream and design	Each participant typically gets three votes to use for the factors which would have the most positive impact on the course/program if further developed. The three or four factors that obtain the most votes are selected for building
11:00-11:30	Program/Course Open Space with Build to think	From the prioritized ideas, the participants are asked to 'follow their heart and passion' for the idea that they want to see realized. Three to four design tables are set up, and the Open Space "rules" are used as guidelines

11:30-11:45	Program/Course Action plans	Each design table is asked to plan for the realization of their designed course/program solutions in detail
11:45-12:15	Program/Course Presentations	Each table presents their result in terms of their course/program solution together with their action plan for realization

As seen in Table I and Table II the ACED uses “the egg” for circle mapping on three levels to support the mapping of enabling factors during the one-to-one interviews. This circle mapping was developed as part of the process and implies that identified factors are visually sorted as related to (1) the student and student behaviour, (2) the context and surroundings, (3) the program management, teachers and course setup as seen in Figure 3.

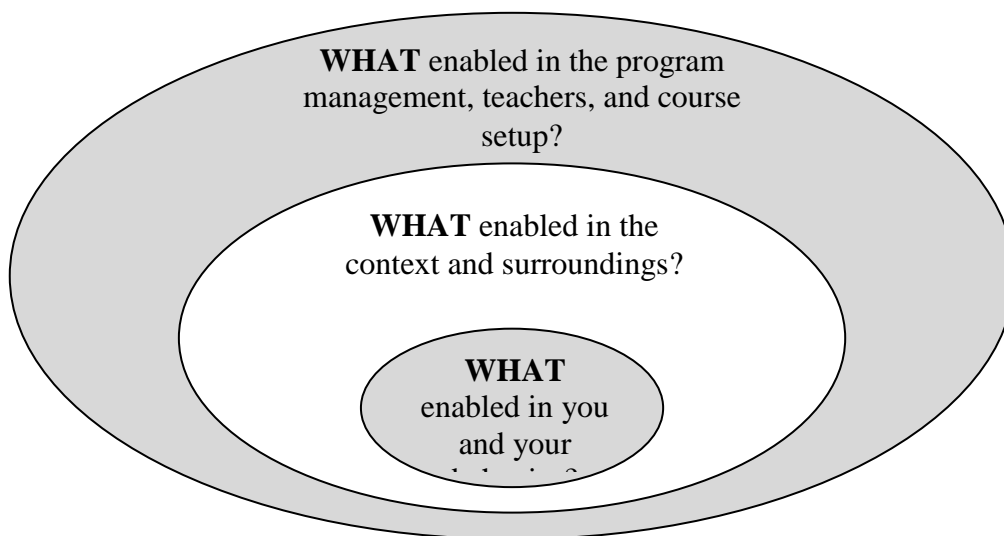


Figure 3: The circle mapping used to support the mapping of enabling factors during the one-to-one interviews, referred to as “the egg” with the student as the core.

Results from applying the ACED

During the case study, the ACED process was applied as a voluntary two-day summit for the 28 students involved in the second year of the “Skarp Åre” education. The session was scheduled after the final obligatory lesson which made it important to offer a clear and evident value to the students in order to attract them to attend the session instead of going on summer vacation. To encourage attendance it was decided to focus the first design session on alumni activities and forms, i.e. activities and forms for the students to meet and interact with each other and the institution after their graduation at Mid Sweden University. Seven students attended during the ACED process which was facilitated by two teachers from the course.

When it comes to the affirmative topic of inquiry, it was decided that the summit should be directed towards what had made the students most “powerful” and “enterprising” during the year. The choice of affirmative topic was based on one of the major differentiators for “Skarp Åre” in comparison with related courses. This was the focus on actual skills in combination with theoretical understanding and the possibility to lead

innovation in practice. The focus on “powerful” was furthermore inspired by Whitney et al., (2010) highlighting “being powerful” as critical for leadership in general.

Among the results achieved from applying the ACED process in the “Skarp Åre” context the four most apparent are presented below.

The ACED became a natural bridge to entering working life

One of the benefits of the ACED process as experienced during this case study was that it became a natural and highly appreciated bridge between being students and becoming graduated alumni and professionals. The feedback from the students included the comments:

“It feels like a natural ending of the program”

“It feels great not just to be thrown out of the education but realize we will continue to be part of this context but in new forms and with new roles”

The ACED increased the student involvement dramatically

A second benefit of the ACED process as experienced during this case study was that it increased the student involvement most dramatically. The students were invited to actually brainstorm and design alumni activities and forms as well as the following year’s course together with their teachers. We experienced that the ACED process broke the former unwanted role of students as external “bug reporters” and made them into the co-designers we had aimed for. As illustrated in Figure 4, the involvement of the students became stretched in comparison to the common procedure to also include the later phases of the evaluation and design process. This obviously increased the chance of the redesign being in line with the needs and wishes of the students, and thereby lowered the risk in the design process.

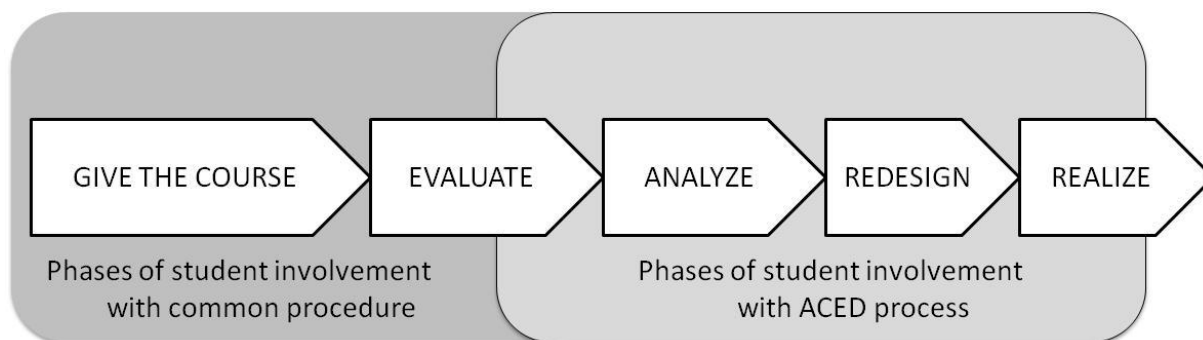


Figure 4: The phases of student involvement with the ACED process for course evaluation and design as applied during the second year of the “Skarp Åre” education.

The ACED was fun and rewarding to work with

A third benefit of the ACED process as experienced during this case study was that the commitment among both students and teachers increased substantially. For the students it was an obvious value of sharing their own stories of moments that made them “powerful” and “enterprising” during the year. The stories reminded students and teachers of the successful moments during the year. Being part of designing new

solutions together with the teachers was furthermore much appreciated. The feedback from the students included the comments:

“This was really fun!”

“This was so different from filling in an end-of –the-course evaluation form that one doesn’t know if anyone ever reads”

“Now I want to go for another year”

The ACED gave innovative and new ideas

Fourthly, the ACED process provided ideas and information different from what was generated by the common procedure with end-of-the-course-evaluation forms. The ideas and solutions generated were more innovative and visionary. The new course/program solutions generated from the three open space tables were:

The first new course/program solutions generated were to include and develop more of the exhibitions that motivate the students during “Skarp Åre”. During the mapping of enabling factors the existing closing exhibition “Skarp SPRING”, where the students got to present and demonstrate their new products and services in public, proved to be a major factor making the students “powerful” and “enterprising”. As a result three more exhibitions were developed to bring more of this factor into the whole year. A test exhibition was developed for Easter, a film exhibition with the films from their international studies was developed for the winter, and a prototype exhibition was developed for the spring focusing on trying prototypes of new products and services in interaction with the visitors of the ski resort Åre.

The second new course/program solutions generated were to increase the interaction with highly committed partner companies. During the mapping of enabling factors such companies, that suggested interesting development projects for the students as well as was being highly present and interested during the year, proved to be a major factor making the students “powerful” and “enterprising”. As a result two new partner companies were recruited and the interaction forms were developed in order to secure the development of common development projects of high value both to partner companies and students. As part of the new interaction forms, a new educational moment including “pre-innovation”, where the students developed attractive project suggestions before meeting the partner companies was developed.

The third new course/program solutions generated was to increase the feedback stimulation. During the mapping of enabling factors stimulating feedback, that brought new insights and energy into the project teams, proved to be a major factor making the students “powerful” and “enterprising”. As a result a new part of the examination was developed that built upon the project teams’ ability to exceed in the project status presentations every second week. Another resulting new solution was the development of coaching sessions, a session every second week where the project teams could interact and receive feedback and help individually by coaching meetings with each of the teachers with competences such as business planning, innovation management, team development, and commercials.

In sum the experienced results of applying the ACED process in contrast to the common procedure are summarized in Table III below.

Table III: Results from applying the common procedure versus the ACED process.

Procedure used	Common procedure	ACED process
	End-of-the-course-evaluation form together with “bug reporting” every week	A two day summit inspired by appreciative inquiry and appreciative design
Focus	What is wrong with the course/program, what should we do less of?	What is right with the course/program, what should we do more of?
Student involvement	Limited to evaluation in terms of reporting bugs/problems rather than being involved and taking part in the actual process of improving and designing better solutions	Highly involved in analyzing, designing and realizing better solutions
Commitment	Teachers and students are typically weakly committed to taking part in and analyzing the outcome of the evaluation process	Teachers and students feel appreciated and acknowledged as they get to tell their own success stories from the year and becomes committed to the process
Solutions generated	The generated solutions are typically minor adjustments/reductions of aspects that have led to course frustration or problems	The generated solutions are more innovative and visionary yet build on what has already been done so often possible to realize

Some significant background elements leading to the resulting success of the ACED process in this case study should be mentioned. The students involved had already completed courses in brainstorming, prototyping, visualization and design that supported their involvement in the design process. They had furthermore been conducting one-to-one interviews as part of earlier Appreciative Inquiry elements in their education.

Conclusions and discussion

A conclusion to be drawn from this study is that Appreciative Inquiry (AI) appears to have a lot to offer as a complement to the common and traditional procedures for program and course evaluation in higher education. Applying the introduced ACED process to the “Skarp Åre – Business and product development” educational program led to a number of perceived benefits in comparison to conventional practice. The benefits found include higher commitment by the course participants, lower risk in the design process, and increased student involvement in the evaluation and design process. Previous research, in terms of Norum and colleges (2004) using an appreciative approach to program evaluation at the University of South Dakota, support the substantial increase in commitment as well as creativity, noticing that “... instead of dwelling on those ‘problems’, a creative, generative energy is engendered, reducing the challenges typically found in program evaluation.”(Norum et. al., 2004, p.211).

When it comes to the disadvantages of the ACED process one spontaneous drawback is that it takes additional time. Even though the ACED process is compressed in

comparison to the traditional four-day summits that usually are used for applying AI (Whitney & Cooperrider, 2000; 1998) it still takes up nine hours of actual summit time and in addition to that is also demands time for preparation and follow-up. However, approaching the process of evaluation and design as a whole, the “additional” time spent in applying the ACED process is likely to be more than compensated by shortening the substantial time for analysis, redesign and realization that the teacher normally spends on his or her own in the annual course and program improvement process.

From a historical perspective the awareness about strengths is not new when it comes to quality evaluations or assessment. On the contrary, assessment in accordance to excellent models, as the EFQM Excellence Model and the Malcolm Baldrige Quality Award, do identify strengths in addition to areas for improvement. However, as concluded by Rusjan (2005) in discussing the usefulness of the EFQM Excellence model in practice “...the EFQM Excellence Model is appropriately structured to perform the first phase of the analysis, i.e. identification of a problematic situation, but on the other hand the model does not offer any specific guidelines about the second phase, i.e. problem identification. The model offers no structured approach about how to exploit strengths or about how to classify or prioritize areas of improvement.” Rusjan (2005, p.363). Current praxis in quality assessment and evaluation seem to be in need of processes for exploiting strengths rather than just highlighting them as a way to alleviate the list of areas for improvement that today becomes the obvious focus for the following improvement and design activities.

Another fact pointing at the value of incorporating more of Appreciative Inquiry into quality management and evaluation is two decades struggling for the creation of Attractive Quality as highlighted by Lilja (2010). The current praxis where “improvement” typically equals to addressing problems is simply not efficient for the creation of attractive quality.

We believe that Appreciative Inquiry (AI) is promising as a complement or alternative when it comes to improving and developing quality initiatives and quality evaluation in all sectors. Our hope is hence that the insights presented will inspire future research and application of AI and Appreciative Design not only to the evaluation and design of higher education, but also to the evaluation and design of products, services, organizations and society.

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University Services for Regional Development – The case of Knowledge Management of Change Competence in Gotland

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Introduction

It is widely accepted that knowledge is a key economic resource, and one of the most important resources for development and competitiveness in organizations (Anantatmula, 2010; Lerro & Schiuma, 2009; Isaksson, 2004; du Plessis, 2004; Yakhlef, 2009). It has been largely recognized that knowledge resources play a fundamental role and have relevance for regional development (Lerro & Schiuma, 2009; Pike, Rodrigues-Pose & Tomaney, 2006). It is also stated that one key to organizational success is in the organization's capacity to develop new knowledge in a continuously learning process (Alvesson & Sveningsson, 2007; Anantatmula, 2010; Isaksson & Trönnadal, 2005; Yakhlef, 2009). To lead and control these knowledge issues and learning processes, you need knowledge management (KM) and an understandable knowledge management system which assures that all relevant knowledge is being used (Alvesson & Sveningsson, 2007; Anantatmula, 2010; Isaksson & Trönnadal, 2005).

Binney (2001) states that KM in years to come, must be considered by all organizations in their strategic thinking and planning. So, with that in mind, KM should be important also in regional development. Visualizing KM on organizational change competence on a regional level could be a challenge.

Universities are working at the edge of new knowledge and could be seen as having an important role in identifying, refining, storing and dissemination knowledge for practical use. The question is how this could work to support regional development. Pike, et al. (2006:101) state that “the ability of development institutions to acquire, absorb and diffuse relevant information and knowledge is critical to local and regional prospects”.

The general purpose of this study is to see how universities could contribute to regional development. The specific research questions in this study are:

- How could knowledge management be described on the regional level?
- How could a university contribute to regional knowledge management?
- How could knowledge management of regional change management be described?

Methodology

Knowledge management theory on change is reviewed and categorized. A region is viewed as a process based system with the identification of main processes, principal resources and Key Performance Indicators. A system model integrating KM is presented and used for categorizing elements of knowledge that need management. Based on the regional vision change challenges are identified and these are translated into competence needs. These needs are compared with university competences. We use knowledge on change competence as an example to study the relevance of regional KM and as an example of opportunities for university support to regional development. The area of change concerned is defined as change management competence for desired change. The interpretation of desired change is that it is change that maximizes the stakeholder value in relation to stakeholder harm while not causing any stakeholders unduly harm. The structure of a possible university KM process is discussed based on theory and based on a case study of an existing KM process where the university plays an important role for the region and the nation. This is the case of knowledge on wind power management. Information on this is based on a web-site review and an interview of the person in charge.

Defining Knowledge Management

Knowledge management has many definitions. Maybe it is because KM often is seen as a hybrid discipline (Awad & Ghazari, 2004; Binney, 2001; Collison & Parcell, 2004; Pearlson & Saunders, 2006). Anantamula (2010:241) says that: “Knowledge management is a systematic approach to utilizing information systems, business processes, best practices and culture, to develop and share knowledge within an organization, and connects those who possess knowledge to who’s to do not.” Pearlson and Saunders (2006:318) say about KM :“The most profound aspect of knowledge management is that, an organization’s only sustainable competitive advantage lies in what its employees know and how they apply that knowledge to business problems”. Functionally, KM can overlap the fields of learning and organizational development, human resources and IT. This mix can be described as three (3) circles, see Figure 1, and KM is the area where these circles overlap (Awad & Ghazari, 2004; Collison & Parcell, 2004).

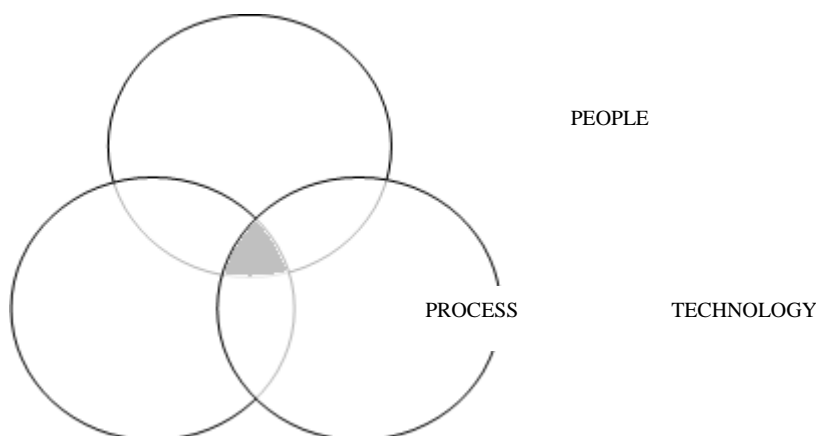


Figure 1. Knowledge management - the gray part - needs a balance of people, process and technology (Collison & Parcell, 2004:20).

Collison and Parcell (2004) claim that the messages from Figure 1 are powerful and indicate that the elements for successful KM include:

- A common reliable technology infrastructure to facilitate sharing,
- connecting the people who know, and
- the behaviours to ask, listen and share, and some
- processes to simplify sharing, validation, distillation.

Bhatt (2001) presents an interpretation similar to that of Collison and Parcell (2004) and Awad and Ghazari (2004) for knowledge management: “It is the interaction between technology, techniques and people that allow an organization to manage its knowledge effectively”, (Bhatt, 2001:68). No amount of accumulated knowledge has practical meaning until it is applied to human needs and concerns therefore an adaptive leadership competency is necessary to move knowledge into action, perhaps with help of a kind of system (Garrity, 2010).

A process based system view could be used to describe how KM is visualized (Anantamula, 2010; Awad & Ghazari, 2004; Braf, 2004; Isaksson, 2004; Pearlson and Saunders, 2006). A Knowledge Management process can be described as collecting, filtering, storing, sharing, applying and refining knowledge for attaining higher levels of competence (Awad & Ghazari, 2004; Isaksson, 2004). In other words KM is about preserving and using existing knowledge and creating new knowledge for effective use (Awad & Ghazari, 2004; Anantamula, 2010; Braf, 2000, Pearlson and Saunders, 2006).

Our interpretation based on above can be summarised using the one from Isaksson and Tröndal (2005). KM is described as the process of:

- 1) Identifying the knowledge that needs to be managed
- 2) Acquiring the identified knowledge
- 3) Refining and processing the acquired knowledge
- 4) Storing the processed knowledge
- 5) Sharing the knowledge
- 6) Applying the knowledge in processes and products

Braf (2000) separates KM into two strategies. The first strategy is the codified one with focus on IT. This is about software and systems for storing knowledge in different databases, where the co-worker can reach the knowledge. The personified strategy is the second one and is about how to transmit knowledge through contact between co-workers and where IT is used to communicate knowledge and not to codify and store it. Walsam (2001) states that the solutions to develop KM in organizations is not to create IT systems based on technology and technical solutions, rather it is about starting to indentify the needs that co-workers have and to make the co-worker involved in the process. An effective and efficient KM process requires good resources such as relevant IT-systems and databases but also a culture that is aware of the needs of KM. Our interpretation is therefore that KM should be described with a model describing both “strategies” as described by Braf (2000).

Knowledge management as a process and as part of a system

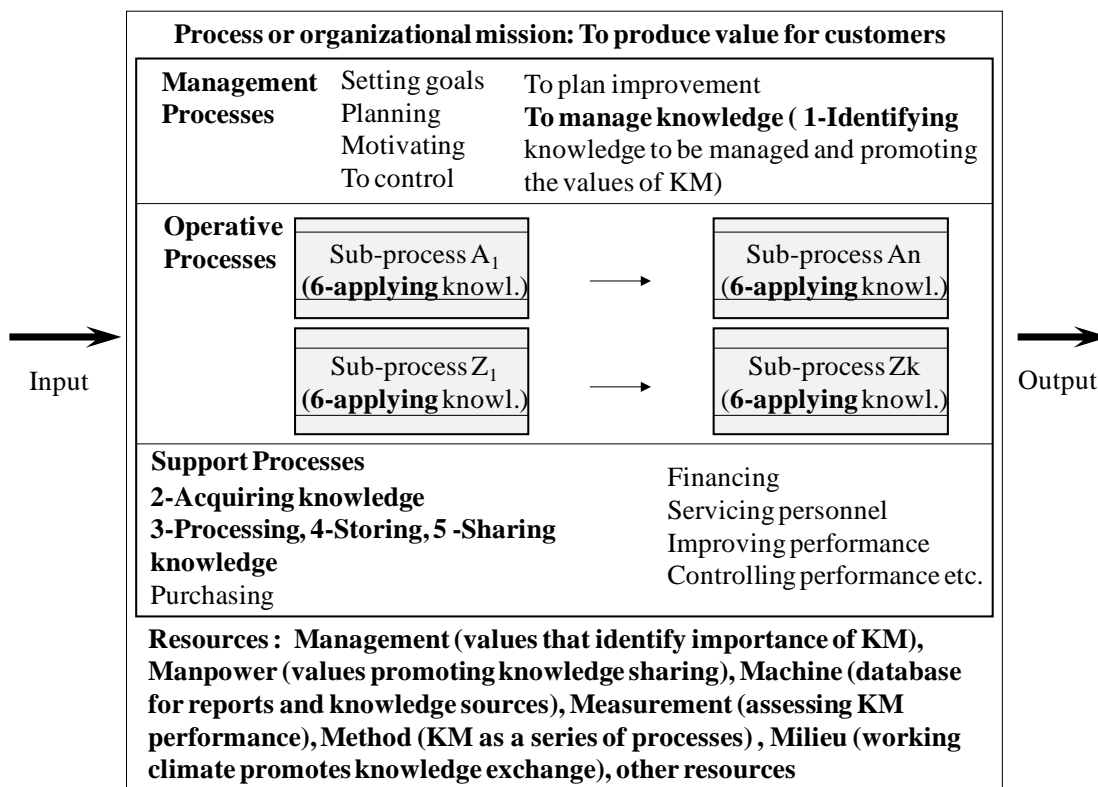


Figure 2. A process based system model proposing how knowledge management could be included in management and support processes as well as in resources. The model also describes some generic processes as examples. Adapted from Isaksson and Tröndal (2005).

Viewing knowledge management as a process is based on work from Isaksson and Tröndahl (2005) and process based system models are originating from Isaksson (2006) and Isaksson, Hallencreutz and Garvare (2008), Ljungblom, Hallencreutz and Isaksson (2010).

KM is often seen as an abstract concept which goes unnoticed in many organizations (Awad & Ghazari, 2004; Binney, 2001; Braf, 2000; Isaksson & Tröndal, 2005). To make KM more visible in organizations and to recognize relations between the KM processes, the required resources and the organization, one way could be to include KM in the organizational process chart (Anantatmula, 2010; Awad & Ghazari, 2004; Isaksson & Tröndal, 2005). Isaksson and Tröndal (2005) propose an organization wide process that describes KM both as a management and as a support process, see Figure 2. The proposed six step process above has been placed into the process model with the sixth step “Applying the knowledge” ending up in the Operative or Main Process. This is to demonstrate that the KM process is complete only when the knowledge is used for adding value to the external customers. The six KM steps are tested for the process of managing change management knowledge, see Table I.

Table I. Six step knowledge management process applied to change management on the regional level. Adapted from Isaksson & Tröndal (2005). The steps follow the numbering in Figure 2.

Process step	In	Out
1) Identifying and selecting knowledge to be managed	A need to know more about Change Management in order to be able to manage sustainable change in a region	A defined area within Change Management that is relevant and that is needed for successful change
2) Acquiring the selected knowledge	Defined needs for Change Management knowledge	Existing state of the art competence on Change Management has been collected and further needs of refining have been identified
3) Processing the acquired knowledge	Needs for refining knowledge	Refined and usable knowledge
4) Storing the processed knowledge	Usable knowledge	Usable and accessible knowledge and interest to use it in a workable technical solution (database as Machine resource – see Figure 2)
5) Sharing the knowledge	Interest to use knowledge from shared resources	Use of relevant knowledge which requires easy technical access to knowledge
6) Applying the knowledge	Relevant knowledge	Successful application of knowledge to improve processes

Organizational change

As mentioned knowledge management has many definitions and can be seen as a hybrid discipline. The same could be said about the field of organizational change management. Here we focus on knowledge management and define change management broadly as:

“The coordination of a structured period of transition from situation A to situation B in order to achieve lasting change within an organization.”
(BNET Business Dictionary)

The relation between change and knowledge management could be described using the customer and process perspectives. The process delivers value to customers. A perfect process can be described as effective (doing the right thing), efficient (doing the thing right without errors) and flexible (changing shape quickly without losing effectiveness or efficiency). A perfect change management process identifies the right thing to change and does this efficiently. It relies on having the latest knowledge on what customers require (the right product design) and it relies on the relevant knowledge of how to carry out change in the best way. In Figure 2 there is a support process called Improving performance which could be seen as the organizational change management process with additional support from the management process to plan improvement.

The content of what constitutes best change management will vary from organization to organization and will change over time. The important thing here is to identify that a core indicator for good KM of change management is how the people component is managed (Pearson & Saunders, 2006). Every organization needs competent change managers (Kotter, 2006). Change competence could probably be expressed as an

indicator for managers. This could for example be based on to what extent managers have an additional education in leadership for change and to which extent they have experience of leading change. This means that an organization that has knowledge management of its change management competence needs to have a KM process that continuously identifies change competence required and then sees that this is shared and used by managers. The importance to handle KM as a manager and also to understand the complexity of change is the reason for us to study this area.

Knowledge Management Needs in the Region of Gotland

The region of Gotland has a number of challenges which are defined in the Vision 2025 document. We describe shortly the content of the document and identify areas and processes where change management knowledge is needed. This gives us a base for checking the current situation and to what extent it could be improved with the help of Gotland University.

Region Gotland has the municipal cooperative business responsibility for regional development on the island. In accordance with the missions a regional development program, Vision Gotland 2025, where the objectives of Gotland are described. Region Gotland is also responsible for development analysis and monitoring of performance. Linked to Vision 2025, Region Gotland has a number of specific programs for growth, environment, public health, transportation, comprehensive planning and international work (Lindskog, 2011).

Vision Gotland 2025 is a collective development program for all of Gotland with the purpose to create better conditions for sustainable growth in region Gotland. The definition of regional development its objectives and its priorities is ultimately a political issue. The proposal has been circulated for comments and open consultation. The vision was adopted by the City Council in June 2008 (Lindskog, 2011). Vision Gotland 2025 is not just a vision and a development program. There is also a policy for the whole of Gotland and all stakeholders.

Regional Partnership on Gotland provides a platform for information sharing, idea development, collaboration and allows wide decision support for the policy-making. Gotland University is included in this partnership. Vision Gotland 2025 states: "Gotland University is an engine for development". (Region Gotland, 2008).

- Collaboration between The University, society and commercial part will further increase.
- The University and the business sector in Gotland will collaborate for developing new products and services (Region Gotland, 2008:17).

The University collaborates with Region Gotland to integrate students into the society. One step is to create deeper contacts with the surrounding society. Further, the University education and research is more and more aligned to the environment of Gotland and to the unique prerequisites of community, nature and culture. Basic education, further training and research contribute to developing the society and the business sector in Gotland, (Region Gotland, 2008). The vision 2025 also states: It is also important to promote creative processes and new perspectives (permitting that something new, which is unique for Gotland is created in the future). The business and

public sector and the University have to collaborate to create new environments that support this.

The University of Gotland has several fields where education and research are performed. Abrahamsson et al. (2011) have made a matrix with five areas of importance for regional development - Economy, Environment, Education, Health and Care. This has been interpreted from the regional view of the Triple Bottom Line with the dimensions of Economy, Environment and Social Responsibility. The social responsibility has been divided in Education, Health and Care. Additionally management has also been identified as a key area. The connection between the University topics and the relevance for with the identified core areas (from Vision 2025) are rated from 1 to 5 with 1 as low connection and 5 as strong connection. The conclusion is that Quality technology and Business Administration are the fields with the strongest connection to the core areas identified for regional development. The same relevance is assessed to exist with the goals and work with Vision 2025 (Abrahamsson et al., 2011).

Knowledge Management Maturity

When we view the Knowledge Management as a process it means we can assess its maturity based on a suitable maturity model. One way to assess the organizations Knowledge Management-maturity could be by using a maturity scale inspired by the ISO 9004 process maturity model, see Table II.

Table II. Proposed Knowledge Management Maturity model, adapted from ISO 9004:2000.

Maturity level	Performance level	Guidance
1	No formal approach to KM	No systematic approach to knowledge management in place, no results, poor or unpredictable results.
2	Reactive approach to KM	Problem- or corrective-based systematic approach to knowledge management; minimum data on improvement results available.
3	Stable formal system approach to KM	Systematic process-based approach to knowledge management, early stage of systematic improvements; data available on conformance to KM objectives and existence of improvement trends.
4	Continual KM-improvement approach	Improvement process in use; good results and sustained improvement trends in KM processes.
5	Best-in-class KM performance	Strongly integrated improvement process; best-in-class benchmarked results demonstrated in KM processes.

The proposed model in Table II is tested in assessing the current maturity of regional and university knowledge management processes.

Knowledge Management in Gotland University

Gotland University hosts a centre for wind power information that actively collects relevant information which is stored on the web-site (CVI) for common use (Aldén, 2011). This could be seen as a typical example of knowledge management. Below the process has been studied and interpreted using the six step process from Table I. Every stage has been commented and assessed individually using the maturity model in Table II.

Table III. Six step Knowledge Management process used at Wind Power department (Aldén, 2011).

Process step	What WP do	Comments
1) Identifying and selecting knowledge to be managed	Continuous contacts with industry, governments, stake holders, networks, researchers', journals and public gives WP relevant input what's needed and necessary in the wind power arena. WP is also active in the media debate to find information what's new.	No systems that secure that the whole market has been scanned. Each of the teachers takes care of their contacts. Maturity - 3
2) Acquiring the selected knowledge	<ul style="list-style-type: none"> • Experiences from real projects • Research • Compilation of knowledge • Reports, investigations from industry and governments 	As above. Maturity - 3
3) Processing the acquired knowledge	Two types – education and information to CVI. For education each teacher picks out the relevant part for their course. However almost all of the acquired knowledge is presented in the CVI database.	More collaboration between lecturers is needed. Maturity - 3
4) Storing the processed knowledge	WP uses the university's website for education to store courses. They also use a shared drive in the Gotland University IT system to archive evaluation results, comments, old stuff to each course. There is still a lot of information in file folders in the teacher's offices.	Not all usable knowledge is accessible Maturity - 2
5) Sharing the knowledge	<ul style="list-style-type: none"> • Databases in university • Courses • In-house seminars • Web site CVI 	Unclear how the use of knowledge is. However there are statistics for how the website is used. Maturity - 2
6) Applying the knowledge	Applying relevant knowledge in work with Wind Power	Unclear how much is applied to improve processes Maturity – 1

Results from Table III show a reasonable well functioning Knowledge Management process with an average maturity of 2.3. With corrections based on comments this process could be used as a benchmark.

Knowledge Management of Change Management – Analysing Gotland University

With the KM process of the centre of wind power information as a model including identified improvements it becomes possible to visualize how a similar process for change management could look like. In Table IV we used the six step process model to look at how KM of change management is currently carried out in Gotland University using the topic of Quality Management as an example. In Gotland University Quality Management also handles leadership education and change management courses. We also assess the maturity of the different steps.

Table IV. Six step knowledge management process applied on change management competence within the topic of Quality Management (that includes courses in leadership and Change Management). Assessment of maturity is includes based on the model in Table II.

Process step	What Quality Management does	Comments
1) Identifying and selecting knowledge to be managed	No university directives and no directives within the topic. Some ad hoc contacts with industry, researchers, professional networks and relevant journals. Few contacts with the public sector other stakeholders and the general public- Participating in conferences gives some relevant input of what is needed and what is essential necessary in the area of change management arena.	No systems that secure that the whole market has been scanned. Which knowledge is included is depending on the view and interest of each lecturer. Maturity – 1
2) Acquiring the selected knowledge	No directives as above. No dedicated budget. General research funds or funds for personal development have to be used. Ad hoc input from research done, course development, books read and conferences visited.	Each lecturer takes care of their own acquisition of knowledge based on availability of time and priority. Maturity – 1
3) Processing the acquired knowledge	No identified approach. Acquired knowledge is not systematically discussed. Processing is mostly done within the student education when several lecturers co-operate in the same program or course. Some processing of knowledge is done in the form of action research. Course evaluations are studied and changes proposed according to directives.	More collaboration between teachers is needed. A deeper analysis of student feedback would be needed including alumni feedback. Maturity - 1
4) Storing the processed knowledge	QM uses the university website for education to store course and program information. There is still a lot of information in file folders in the teacher's offices. A shared drive in the Gotland University IT system to archive evaluation results, comments,	Not all usable knowledge is accessible. The information is mainly accessible for those who have worked as teachers on the courses. DIVA is still not fully used Maturity – 2

	old stuff to each course. Research results are stored in a common database DIVA.	
5) Sharing the knowledge	There is no approach on how to share the information internally in the university or externally. Data bases are partly available to lecturers. Presentations on conferences and publication of articles. Courses on demand organised for external organisations.	There is no identified approach for identifying existing competencies that lecturers have. External stakeholders have not been identified and they have little possibility to share existing knowledge. Maturity – 1
6) Applying the knowledge	The university vision mentions regional development as an important area. The Swedish university mission includes co-operation with society within education and research. There are no directives at the level of the topics. QM has an approach in the education of using a pedagogy that combines theory and practise in real world cases.	Some research has been carried out on to what extent knowledge is being applied. However, this is not systematic. Maturity – 2

Results from Table IV show that the KM process for Change Management exemplified with courses within the topic of Quality Management in Gotland University has a low maturity. The KM processes are driven by individuals without any clear directives. There does not seem to be any systematic process based approach to knowledge management of change management. This can be seen as an indication of the fact that KM has not been identified by the university management as an issue. The first step in the six step process has not been activated, see Figure 2. With focus on the vision statement that mentions the region as a focus area it should be relatively easy to create approaches for improving the flow of change management competence to the region. Documented and adopted procedures for systematically sharing of knowledge among scholars and the use of data available on conformance to KM objectives and improvement trends could improve the KM process maturity. This should form a good starting point for supporting regional change management with an improved KM process.

Currently Gotland University and the region of Gotland only have limited benefits from the existing knowledge of change management. This exists mostly as isolated competences with individuals and among work groups. To make full use of the globally existing knowledge of change management the KM process needs to be thoroughly improved. Abrahamsson et al. (2011) find that Quality technology is one of the fields with the strongest connection to the core areas identified for regional development including the contribution to improved management practises. In Figure 3 regional key processes have been identified.

To develop good knowledge management strategies in Gotland University and in the topic of QM it is necessary to start with a review of stakeholder needs in the region. For this the proposed system model in Figure 3 could form a base that is successively

developed. What is needed in the region related to change management competence? At the same time the Knowledge management maturity in Gotland University should be developed having a systematic approach to find new research and knowledge on change management.

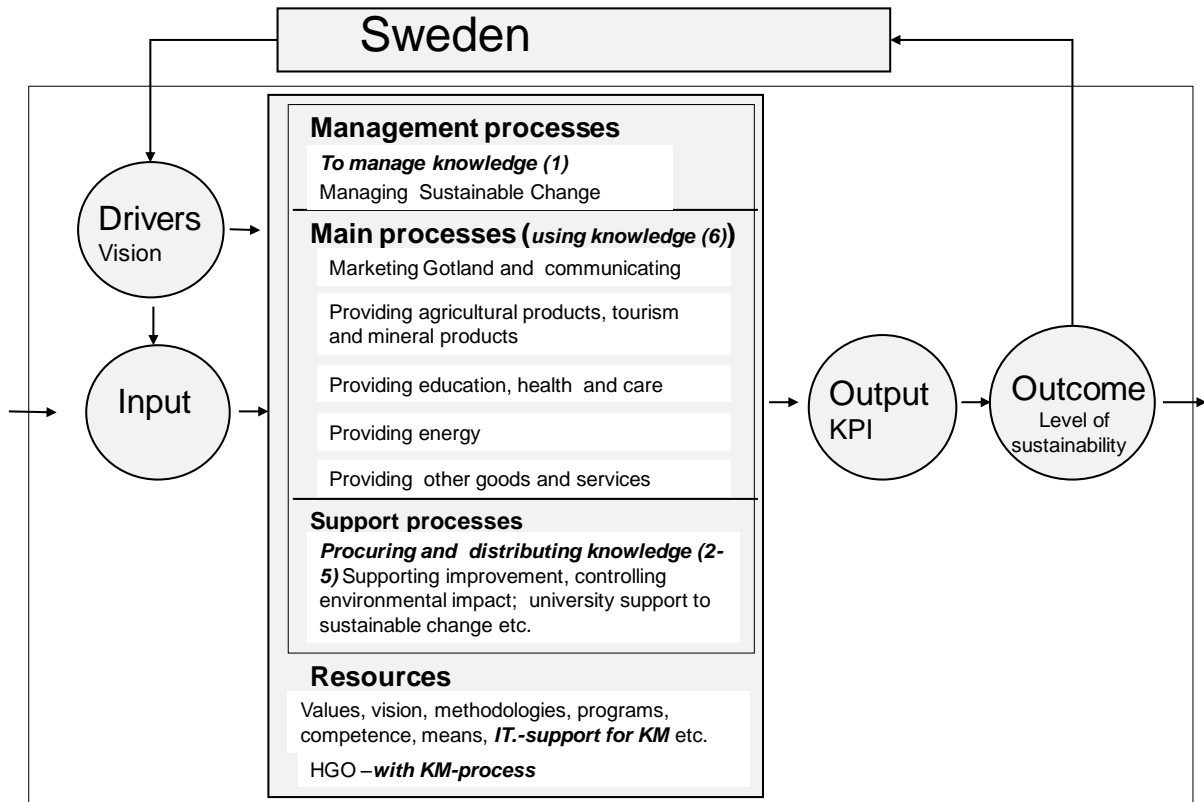


Figure 3. The region of Gotland described as a system of processes where key processes and resources have been identified. Knowledge management elements based on Figure 2 have been introduced. Adapted from Isaksson et al. (2008) and Abrahamsson et al. (2011).

Conclusion

The proposed answer to the research questions – “How could knowledge management be described on the regional level?” – is to use a system based process model in combination with the six step process of Knowledge Management described in Table II and introduced in Figure 3. The model only provides an overview. However, with focus on a particular topic like change management it should be possible to describe the activities in more detail and also to assess the current performance using the proposed maturity model in Table II

The answer for the second research question – “How could a university contribute to regional knowledge management?” could be seen as two separate activities. The first is to strengthen and to better define the University internal knowledge management process. The second activity would be to study the regional knowledge management processes and to support regional stakeholders in improving them.

The answer for the third research question – “How could knowledge management of regional change management be described?” – is to see it as a subset of Knowledge Management as described in Figure 3.

Discussion

The work has covered many areas superficially and is based on a number of working hypotheses, which still need to be validated. An example of this is the proposed maturity model in Table II and the process based system model presented in Figure 3. Also, the identification of key processes as proposed by Abrahamsson et al. (2011), only presents a proposal that needs to be validated. However, the model interpretations present a solution for describing Knowledge Management including both an IT component and a component for how to deal with knowledge as described by Braf (2000). It forms an interesting platform for further research.

In the regional context we have identified the main regional management processes which could be further studied. As an example the political and the public servant based management of an area like Health Care could be taken as an example and studied using the models. The validation could be done by assessing the effect on sense making that the models create and the areas of improvement that they reveal. As Region Gotland seems to be interested in increased collaboration between the University and developing new products and services (Region Gotland, 2008), this presents an opportunity.

Future research could also deal with the leading strategies of the Region studied. There are a number of goals and indexes in Vision 2025. The Region managers have also identified measurable goals. But there is no strategy that deals with how the goals will be decided and measured. For example; In vision 2025 there is a goal that says 65000 citizens in the Region 2025. The last three years the total population number increased with 30 persons each year – and we could not find any visible evaluation or plan to cope with this.

The results show that we ourselves working within the topic of Quality Management should improve our KM processes. One important issue is how to share our knowledge in change management and Quality Management. Possibilities are such as setting up a web site open for public. We could also blog, presenting results from research, thoughts from conferences, education and so on. The challenge is to find out who the main stakeholders are, what they would be interested in and need and how they could be motivated to take in new knowledge.

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Rethinking the risk matrix

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Key words: Risk matrix, Risk sustainability, Managerial perspective, Social perspective

Introduction

Any decision under uncertain conditions imposes to evaluate the ‘risk’ related to the possible consequences. Such evaluation can be absolute or relative. However, in both cases a quantitative indicator is needed to take into account all factors involved in the ‘risk’. In the first case (absolute evaluation), it is necessary to express such indicator as a measure in monetary, material or human terms (cost, number of causalities, etc.). Also in the second case (relative evaluation), this assignment is necessary but it looks less critical, because a proportional error in the definition of the measure will be neutralized.

In both cases above, the definition of risk and its measure are often confused.

In an ideal world we would like that the negative consequences (*Loss*) be null or minimal. This should be the goal of the improvement work, in technology and human sciences. Any ‘measure’ that clouds this aim or deflects from this path, has inside something wrong.

Since the consequences are usually ‘possible’, the definition – or, better, the measure – of risk is inevitably associated with the concept of probability.

Unfortunately, as we will see in this note, even if the consequences are correctly evaluated and the probability is a well-established measure, an ‘inappropriate’ mix of the two can lead to a ‘risky’ evaluation of risk. This idea will be described in Section 2 and Section 3 and further clarified by an illustrative example in Section 4.

The Risk Matrix

Pioneer work on establishing a common definition of Risk was started in the early 60’ with Wood (1964), where risk is defined as an objective state differing from the concept of uncertainty, more related to a subjective state. Many papers have studied the relation between the perception of probability in comparison with the rational computation. This link between risk and perception of risk has been object of further studies, see e.g. Weber and Milliman (1987). They also discuss the influence of posing a question concerning a consequence either in positive (gain) or in negative (loss) way.

As for the measure of risk, a milestone work was due to Kaplan and Garrick (1981) where, in place of a simple univariate measure of risk, a more complex definition including scenarios and risk curves was proposed.

However, despite more complex definitions, in the practice of risk management, the tool generally adopted to classify risk levels is the so called *Risk Matrix*. The risk matrix has two dimensions, likelihood and severity, both usually classified on five levels. The risk level, reported on each cell of the matrix, can be usually classified on three-five levels. The risk matrix reported in Table 17 is just an example. Slight modifications can be found depending on the specific risk analysis context.

Table 17. Risk matrix

LIKELIHOOD	CONSEQUENCES				
	Insignificant	Significant	Moderate	Severe	Extremely severe
Almost certain	High	High	High	Very high	Very high
Likely	Medium	Medium	High	High	Very high
Possible	Medium	Medium	High	High	High
Unlikely	Low	Low	Medium	Medium	High
Rare	Low	Low	Low	Medium	Medium

In several articles such matrix has been sometimes criticized. In particular, Smith *et al.* (2009), have experimentally demonstrated for instance that [...‘*Human subjects exaggerate the influence of losses when the losses occur to their personal wealth*’...]. (We suppose that an opposite effect could occur when impersonal decisions regarding the general health, must be taken). In addition, these Authors showed that when probability is very low or very high a biasing effect occurs, deflecting its evaluation towards medium levels.

The risk matrix shows that the risk level depends on the probability of occurrence of the ‘negative event’ and the severity of the possible consequences. The ‘very high’ risk level is reserved only to the cases where both factors are at high or the highest level (the three purple cells in the top right corner of the Table).

According to us, the attention should not only be devoted to the ‘highest-highest’ and ‘lowest-lowest’ corners, leading to obvious evaluations, but mainly to the other two corners.

In fact, in those cases even an ‘extremely severe’ consequence is generally reduced to a ‘medium risk’ evaluation if a ‘low’ or ‘very low’ probability has been attributed to the event. Specularly, very likely events, characterized by low consequences, could be undervalued.

The relationship between the risk matrix and its analytical definition has been already noted by Cox (2008).

The analytical measure of Risk

Usually, Risk is analytically measured by using the following formula:

$$Risk = Probability \cdot Loss \quad (1)$$

Whenever it is possible to quantify the consequences as a *Loss* and normalize it in a [0, 1] interval, the contour plot of this function in log-log scale is presented in Figure 1. With an opportune choice of axes scales and contour levels, it is evident that the formula (1) can be assumed as the theoretical basis of the above mentioned risk matrix reported in Table 17.

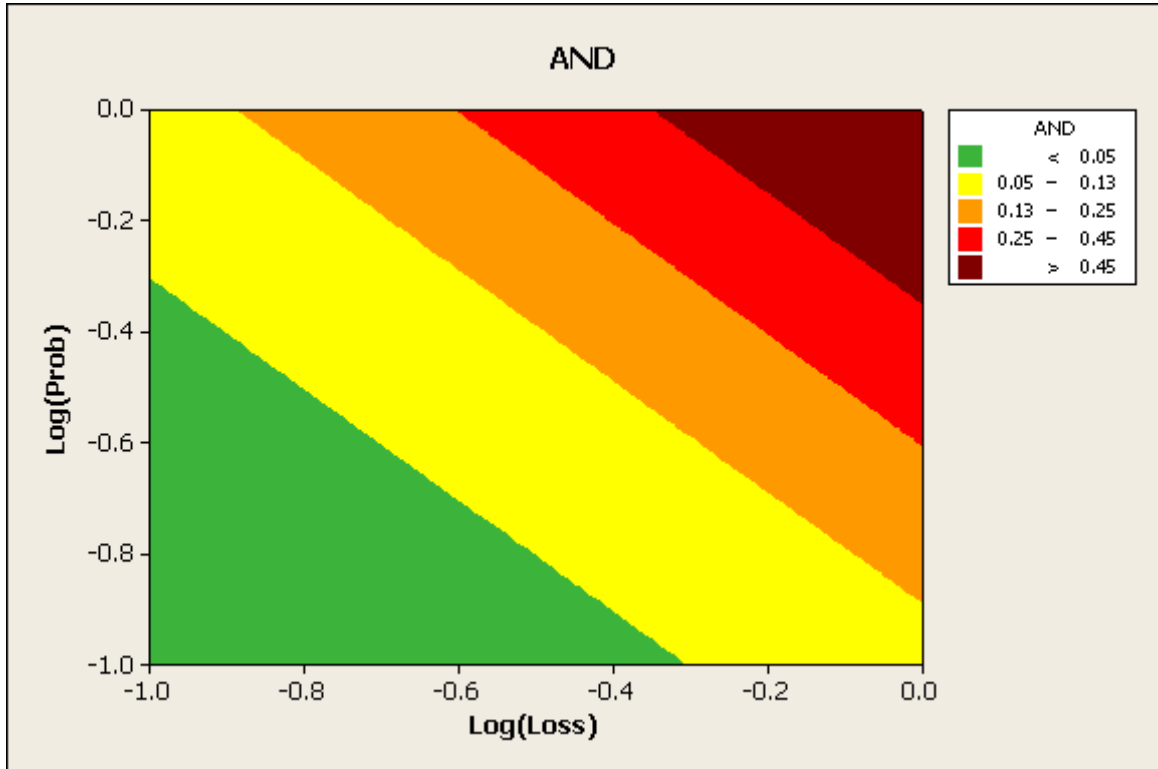


Figure 1. Contour plot of the function *Probability · Loss* in log-log scales.

Range, number of levels and their limits can be arbitrarily assigned. For the plot in Figure 1, we chose them in order to obtain a picture similar to that in Table 1.

The measure of risk stated by (1) is based on the logical operator “AND”. The main aspects of such measure are the following:

- it is possible to reduce the risk level by appropriately reducing the probability of the event;
- very likely events do not entail high risk if their consequences are not severe;
- only likely AND severe events lead to extreme risk.

The drawbacks of such measure become obvious when the function (1) is plotted on natural scale axes, see Figure 2.

In this Figure limits are chosen in order to obtain five zones covering same area. Those limits are the same chosen in Figure 1.

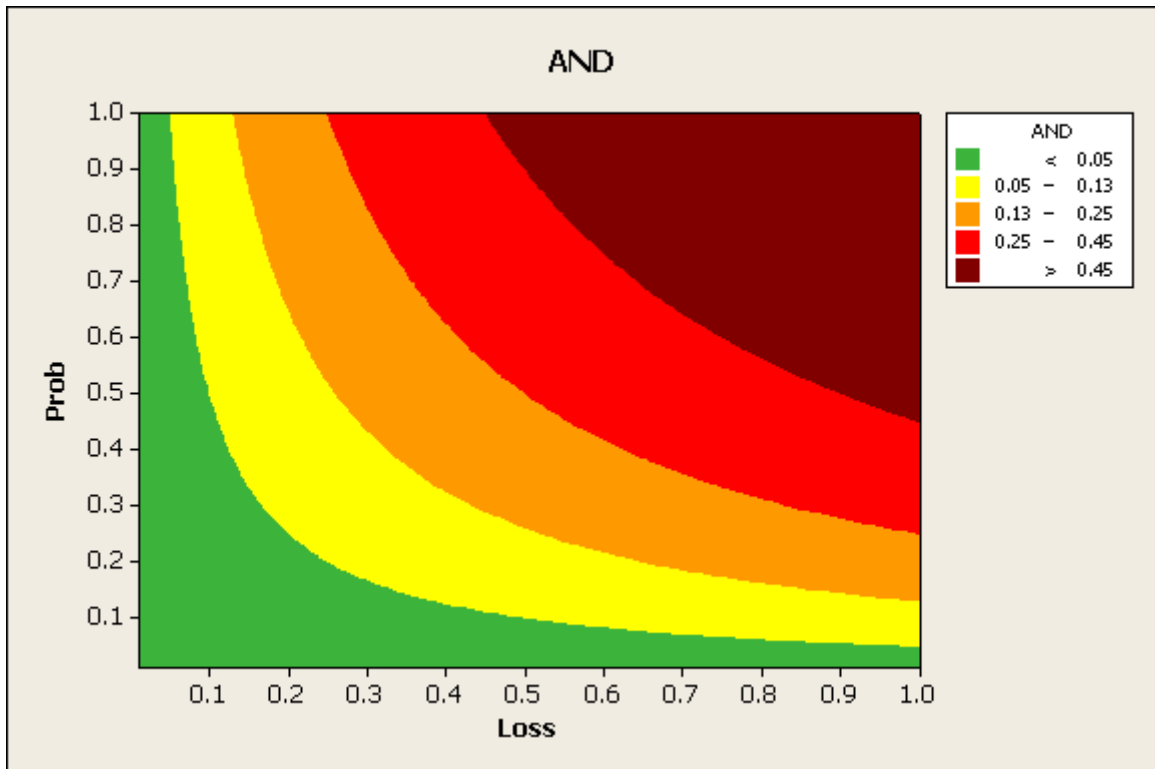


Figure 2. Contour plot of the function *Probability-Loss* in natural scale axes

The concept of Probability in Risk measure

The measure of Risk as *Probability* times *Loss* is universally accepted, but not always adopted. There are many cases diverging from this measure. A typical example of disagreement of everyday behavior from a probabilistic point of view concerns the choice of means of transport. Nobody of us will drive a car if we would consider the probability and the severity of consequences of an accident. In this case, since the probability is very low, people seem to not exactly understand what does unlikely mean.

This behavior is not only typical of human beings. Experiments carried out in aquariums showed that, until the ratio predatory/preys is low, fishes do not exhibit visible anxiousness.

Many examples can show the attitude of human beings, who are used to live in a dangerous environment, but are not paralyzed by fear. This attitude can lead individuals to afford high risks, but can allow species to survive.

What does Risk mean according to the “AND” logic? Particularly, what does “probability” mean?

A typical probabilistic statement is: ‘This event has a probability to occur once in a thousand years’. What does it mean? How many years we are now from the last occurrence?

This question is meaningless in a Poissonian world (remind the so called memory-less process) where the probability does not increase or decrease over time. The ‘event’ could either occur now or we should wait for more than expected.

The measure of Risk (1) can be also viewed as an expected cost (long-term mean), therefore it is acceptable only when “the mean is meaningful”, for instance when we handle amortizable figures. In fact Risk is appropriately seen as an expected cost when it is possible to ‘amortize’ an issue over several units (time, persons).

For example, saying “10% probability of paying a cost C” means that we expect 10 occurrences of the negative event out of 100 times, so we divide $10 \cdot C$ by 100.

Another example: when using 100 bulbs in a row, it makes sense to sum up the lifetimes of each of them and to divide by 100 to estimate the mean life. In such a case, one long-life bulb can counter-balance several short-life bulbs. Conversely if it is necessary to use only one bulb, it is better to refer to the probability to reach an assigned time horizon. In a very asymmetrical distribution, as the Exponential one, governing memoryless processes, the probability of having an element with life-time less than the mean is the 62.3%. It means that we approximately expect that 2 bulbs out of 3 will fail before their mean life. For systems that can be modeled as “renewal processes” the mean lifetime can be used as a valid criterion, otherwise when a very high reliability is required, it is necessary to take into account more conservative percentiles.

In conclusion we think that the measure of Risk as a mean loss is in agreement with the manager’s perspective, i.e. a long term perspective, in which a today’s high cost can be amortized by several tomorrow’s low costs. This vision should never be used when non-replaceable elements are involved, like human (or living) beings, non-renewable environmental resources, and so on.

An alternative measure of Risk

Doubtless, the mean is a very simple and attractive way to summarize variable quantities. Moreover the product *Probability* times *Loss* is very easy and manageable. Therefore, we wish to express a new measure of Risk that is as simple as the previous one, but avoiding the drawbacks discussed above.

We may define ‘Safeguard’ as the complement to one of the Risk and as the product of ‘improbability’ times ‘saving’, therefore:

$$Risk = (1 - Safeguard) = 1 - [(1 - Probability) \cdot (1 - Loss)] \quad (2)$$

The contour plot of the function (2) in natural scale axes is presented in Figure 3, using the same number of levels and limits of Figure 2.

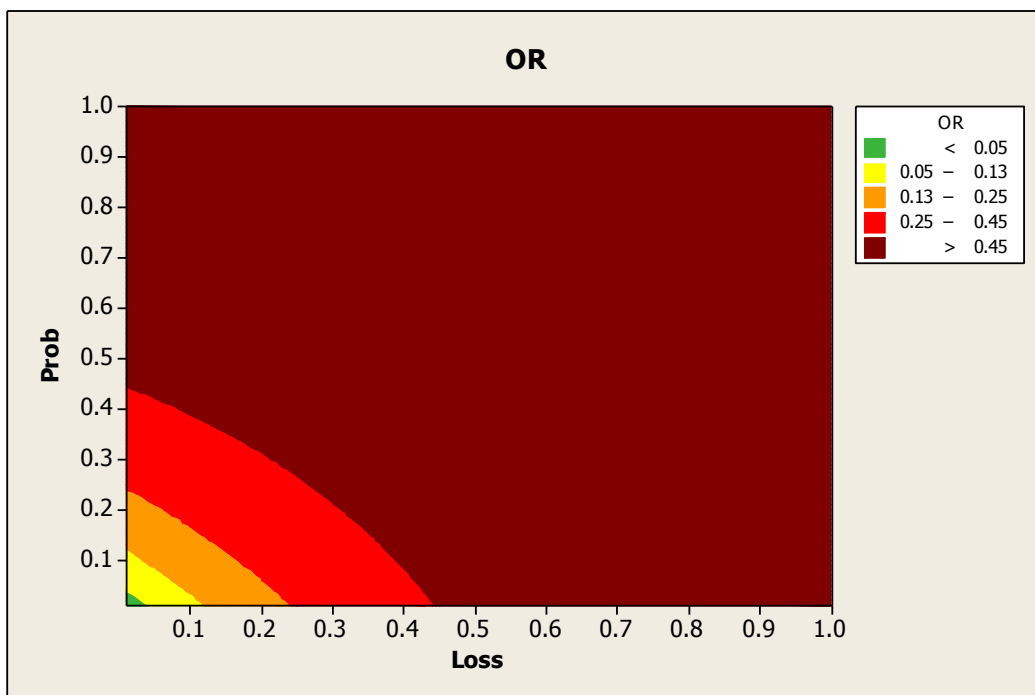
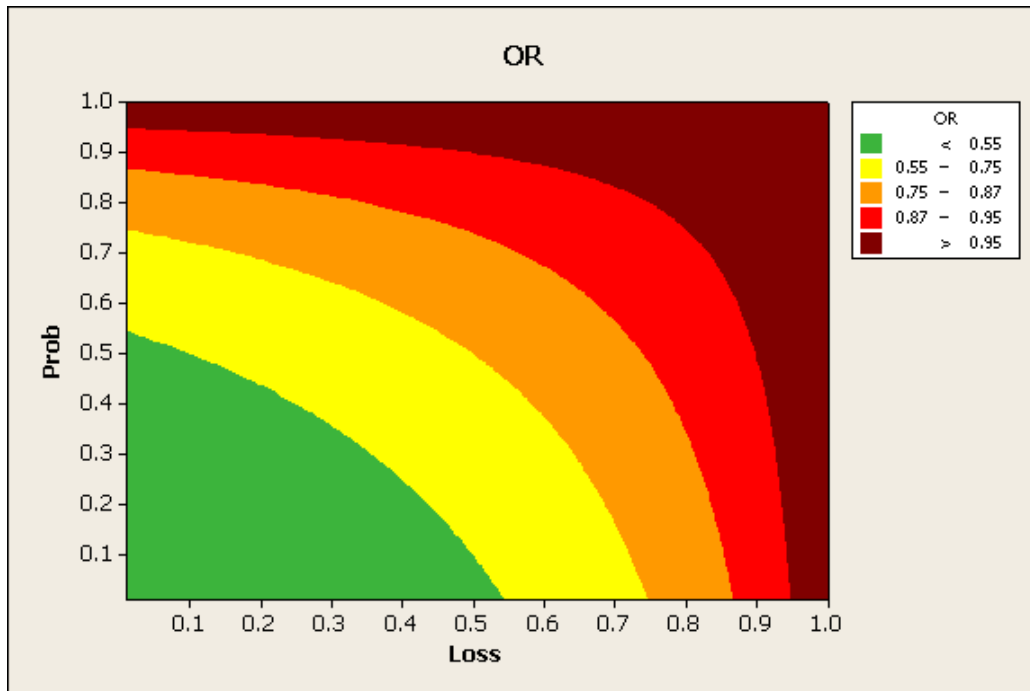


Figure 3. Contour plot of the Risk function expressed in (2)

By opportune rescaling, in order to obtain five almost equispaced zones, limits have to be changed. Hence Figure (4).



However any rescaling does only affect an absolute evaluation of risk, but not a relative evaluation, i.e. when comparing different alternative scenarios.

The advantages of the measure of Risk expressed by (2) are evident.

In fact:

- very frequent events must be evaluated as highly risky, even if their consequences are not severe;
- events with catastrophic consequences may never be associated to an acceptable level of Risk, even when their probability is judged as negligible;
- it is sufficient the presence of high severity of consequences (*Loss*) OR high probability of the negative event to lead to a high evaluation of Risk.

The last property is in line with the precautionary principle.

We are compelled to reduce both severity and probability (whenever possible) to have an activity that can be declared SAFE; this is a path towards a real continuous improvement process that cannot be stopped when one or another of the two terms is minimized.

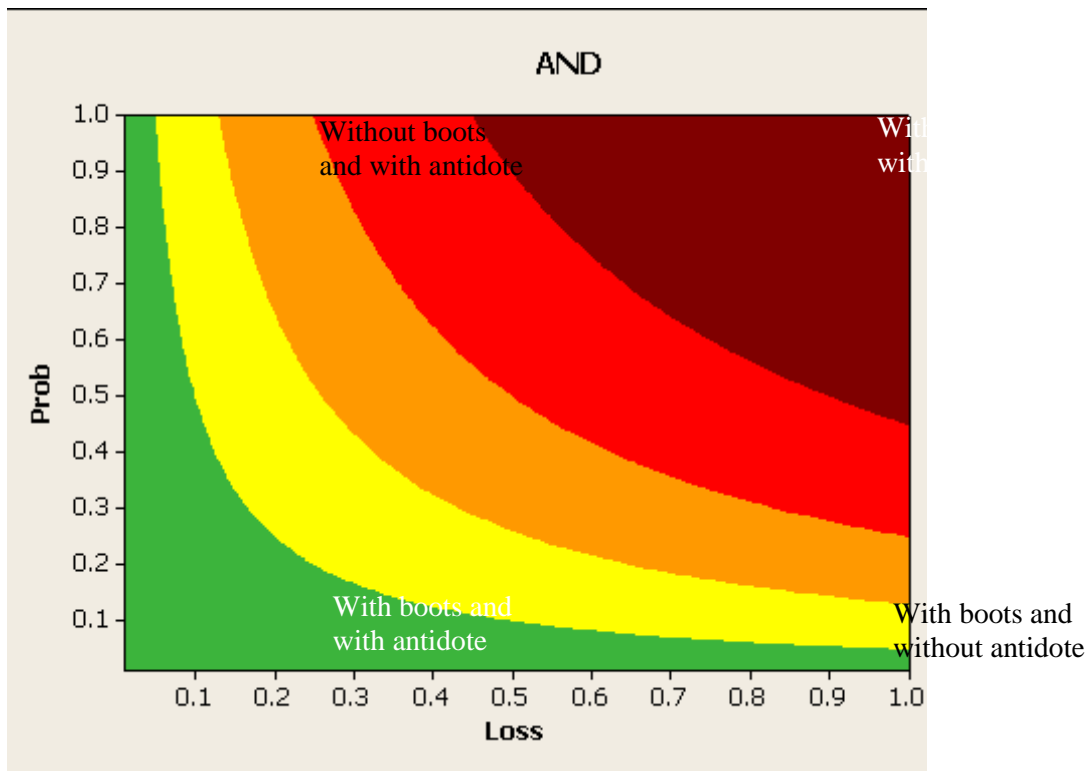
An illustrative example

To clarify the difference on applying the two investigated measures, 'AND' and 'OR', we use an illustrative example: a walk in the countryside.

A possible danger when walking in the countryside is a viper bite. The consequences of the viper bite can be minimized using an antidote, while the probability of being bitten can be minimized by using boots.

According to the traditional 'AND' logic a very risky action is committed only when not using boots and not bringing an antidote. While it seems sufficient, for reducing the risk level to an "acceptable" one, to adopt just one precaution.

Conversely, according to the 'OR' logic here proposed, this is excluded. Not bringing an antidote OR not using boots keeps the level of risk at high levels. Only bringing antidote and using boots implies a low risk.



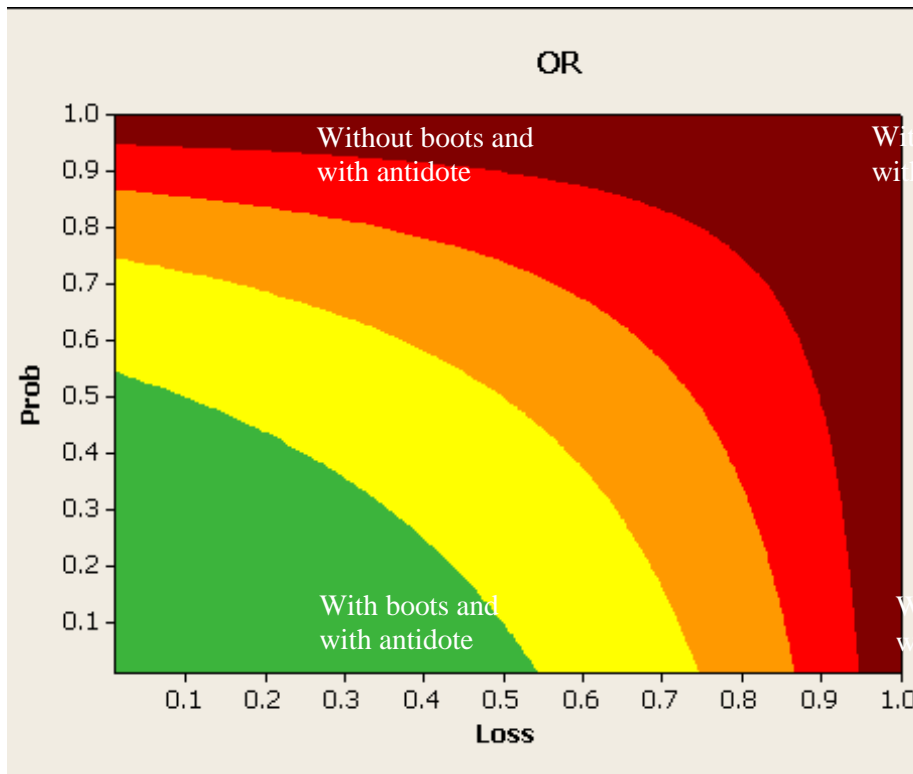


Figure 4. Comparison of the Risk logics AND (Figure a) and OR (Figure b), through an illustrative example.

Conclusions

The ‘AND’ logic, directly deriving from the measure of Risk as ‘expected consequence’, i.e. the product of *Probability* times *Loss* is a simple and effective measure that can be used (and it is used) to give managers the ability to assess the risk level of an activity and then to rank possible alternatives. This logic, also expressed through a traditional Risk matrix, where both *Probability* and *Loss* are discretized in e.g. five levels, in our opinion may be appropriate only for central values of the two factors.

Also in the corners low-probability/low-loss, and high-probability/high-loss, the assessments are fairly obvious and do not show weaknesses.

However, when we consider the two other corners, such definition of risk has big drawbacks.

The first reason is that often low probabilities are not perceived or interpreted correctly. The second reason is that some phenomena are not amortizable. The AND logic can be defined as the “manager’s logic”, where it is possible to dilute a potentially catastrophic event, which can very rarely occur, over a high number of other, lucky or successful, cases. This logic often presides over the decisions of Authorities and it is far from those who actually pay the real losses.

The alternative logic and consequent measure of Risk, that we have proposed here, privileges the perspective of citizens, who are unable to offset the consequences of a catastrophic event that could invest them, and therefore must seek to avoid in any way actions that could lead to disasters, albeit with low probability.

As a last reflection, consider the insurance contracts. The basis of their attractiveness lies in the fact that they match the AND manager's logic used by the company having the possibility of amortizing adverse events over large numbers, with the OR citizen's logic who prefer to pay a fee (although higher than the expected loss), rather than afford an enormous expense even very unlikely.

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Improvement systems in engineering

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Key words: Improvement systems, learning, engineering, projects

Introduction

Quality management and learning are regarded as competitive advantage, but in connection with engineering projects the research is scarce, especially empirical research. Engineering processes are largely based on tacit knowledge and creativity, fragmented and complex (Johnsson 2008). A common and practical approach to ensure improved performance and learning, many organizations use computer based improvement systems.

Few have looked at the connection and influence of learning, and computer based improvement systems from a quality management viewpoint in engineering projects. There has also been less focus on empirical research on quality management and knowledge management (Linderman, Schroeder et al. 2004).

Researchers have seen quality management fundamentals as enablers to facilitate learning and continuous improvement in organizations. The basic idea behind this approach is that knowledge drives performance, should lead to competitive advantage (Choo 2007) and is the basis to improve systems and processes (Chang 2002). Engineering and product development performance is characterized and dominated by its complexity and natural inbuilt unpredictability (Johnsson 2008), and hidden knowledge-based processes that's makes them difficult to plan, manage and improve (Johnsson 2008). However, the relationship and integration between quality management practices, learning and knowledge management have so far been discussed in general terms only (Rodriguez-Ortiz 2003; Linderman, Schroeder et al. 2004; Choo 2007; Choo, Linderman et al. 2007; Kim, Kumar et al. 2009; Punnakitikashem 2010).

Our aim for the study was to find better understanding and new insight on the importance and impact of using a computer based improvement systems in engineering in multidiscipline engineering projects. To explore this context and area further, we have used an exploratory survey within an engineering projects, comprises a literature review on topics handling the relationship between learning, a computer based improvement system and quality management.

Business improvement processes research

There are several tools and principles giving guidance to establish, implement, and accomplish improvement processes, ranging from more conceptual models and philosophies (TQM, BPR, and Six Sigma) to detailed guidelines. The challenge for many companies is to use these concepts, methods, and toolboxes available continuously and over time. Reviewing relevant literature on business process improvement, a dominate part is about models, methods, and tools to establish a structured and systematic approach for solving problems and performing business process improvement project (50% of the reviewed literature). In our literature review

we found that research and focus on computer based improvements systems alone represents one of many improvement methods, and only a starting point for improvement. This is illustrated in Fig. 45, giving an overview over the subjects and approaches of business improvement methods.

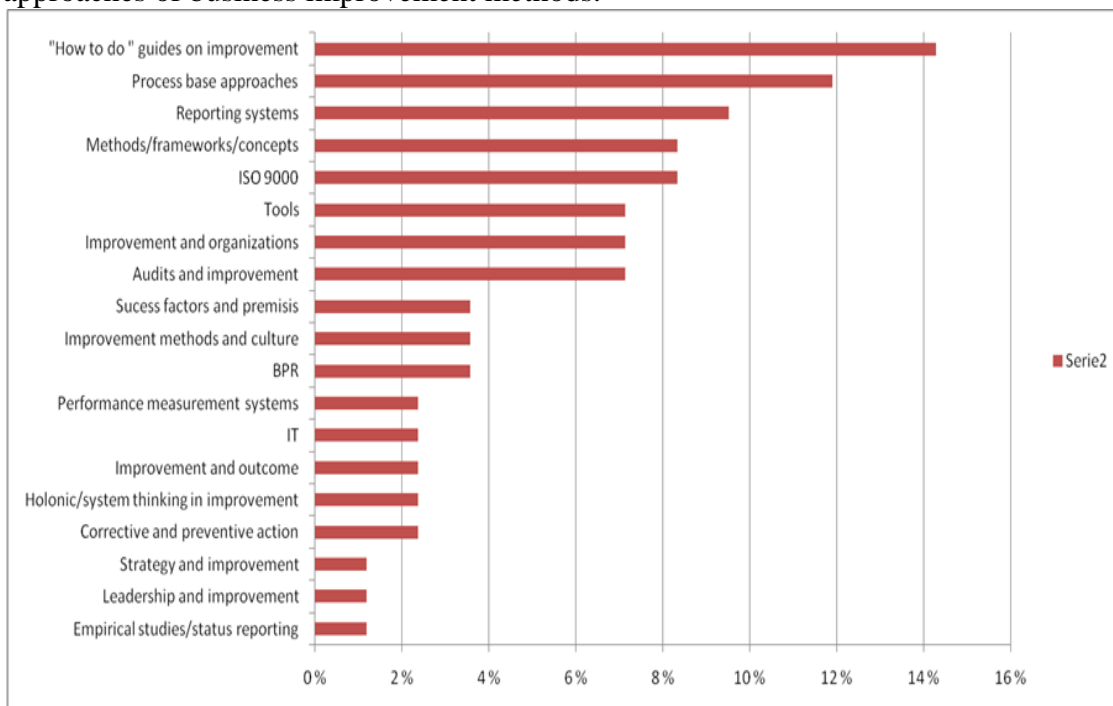


Fig. 45 Business improvement approach in research

Challenges in business process improvement

In engineering projects, constraints to learn and do improvement activities are, like many other areas, given by time, money and people available. Management are heavily involved in short term operational problems, and less on strategic improvement (Barad 2001).

A interesting observation is that, in the large amount of methods and tools, the main challenge for any company may not be to learn and identify new improvement methods, but the biggest challenge is to implement them and learn to use them in everyday activities (Repenning 2001). Continuous improvement has been regarded as a competitive advantage, and may include systematic efforts to improve work processes (Punnakitikashem 2010), but also include learning and knowledge based activity (Choo, Linderman et al. 2007). Continuous improvement is also claimed to be a communication tool for knowledge (Nereu F. Kock 1997).

There are no lack of models and perspectives on quality management and quality improvement, so selecting one may be difficult (Mutafelija 2003). Assuming the company have the right attitude and understanding of improvement processes, a number of methods and tools will do (Repenning 2001).

In knowledge creation process the business performance effect of structured tools and methods are considered to have indirect effect (Choo, Linderman et al. 2007). However, some claim that a culture emphasizing integration and teamwork, measurement for

improvement and continuous learning, continuous improvement have its greatest potential when integrated into a systematic organizational approach (Shortell 1998).

The relationship between knowledge and continuous improvement seems diverted, where some claims that the use of quality techniques (Linderman, Schroeder et al. 2004) facilitate and amplifies learning and knowledge creation processes; others sees the continuous improvement process as the learning process (Punnakitikashem 2010). A common perception is that if quality management tools and techniques should facilitate learning, knowledge must be captures and documented (Punnakitikashem 2010).

A computer based improvement systems can fulfill both objectives and may facilitate learning and knowledge activities.

Learning

The concepts of learning and knowledge are closely linked (Nereu F. Kock 1997), but definitions on these subjects in quality management literature are scares.

However, we find reference common definition on learning in the context of improvement activities and management systems. In short, learning represents a social processes of “information seeking, discussion and asking questions” (Choo 2007), change of behaviour and to “do something better” (improve), where creation of “new knowledge” is the outcome (Chang 2007; Choo 2007; Jacobsen 2007; Punnakitikashem 2010).

Learning is by many regarded as a generic feedback cycle, consisting of four processes ; observing, reflecting, creating and acting (Carroll 1998), taking place at different levels in an organization (Punnakitikashem 2010).

Knowledge are the outcome of learning processes, and “knowledge is multifaceted concept with multilayered meanings “ (Nonaka 1994).

In theory, a computer based improvement systems can also fulfill the objectives and mechanisms of learning and knowledge creation.

Organizational learning

Learning takes place in organizations, and in many ways learning is very consistent with the principles of quality management i.e the PDCA-cycle (register problems, systematic problem analysis, develop and implement actions and measures) (Linderman, Schroeder et al. 2004). If we look at knowledge as the outcome of learning, Knowledge Management is the process of managing knowledge creation. Organization's challenge is to retrieve and reinforce knowledge, formalize it and making it available to the entire organization (Nonaka 1994). Engineering is characterized by great deal of tacit knowledge, so how suited and practical a computer based improvement system may be challenging in engineering projects.

Safety reporting systems

SHE performance and information registration systems have a central position in the

safety fields. Figure 2 show the main principles of a typical system handling SHE information and data in the safety context

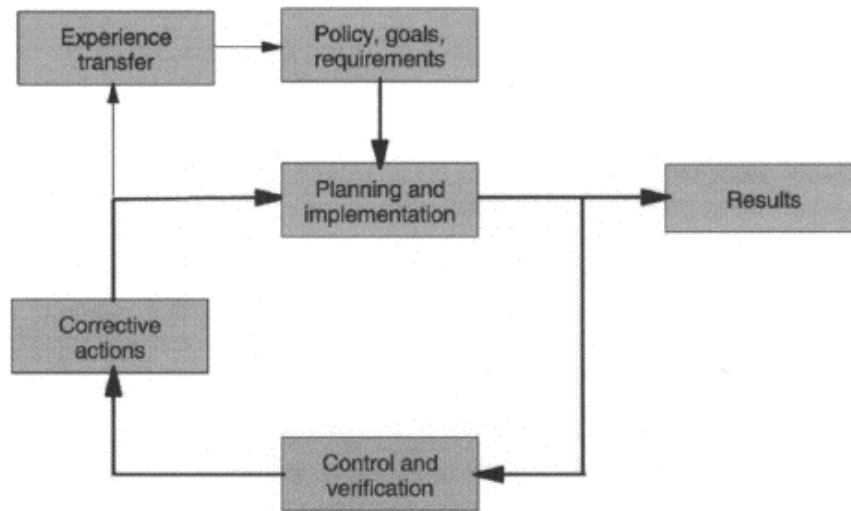


Figure 27.9 The SHE control loop.

Figure 2 Typical system handling SHE information (Kjellén 2000)

The use of SHE information is central in theories used for safety and accident prevention, and the designing and use of SHE information systems to build organizational learning and experience is central (widely discussed in Kjellen's book "Prevention of Accidents Through Experience Feedback" (Kjellén 2000)). The focus is on structured design and use, but also highlights and discusses the challenges inherent in the use of the information, and the challenge that lies in the personal versus organizational learning based on informal versus formal communication (Kjellén 2000; Wouters 2005).

The safety reporting systems are influenced by the development within the use of information technology, affecting the data collection, access, use and performance presentation. One of the crucial aspects on using SHE information is in risk prevention, linking data with processes and systems to provide understanding and learning. The attention on reporting systems seems to have a more central role than the field of quality management. Another interesting observation on safety research is that great attention is on learning organizations, focusing on the management of the processes of change and learning (Kjellén 2000).

Review summary

Through our literature review we found a theoretical basis for the connection between improvement processes, computer based improvement systems and learning activities, in the context of quality management. We also found that quality management literature are dominated by models and frameworks on improvement processes, but that the field of safety have greater emphasis on computers based systems to be central in learning and improvement processes. Quality management literature notes that if a company have the right attitude and understanding of improvement processes, a number of

methods and tools will do (Repenning 2001), and do not really highlights any computer based improvement systems as core for learning and improvement. A computer based improvement systems might on the other hand represent structured approaches to guide and streamline the organization improvement efforts, outlining the steps needed to systematically and incrementally introduce improvements and measure their effectiveness (Mutafelija 2003).

Learning and knowledge creation appears as a social construct. The social constructs are scares debated in connection with quality management principles, learning and improvement processes, but learning is facilitated by far more than quality management principles. We did find connection to both improvement processes and quality management in theory on learning and knowledge. Research on learning and knowledge are mainly influenced by social interactions processes (Dibella, Nevis et al. 1996; Chang 2007; Serenko 2007; Kim, Kumar et al. 2009). Besides the social interaction, typical organizational factors such as leadership, culture, resource availability (and time), challenging work, trust and a methodical frameworks are the main and dominant premises to facilitate learning and knowledge (Chang 2007; Choo, Linderman et al. 2007).

Survey

Based on these findings we designed a survey to explore whether computer based improvement systems, have any prominent influence on learning and improvement, or if the social constructs and organizational factors in an engineering project are more prominent in order to facilitate learning and improvemet. Based on the literature review, prominent and widely discussed organizational factors effecting social processes and performance in organizations was derived from the organizational theory literature (Thompson and McHugh 2002; Clegg 2005; Jacobsen 2007), such as:

- Management
- Quality management system
- Training
- Caring
- Quality/management commitment
- Work processes and information flow
- Motivation
- Compliance with quality management system
- Project goals
- Improvement tools/methods
- Performance measurement
- Trust
- Teamwork/collaboration
- Communication
- Feedback
- Empowerment/job enrichment

The survey was distributed to all employees in the engineering discipline in a specific multidiscipline project. The survey comprised registration of demographic data and they were asked to rate the organizational factors listed, continuous improvement activities, the perception of the computer based improvement system, and to what extent they experience learning within their project, between other projects in the organization (for learning and experience transfer) and between the project and the core organization, as their professional network. In order to explore any possible change of influence through the lifecycle, the same survey was performed at two different stages in the project. Since our study was limited to one project only, our data was limited to the amount of project member working in the project at the given time. At the early stages of the projects 65

project members responded (a 65% response rate) representing 18 different disciplines. At the late stages of the project 33 project members responded (a 59% response rate) representing 15 different disciplines.

To reduce complexity and to explore insight, we performed only simple correlation analysis on which factors correlating with use of the computer based improvement system in an engineering project.

	Factors correlating the most with improvement activities in the project	Factors correlating low on improvement activities in the project
Early stage of project	<ul style="list-style-type: none"> • Feedback and follow up • Facilitate work environment • Improvement culture • Multidiscipline cooperation • Competence of other project members 	<ul style="list-style-type: none"> • Teamwork/collaboration (within the discipline) • Management of project (cost) • Experience transfer/knowledge management • Quality management system
Late stage of project	<ul style="list-style-type: none"> • Teamwork/collaboration (within the discipline) • Feedback and follow up • Caring • Quality management system • Competence/experience 	<ul style="list-style-type: none"> • Teamwork/collaboration (with other projects) • Training

Table I. Overview over organizational factors correlating with improvement activities in a project

In our exploration of factors influencing improvement and learning activities, using a single factor correlation analysis gives a good indication of factors that may have a connection, and if a computer based improvement system is significant in this context. Our exploration also shows that influencing factors vary over time in a project. Even this is a single factor analysis; it is interesting to observe that the computer based improvement system do not stand out as a major contributing factor on improvement.

Our data may be insufficient to make a conclusion based on data only (based on the few data points and limited to one project only), but have given better insight in important organizational factors influencing a projects learning and improvement processes. Our exploration and assessment of the data, did help us to find set of factors that showed significant relationship and impact on the improvement process.

We have observed through our exploration that the importance of influencing factors on business process improvement changes over time in a project, and have given a foundation for further work and understanding to explore other models and approaches to understand and establish sustainable business process improvements, focusing on other factors than computer based improvement systems. This is also in line with our conclusion in the literature review.

Conclusion

The literature in the context of business improvement, confirms that method and tools for improvement is important (and there is a variety to pick from), but organizational factors and social constructs cannot be overlooked for achieving improvements.

We have observed through our exploration survey that the organizational factors are more related and more important for business process improvement than a computer based improvement systems; even they can represent the tools and methods for systematic approach on improvement activities. This may indicate that structure and improvement tools in engineering projects can inhibit improvement and learning, and that further research has to look for other mechanisms and structures. The factors we found underline this need and approach to some extent.

We found through our survey that a computer based improvement system can be suited for handling diversity among the project members and a protocol for common language. A computer based improvement system showed no significant correlation on improvement and learning processes in general, or double loop learning in particular.

The survey confirmed some general considerations made in literature, but has also revealed some new aspects not discussed or highlighted before in the context of engineering projects.

This has given better insight in how important factors influencing learning and improvement over time in a project not found before.

One of the most prominent observations is that factors influencing learning (and improvement), with very high possibility, will change in character and strength, and became replaced by other factors during the project.

We found factors fare more important for improvement and learning than a computer based improvement system.

The study is limited to one project only in a specific industry, which limits the overall generalization. Yet the study gives a positive indication for the need of further investigations and research on these topics in other organizations and industries.

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Examination of the mediating and moderating effects of employee focus on the relationship between sustainability practices and organizational performance

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Introduction

Nowadays it is widely recognized that corporations need to act in a socially responsible way in order to contribute to social well-being and competitiveness as well as financial success of the firm (Moneva and Ortas, 2010). Green management in organizations has to go beyond regulatory compliance and needs to include conceptual tools such as pollution prevention, product stewardship and corporate social responsibility (Hart, 2005). The needs for efficient use of resources and environment friendly corporate policies and behaviours have now been recognized all over (Das Gandhi et al., 2006).

Whereas sound economic performance in the past was expected to guarantee corporate success by companies and its shareholders, business is currently increasingly led by the so-called triple bottom line. Economic and financial results need to be accompanied by the minimization of ecological footprints and increased attention to social aspects (Lee, 2009). Moving towards sustainable development, therefore, is now a major concern in most of the developed countries, resulting in stricter regulations concerning the impact of the products during their manufacturing, use and end of life, including the obligation to define reverse logistics strategies and systems (Gou et al., 2008; Hong et al., 2008; Kumar and Putnam, 2008).

Businesses today need to fully integrate sustainability and risk management into their strategy - not only to minimize potential losses but also to exploit new business opportunities arising from the sustainability agenda (Kucuk-Yilmaz and Flouris, 2010). Sustainability is a critical part of most major corporations today. Whether the motivation is concern for society and the environment, government regulation, stakeholder pressures, or economic profit, most managers recognize the importance of developing sustainability strategies and activities (Epstein and Rejc-Buhovac, 2010).

Sustainability is often seen to require the adoption of an integrated view of innovation that brings together economic, environmental and social concerns as a basis for system changes (Roome and Cahill, 2001). Moreover, in order to survive and compete successfully, the organization needs innovation-friendly business strategy,

organizational structure, top management style, middle management practices and effective modes of managing innovation for innovational success and competitive excellence (Khandwalla and Mehta, 2004). It is important to encourage creativity by the means of the ability to create or to be original, expressive and imaginative whereas creativeness is the creative potential or the capacity to be creative (DiLiello and Houghton, 2008).

Successful organizations constantly enhance employee capabilities through a variety of special programs (McCowan et al., 1999). Effective, appropriate, and successful training experience serves as an indication that an organization is voluntarily willing to invest in its human capital that both builds employee capabilities and increases their degree of job satisfaction (Bontis and Serenko, 2007). According to the resource-based view of the firm, resources (i.e. inputs for the production of goods and provision of services) and organizational capabilities (i.e. intangible assets that are based on skills, learning, and knowledge in deploying resources) can be sources of competitive advantage (Wilden, 2007). Moreover, Carmeli and Tischler (2004) discovered that intangible organizational elements like managerial capabilities, human capital, internal auditing, labor relations, organizational culture, and perceived organizational reputation each influenced organizational financial performance positively

As a way to better understand these differing views, this paper examines the relationship between sustainability practices and organizational performance with the mediating and moderating impact of employee focus.

Methodology

Sample

This study utilized a mail survey of a sample of Slovenian organizations, encompassing various sectors. In total, 1000 surveys were mailed out, and 171 responses were received (response rate 17.1%). Among the received responses 70 were used as input data for the further statistical analysis, due to the fact that not all returned questionnaires were completely filled out.

The questionnaire was responded by manufacturing, service as well manufacturing/service type of industry, in portion of 33.8%, 41.6% and 24.7%, respectively.

Measures

Several topics (related to sustainability) were conceptualized to formulate questionnaire, each tested on five-point Likert scales (1 = “strongly disagree”, 5 = “strongly agree”).

Table I. Construct validity and reliability

Factor	Items	Factor loading	Cronbach's alpha
Commitment to SD	Top management is committed to promoting a concept of sustainable development	.819	.808

	Top management is committed to promoting a culture that encourages innovation and risk-taking	.788	
	Top management is committed to an open, participatory process of continuous improvement, focused on the long-term economic performance of the organization	.773	
	We develop and implement incentive mechanisms to promote sustainability initiatives	.684	
Employee focus	Security and employees' well-being is a priority of our organization	.900	.884
	Our employees are encouraged to continuously develop their talents and capacities	.873	
	Workers are valued and their work is organized to conserve and enhance their efficiency and creativity	.713	
Environmental focus	We deploy the process of continuous improvements in the field of environmental protection	.832	.791
	We have developed a strategy for environmental protection	.791	
	We follow-up on environmental legislation and other requirements	.758	
	Top management accepts responsibility for environmental protection	.661	

Organizational performance was also measured using Likert-type items, where 1 = “not at all” through 5 = “to a great extent”. Organizational performance construct consists of non-financial performance measures as well as financial performance measures. Non-financial measures include variables relating to employee involvement, satisfaction of stakeholders, ability to acquire and to share new knowledge, efficiency and effectiveness of processes, employees’ trust in top management, employee satisfaction rate, relationships with suppliers. The second factor shows variables having a common dimension of financial performance, primarily relating to ROE - return on equity, ROA – return of assets, ROI - return on investment, value added per employee, investment in new processes and products and market value added.

Research methods

Exploratory factor analysis

For the purpose of validating the measurement instrument we used an exploratory factor analysis.

Moderated multiple regression analysis

We used moderated multiple regression analysis to examine moderator effects. A moderator is an independent variable (M) that affects the strength and/or direction of the association between another independent variable (X) and an outcome variable (Y). Figure 1 illustrates a moderator effect.

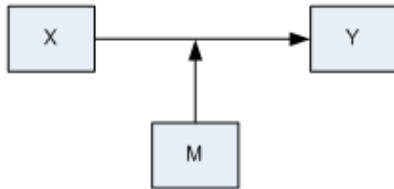


Figure 1. Conceptual model of a moderator effect

Mediation analysis

In order to test the mediation effects of employee focus on the relationship between sustainability practices and organizational performance, we used SPSS procedure (SPSS macro) for estimating indirect effects in simple mediation models proposed by Preacher and Hayes (2004).

The macros provide unstandardized coefficients as required to test mediation (Preacher and Hayes, 2008). Path a represents the effect of X on the proposed mediator, whereas path b is the effect of M on Y partialling out the effect of X (Figure 2B). All of these paths would typically be quantified with unstandardized regression coefficients. The indirect effect of X on Y through M can then be quantified as the product of a and b (i.e., ab). The total effect of X on Y is quantified with the unstandardized regression weight c (Figure 2A). The total effect of X on Y can be expressed as the sum of the direct and indirect effects: $c = c' + ab$.

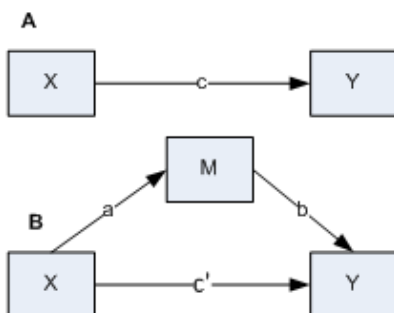


Figure 2. (A) Illustration of a direct effect. X affects Y. (B) Illustration of a mediation design. X is hypothesized to exert an indirect effect on Y through M.

Results

Construct validity and reliability

In order to confirm the latent factor structure for measured variables, an exploratory factor analysis was performed. To test the reliability, the internal consistency of the

questionnaire was measured using Cronbach's alpha coefficient. The results of validity and reliability are presented in Table I.

Mediation analysis

In this section, we present four different models, each of them tested for mediator effects.

Model 1

Dependent variable: Non-financial organizational performance
 Independent variable: Commitment to sustainable development (SD)
 Proposed mediator: Employee focus

Model 2

Dependent variable: Non-financial organizational performance
 Independent variable: Environmental focus
 Proposed mediator: Employee focus

Table II contains all the information necessary to assess the meditation's effect in accordance with the Figure 2B.

Table II. Mediation of the effects of the sustainability practices on non-financial performance through employee focus

Coefficients			
(a paths)	(b paths)	Total Effect (c path)	Direct Effect (c-prime path)
Model 1			
0.8632, p=0.0000	0.6260, p=.0002	0.6186, p=.0003	0.0782, p=.6797
Model 2			
0.1849, p=.2255	0.7008, p=.0000	-0.0169, p=.9089	-0.1465, p=.1709

The results indicate that direct effect is not statistically different from zero, indicating no relationship between commitment to sustainable development and non-financial organizational performance after controlling for the mediator ($c' = 0.0782, p > .05$). This suggests that employee focus completely mediates the effect of commitment to sustainable development on non-financial organizational performance. However, employee focus appears not to be significant mediator in the Model 2.

Table III. Bootstrap estimates of the mediated effect and its standard error

	Point estimate	Product of Coefficients		Bootstrapping BCa 95% CI	
		SE	Z	Lower	Upper
Model 1					
Mediator	0.5404	0.1548	3.4906	0.2419	0.8371
Model 2					

	0.1296	0.1058	1.2249	-0.1670	0.3836
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Bca -Bias Corrected and Accelerated Confidence Intervals, 1000 bootstrap samples

The indirect effect for the proposed model is 0.5404 (through employee focus). Hence, we can conclude that employee focus is likely an important mediator ($Z = 3.4906$, $p = .0005$). The total effect of X on Y can be expressed as the sum of the direct and indirect effects: $c = c' + ab = 0.6186$.

The point estimate of ab is simply the mean ab computed over the 1,000 samples, and the estimated standard error is the standard deviation of the 1,000 ab estimates. As can be seen from the bootstrapped estimate of the indirect effect, the true indirect effect is estimated to lie between 0.2419 and 0.8371 with 95% confidence (Table III).

Model 3

Dependent variable: Financial organizational performance

Independent variable: Commitment to sustainable development (SD)

Proposed mediator: Employee focus

Model 4

Dependent variable: Financial organizational performance

Independent variable: Environmental focus

Proposed mediator: Employee focus

The results in Table IV show no support for assumption that employee focus mediates the relationship between sustainability practices and financial organizational performance. The findings show that there is no significant relationship between the mediator and the dependent variable.

Table IV. Mediation of the effects of the sustainability practices on financial performance through employee focus

Coefficients			
(a paths)	(b paths)	Total Effect (c path)	Direct Effect (c-prime path)
Model 3			
0.8479, p=0.0000	0.1382, p=.5854	0.2364, p=.2186	0.1192, p=.6790
Model 4			
0.2711, p=.0739	0.2816, p=.1110	-0.1187, p=.4373	-0.1950, p=.2160

Table V. Bootstrap estimates of the mediated effect and its standard error

	Point estimate	Product of Coefficients		Bootstrapping BCa 95% CI	
		SE	Z	Lower	Upper
Model 3					
Mediator	0.1172	0.2073	0.5653	-0.2683	0.6299
Model 4					

	0.0763	0.0609	1.2527	-0.0240	0.3297
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Bca -Bias Corrected and Accelerated Confidence Intervals, 1000 bootstrap samples

Moderation analysis

The following section provides results regarding the moderation analysis. The findings of multiple regression analysis are presented in Table VI and Table VII.

Table VI. Multiple regression analysis – non-financial organizational performance (OP)

non-financial organizational performance		
	Model 1	Model 2
Employee focus	.581**	.761
Commitment to SD	.267	.192
Environmental focus	-.339*	-.361
Commitment to SD x Employee focus		-.134
Environmental focus x Employee focus		.066
R ²	.630	.654
Adjusted R ²	.600	.606
F	21.541	13.611

*p<0.05; **P<0.01

Model 1 (Table VI) tests the baseline relationship between sustainability practices and non-financial organizational performance. The results of Model 1 show that employee focus has a positive effect on non-financial organizational performance (B = .581, p<.05). Model 2 tests the moderating effect of employee focus on the relationship between sustainability practices and organizational performance. In order to perform this test, product terms were computed as can be seen in Table VI. Prior to this process, all variables involved were standardized to minimize the multicollinearity between the independent variables and their product terms. In this model, however, no significant moderation effects were found. On the other hand, results show that none of the sustainability practices have significant relationship with financial performance (Table VII).

Table VII. Multiple regression analysis – financial organizational performance (OP)

financial organizational performance		
	Model 1	Model 2
Employee focus	.201	.109
Commitment to SD	.170	.207
Environmental focus	-.251	-.234
Commitment to SD x Employee focus		-.092
Environmental focus x Employee focus		-.166
R ²	.117	.192
Adjusted R ²	.034	.057

F	1.411	1.425
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*p<0.05; **P<0.01

According to the results (Table VII), Model 1 accounts for 11.9% of the variation in financial organizational performance, with a slight increase in the Model 2 (R square change = 0.075).

Surprisingly, F ratio indicates that both models as a whole have no statistically significant predictive capability.

Discussion

This study presents several findings concerning the relationship between sustainability practices and organizational performance.

The interpretation of mediation analysis is that, taken as a set, employee focus does mediate the effect of commitment to sustainable development on non-financial organizational performance. As can be seen in the results, the total and direct effects of commitment to sustainable development on non-financial organizational performance are 0.6186, $p < .001$, and 0.0782, $p < .7$, respectively. The difference between the total and direct effects is the total indirect effect through the three mediators, with a point estimate of 0.5404 and a 95% BCa bootstrap confidence interval (CI) of 0.2419 to 0.8371. Hence, we can claim that the difference between the total and the direct effect of commitment to sustainable development on non-financial organizational performance is different from zero, which indicates that employee focus is a mediator. Moreover, Baron and Kenny (1986) simply state that perfect mediation has occurred if c' becomes nonsignificant after controlling for M, which is so in our case ($c' = 0.1192$, $p = .6790$).

According to the results (Table II, Model 1), the directions of the a and b paths are consistent with the interpretation that greater commitment to sustainable development leads to greater employee focus dimension, which in turn leads to greater non-financial organizational performance. These findings are consistent with the work of Chandler et al. (2000), who stressed the importance of encouraging a culture favourable to innovation in the organizations' innovative behaviour (Chandler et al., 2000). Moreover, a common overall organizational culture that builds on sustainability can further help managers and other decision-makers deal with the trade-offs that the simultaneous management of social, environmental, and financial goals often causes activities (Epstein and Rejc-Buhovac, 2010). We can also argue that such an organization culture should be characterized by a continuous focus on learning capability (learnability) and innovation capability (innovability) (Dahlgaard-Park and Dahlgaard, 2010). These arguments imply the importance of building capabilities that foster the competence by business to innovate in ways that are more sustainable (Kleef and Roome, 2007).

Furthermore, multiple regression analysis was used in order to test the moderated effects of employee focus on the relationship between sustainability practices and organizational performance. Regression analysis shows rather surprising results where only employee focus seems to have a significant positive relationship with non-financial organizational performance, estimated by unstandardized coefficients ($B = .581$, $p < 0.01$). On the contrary, environmental focus appears to have a negative impact on non-financial organizational performance ($B = -.339$, $p < 0.05$), while we cannot confirm the positive impact of commitment to sustainable development on non-financial

organizational performance ($B = .267, p = .061$). These results suggest that increasing attention to environmental issues leads to decreased non-financial organizational performance, which is, however, contrary to our expectation. One should not neglect the approach that is taken within organization to integrate environmental as well as broader sustainability aspects. As a proactive approach takes hold in an organization, we would expect it to redesign its production or service delivery processes. In other words, sustainability aspects should be integrated during product/process conceptualization, when quality characteristics are not finally determined. This means building sustainability aspects into tangible and intangible product/process quality characteristics, through a constant focus on stakeholders' wants and needs, and on the basis of principles of continuous improvement. Therefore, organization should establish a sustainable quality management (SQM) in order to support systematic integration of sustainability aspects into product/process quality characteristics (Maletic et al., 2011). These findings are somewhat consistent with the arguments that for organizations to become more sustainable, managers must address the different dimensions of sustainability at the strategic level, both during the strategic decision-making process and as part of the strategy content at the corporate, business and functional levels (Bonn and Fisher, 2011)

Employee focus was not found to be significant moderator ($p > 0.05$) on the relationship between sustainability practices and organizational performance (non-financial as well as financial). In some sense these results were unexpected as greening of production leads to savings in raw materials, water and energy usage and thus leads to competitiveness and economic performance (Rao and Holt, 2006). Likewise, there is also evidence to suggest that good environmental performance can help enterprises to achieve better economic result (Iraldo et al., 2009).

Our findings, however, needed to be interpreted in the light of the results of both models presented in Table VII (Model 1 and Model 2). It appears that R square values are low and not statistically significant. For both models F test is not significant, which means that regression models are not statistically significant. Further analysis revealed that correlations between independent variables and dependent variable were low and not significant (at the .05 level of confidence), which helps to explain the results. However, these findings suggest that we should reconsider the predictor variables in order to improve overall significance of the regression model. One possible explanation for this could also be related to data, as we observed some problems regarding missing values as far as organizational performance items are concerned.

Employee focus, irrespective of the regression analysis findings, plays an important role in achieving organization's sustainability strategy. Particularly, this implies that corporate sustainability can only be effectively created through first building the employees' capabilities of the organization. Furthermore, shift towards sustainability will also not occur without clear leadership and active support from the company's top management (Pujari et al., 2004). Hence, commitment from top management is like a framework for environmental improvement (Govindarajulu and Daily, 2004).

Conclusion and limitations

The paper has shown that employee focus does have an impact on organizational performance. Specifically, we found that employee focus is not a significant moderator,

but rather serves as a complete mediator in the connection between commitment to sustainable development and non-financial organizational performance. Another relatively straightforward implication of these research findings is that employees are important stakeholder group in any sustainability change initiative that is striving for improved organizational performance. Our findings, therefore, demonstrate that organizations can benefit from focus on employees and their capabilities. Commitment to sustainable development is important as well in terms of achieving higher organizational performance, particularly related to non-financial performance.

The present study has certain limitations that need to be taken into account. First, our sample size should be expanded to a larger group in order to increase the generalizability of the results. Second, from the methodological perspective, this study can be deepened by using more precise measures for gauging construct such as employee focus.

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Malcolm Baldrige National Quality Award Leadership Model –An assessment of Turkey

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Key Words: M.B.N.Q.A., Quality, Modelling, Total Quality Critic Factors.

Introduction

One of the most distinguished features of the second half of the twentieth century is an ever-expanding movement of globalization which triggers strong competition. On the one hand, technological advances and on the other, developments in international relations increase the activities of goods and service beyond borders. These developments have brought about a new kind of competition among companies. The adaptation and survival of these companies in this changed atmosphere is possible through labor, capital and an efficient supervision of the natural resources.

In today's world, the contemporary conceptions of management and quality management in their broadest sense spread almost to every sector, especially to the sector of tourism. For tourism, which is a service based sector, the idiosyncratic features (being a standardized, abstract, versatile and inseparable concept) are necessary for the total quality procedures.

The success of the total quality management depends highly on the leadership of top managers. Total Quality Management is a never-ending process that starts with leadership. Without leadership, support and participation of top executives, total quality management cannot be achieved. The leader in total quality management believes in the necessity of delegating responsibility to the employees, educating them, and also including them in the decision-making process. In total quality management, the success of the leader depends on the degree to which they are able to meet the needs and demands of the employees.

The aim of this study is to analyze the relationship among leadership (L), Human Resources Planning (HRP), Focusing on the Customer (FC), Quality Process (QP), Information Analysis (IA), Strategic Quality Planning (SQP), and Operational Results (OR). Within the frame of these relationships, it is the development of a MBNQ based model, evaluating the MBNQ factors and leadership. The Malcom Baldrige assessment is successful in increasing profitability by improving quality because of its extensive application process. The application process involves and motivates people, provides a proven quality system, focuses on the customer, assesses quality, demands data, provides feedback, encourages sharing, stimulates change and builds financial success (George, 1992).

Involving and Motivating People: The process invites people to think about what they do individually and as a part of a group, department and division to exceed the customers' expectations. Companies use internal experts instead of hiring outside experts to assess quality processes.

Providing a Quality System: The criteria have been designed and are continuously improved by leading quality and business experts. It provides businesses with a standard and effective process to assess their quality issues.

Focusing on the Customer: The application process helps businesses that have forgotten their reason for existence, to focus on meeting and exceed their customers' needs.

Assessing Quality: Businesses are able to determine their strengths and weaknesses and find out if they are headed in the direction of improved quality.

Demanding Data: The award is based on proof, not just stories, assumptions and opinions.

Providing Feedback: Reports what needs to be changed to improve the quality.

Encouraging Sharing: Businesses can benchmark themselves against other businesses to see how competitive they are and find ways to improve their quality through other businesses' successes and failures.

Stimulating Change: Problem solving techniques are used to improve the quality based on the results of the application process.

Building Financial Success: It can improve financial performance by increasing business, establishing an image as a quality leader, reducing the cost of poor quality, and improving critical financial measures (Boehme *at all* 2002).

The Method of Study (Data Collection)

In this study, within the framework of the aforementioned objectives, hotels that function within the service sector have been analyzed and research has been done in order to determine the view points of senior managers and managers in hotels. The focal group in this study consists of all the senior managers and managers working in 4 and 5-star hotels. However, due to the large number of hotels throughout Turkey, this study involves the hotels in big cities and regions where there are a great many number of hotels. Thus, 4-5-star hotels from Ankara, Istanbul, Antalya, Alanya, and Aydn have been selected from hotelguide website.

Questionnaires were used as the method of data collection. 105 questionnaires were sent to senior managers and managers of the chosen hotels. 55 of the questionnaires were completed. Because of the low number of surveys that were returned, face to face questionnaires were also included in the study. As a result, an additional 30 questionnaires were given to hotel managers in Ankara and Istanbul. Out of the total 85, 60 of the questionnaires were taken into consideration.

Research Objectives

This study makes use of the MBNQ criteria. The scale given in the Prybutok and Cutshall research was taken as the basis in relation to the aforementioned criteria. The factors and the number of questions are as follows:

Factors	Question Number
Leadership	7
Human Resources	10
Customer Satisfaction	16
Process Quality	12
Information Analysis	7
Strategic Quality Management	5
Operational Results	4

In order to determine the validity of the question sheets the Alpha Model and the Cronbach alpha were used. The Cronbach Alfa was found to be 0.94, which is a quite high value. To analyze the relationship between six factors given in MBNQ and leadership, factor analyses and regression analyses have been made.

Results

Survey Items: Senior executive LS

Leadership is the category that embodies all other MBNQA criteria (Sullivan, 1992). As mentioned before, the Malcolm Baldrige National Quality Award Leadership Model- which constitutes the main topic of this study- was implemented in the U.S. and certain results were reached. In this study on the otherhand, by taking into consideration the results and findings of this study, analyses will be made on the factors related to MBNQ quality factors.

"Insert Table 1 about here"

During factor analysis, the method of Varimax Rotation was used, and according to the results, the value of Keiser Mayer Olking measure of sampling (KMO) is 0.68 x=170.66., Degree of Freedom is 21, Degree of Significance is 0.00. The variables constitute 66.297 of the total variant. In Table 2 below, the results for 'Leadership' factor analysis are given. As it can also be seen from the table, the factor loading values are quite high and 'the leadership' needs to be evaluated in both groups. The criteria in these two groups can be categorized into two as internal (1, 2, 3) and external organization leadership (5, 6, 7).

Factor 1: HR Development and Management

HR development and planning analyzes the process by which an organization develops and realizes the full potential of its workforce (Leifield, 1992). Table II shows the ten items (monitoring employee satisfaction, team contributions to quality objectives, well defined management practices, etc.) loaded on this factor. While there is one factor related to 'Human Resources' in the original article, 2 factors have emerged in this study.

"Insert Table 2 about here"

As it can be seen in the table as well, the quite high factor loading values and Human Resources need to be evaluated in two groups. The criteria in these two groups can be

named as 'Determining the Needs of Employees' and 'Well-Determined Management Tactics'.

During factor analysis, the method of Varimax Rotation was used, and according to the results, the value of Keiser Mayer Olking measure of sampling (KMO) is 0.852 $\chi^2=320.06$., Degree of Freedom is 45, Degree of Significance is 0.00. The variables constitute 65.38 of the total variant. In Table 2 below, the results for 'Leadership' factor analysis are given.

Factor 2: Customer Satisfaction

Customer focus and satisfaction focus on how an organization manages its customer (Desatnick, 1992). Table III shows the 12 items (such as, how the organization compares on its satisfaction with competitors, industry averages and world leaders, etc.) that were loaded on this factor.

"Insert Table 3 about here"

While in the original article there are 3 factors related to customer satisfaction, in this study- as it can be seen in Table III there are 5 factors. These five groups can be categorized under 'Researching the Efficiency of Customer Management', 'Comparison of the Results of Customer Satisfaction with those of the Competitors', 'Determining the Customer Complaints', 'Measuring Customer Satisfaction' and 'Determining Customer Expectancies.'

Factor 3: Management of Process Quality

Management of Process Quality addresses design, production, support systems, supplier quality, and quality assessment (Heaphy, 1992). Table IV shows the nine items (such as, analyzing process capabilities, customer requirements, monitoring the process, etc.) loaded on factor 3.

"Insert Table 4 about here"

During factor analysis, the method of Varimax Rotation was used and according to the results, the value of Keiser Mayer Olking measure of sampling (KMO) is 0.644 $\chi^2=295.687$., Degree of Freedom is 295.687, Degree of Significance is 0.00. The variables constitute 72.38 of the total variant.

Factor 4: Information Analysis

Table V shows the seven items that were loaded on factor 4 (such as, the use of information, perceptions of the organization's storage, etc.) During factor analysis, the method of Varimax Rotation was used and according to the results, the value of Keiser Mayer Olking measure of sampling (KMO) is 0.654 $\chi^2=152.018$., Degree of Freedom is 21, Degree of Significance is 0.00. The variables constitute 62.10 of the total variant.

"Insert Table 5 about here"

Strategic Quality Planning

Strategic quality planning examines the organizations' strategic business planning and implementation processes (Marquardt, 1992). Table VI shows the four items that were loaded on factor 5.

"Insert Table 6 about here"

While there is only one factor related to Strategic Quality Planning in the original article, in this study there are two factor groups as 'Defining the Strategic Plan Issues,' and 'Extended Information Analysis.'

"Insert Table 7 about here"

At the end of the factor analysis, it is seen that four variables are categorized under one factor (Operational Results). However, for operational results, the factor for each criterion with a value of less than 0.5, will not be included within the "Quality Value." Therefore, hypothesis 6 will not be analyzed.

Regression Analysis

This study takes Malcolm Baldrige National Quality Award (MBNQA) Leadership Model as basis [7] (Prybutok & Cutshall, 2004, p. 558-566). Leadership (L)= $3.201+0.72$, Human Resources (HR)= $+0.273$, Focus on Customer (FC) 0.649 , Process Quality (PQ)= $+0.309$ Information Analysis (IA)

In order to test the relationship between leadership factor and other factors pertaining to Quality Values, this study conducts a Regression Analysis. In the Regression Analysis, 'Leadership' has been taken as a dependent variable. However, during the factor analysis, it is seen that 'leadership' is divided into two as 'internal' and 'external'. Therefore, both dimensions of 'leadership' are taken as dependent variables. In table VIII the external analysis results are given.

"Insert Table 8 about here"

Thus, external Leadership is not affected by 'Human Resources,' 'Focus on Customer,' 'Information Analysis,' 'Strategy Quality Planning,' 'Procedure Quality' factors. Hypotheses 1, 2, 3, 4, 5 have been refuted. Table IX shows the analysis results related to company leadership.

"Insert Table 9 about here"

At the end of the analyses, it is seen that Internal Leadership is influenced by the independent variables ($F=7.859$ $P<0.05$) by 99%.

Table X shows the Regression Analysis Results pertaining to subfactors affecting internal leadership.

"Insert Table 10 about here"

When Table X is analyzed, while internal leadership is a dependent variable, at the end of the analysis, it is seen that the subfactors such as Information Analysis, Human Resources 1 and Human Resources 2 have a positive influence on internal leadership. Therefore, we can come up with the following model:

$$\text{Internal Leadership} = -10.16 + 0.870 \text{ I.A.} + 0.547 \text{ H.R.} + 0.432 \text{ H.R.1} + 0.432 \text{ H.R.2}$$

During the third stage, a regression analysis has been carried out without subcategorizing the factors constituting the Malcolm Baldrige Model. The Regression analysis has been calculated by taking the averages of 61 questions in five dimensions. Table XI shows the analysis result pertaining to factors affecting leadership.

"Insert Table 11 about here"

Human Resources have a positive influence on internal leadership. From the analysis, it is seen that internal leadership is affected by independent variables ($F=7.042$, $P<0.05$) by 99%.

Table XII shows the results of the Regression Analysis pertaining to independent variables affecting leadership.

"Insert Table 12 about here"

Table XII shows the dependent variables explaining the degree of leadership. When Table XII is analyzed, a significant result is reached only for the factor of Information Analysis (IA). The leadership model is set = and the regression equation is tested. However, there are no similarities between these results and those of (Prybutok & Cutshall 2004).

Results and Conclusions

The original article shows model leadership as $(L) = 3.201 + 0.172 \text{ HR} + 0.273 \text{ CF} - 0.469 \text{ PQ} + 0.309 \text{ IA}$. In our study the result is $1.745 + 0.636 \text{ IA}$ ($T= 3.432$, $p < 0.05$, $\text{Beta} = 0.636$) This result shows that the factor of Information Analysis affects leadership, whereas, the other variables, Human Resources, Strategic Quality Planning, Operational Results and Process Quality do not affect leadership. Regression results pertaining to these variables are not significant. ($P>0,05$)

It is seen that the leadership function in Turkey is only related to Information Analysis, whereas, it is clear that Human Resources, Focus on Customer, Process Quality and Operational Results have no relation to the function of leadership.

These findings show that the top executive officials in Turkey, in tourism sector, do not care enough about customer satisfaction and that they do not see a relationship between leadership and customer satisfaction. Also, when one takes into consideration the fact that the executives who have participated in the questionnaires do not see a relationship between leadership and quality, it is seen that executives who work in this sector need to be educated in fields of 'Customer Satisfaction' and 'Human Resources.'

As a contribution to implementation, this thesis show that within the sector of tourism, a one-dimensional leadership, which is directed toward information analysis, prevails in Turkey. Moreover, when this perspective of one-dimensional leadership is compared to the concept of leadership in other countries, it can be argued that this constitutes a disadvantage for Turkey.

This result also shows that the executive officials working in 4-5-star hotels in Turkey are quite successful in areas such as making use of information, disributing information, evaluating the information in an extended manner and documenting the information. However, in order for leaders to be successful, they need to be in full-cooperation with the HR Department, have a customer focused approach and be updated constantly about fields like development of goods, services and processes, and take active role in work related to strategic quality planning. In other words, they need to implement fully the other five factors of the MBNQ criteria.

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Table List

Table 1: Factor Loadings - Leadership

Table 2: Factor Loadings - Human Resources Development and Management

Table 3: Factor Loadings - Customer Satisfaction

- Table 4: Factor Loadings - Management of Process Quality
Table 5: Factor Loadings - Information Analysis
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Table 8: The Analysis of External Leadership
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Table 12: The Regression Analysis of the Independent Variables Affecting Leadership.

Relationship between internationalization and quality of university research

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Key words: Teamworking; Team Effectiveness; High-level Research; Universities research organization

Category: Research paper

Introduction

The growing interest in academic research in the universities can be seen in all areas of knowledge, and it appears to stem from the increased number of specialised publications and the emergence of impact as a factor for measuring the quality of research. The shift also reflects a change in the role of the university. In addition to creating accreditation agencies or bodies to ensure the quality of research, the university can also foster research in groups or teams by changing the conditions for advancement and the incentives that prevail within the university system. As a result, there arises a paradox. While university policies and planning are devised to promote the potentialities and synergies of teamworking, the system of advancement largely centres on individual achievement. To what extent are these two aims compatible? On the other hand, is it a good strategy for these research groups establishing international alliances in order to perform an excellent research? In other words: is it true that international groups achieve better standards in its research?

One of the challenges in summarising the literature on teams remains the difficulty of identifying the variables that have an influence on team output in organisations. The literature on the subject is extensive, and a number of models from diverse perspectives have been put forward to analyse the relationship between the distinct variables and output (Campion et al., 1993; McGrath et al, 2000; West, 2001; Kozlowshi and Bell, 2003; Salas et al., 2004; Gil et al., 2005).

Salas et al. (2004) has, for the most part, grouped and classified the models under two overarching theoretical frameworks. The first group takes a functional perspective (Hollingshead et al., 2004, Wittenmaum et al., 2004) and the theoretical model is the IPO (input-process-output) model of team productivity (McGrath, 1964; Hackman and Morris, 1975; Wittenmaum et al., 2004). The second group is based on the models of Campion and his collaborators (Campion et al, 1993; Campion el at, 1996). They define five broad categories of variables affecting team results: job design, interdependence, group composition or heterogeneity, context and, lastly, process.

This paper marks fourth phase of a study begun in 2005 and builds on papers read at earlier conferences (Triadó and Aparicio, 2005, 2006). The first question was to clarify whether a very big university research groups²¹ – University of Barcelona– were teams or work groups²² and to determine how to characterize the various groups, identifying their defining variables and analyzing correlation patterns. We adopted the IPO model, built on three premises: work groups pursue defined objectives; group behavior varies in quality and quantity and that variation can be measured; and there are both internal and external factors influencing process behavior and output. The findings showed that the groups are not small, but rather exceed twenty researchers. On average, they generally include two chaired professors, five professors and seven visiting researchers. It appears that the presence of a person from Administration and Services Staff (A&SS), normally a technical expert, boosted group productivity, and the most productive groups had at least one in their ranks.

The second phase of the broader work set out to identify whether the need to collaborate with colleagues was the same in all areas of knowledge. It focused on identifying which variables are directly related to the output of research groups. The conclusions were clear in demonstrating that researchers in the sciences showed greater potential for publication than did their counterparts in the humanities. When quantifying the quality of each group's scientific output, the impact of other factors was also apparent, including research momentum (work published by the same group in previous years), assessment and impact of the research, and group size.

In the third phase (Marimon et al, 2010), excellent research groups were identified. Their profile was analyzed to see whether any conclusions could be drawn regarding key success factors. We showed the group characteristics that lead to a cluster of excellence and ensure greater success in research, backed up by publication in prestigious journals²³.

Methodology

The study makes use of a database on the research groups formally constituted by the University of Barcelona. A portion of the data, the most quantitative part, has been provided thanks to assistance from the UB's Office of Research and its GREC system²⁴,

²¹ This university have 109 million euros in research income, 348 research groups with classified as 243 consolidated research groups for the local government, 625 active research projects, 979 research grantholders and 50 research institutes and centres.

²² In a work group, each member pursues individual goals and any output or result is a product of the individual's effort, as is any measure of efficiency or effectiveness. This description fits the university's approach to how research groups function. We think that individual measurement of effectiveness and/or efficiency—researchers are judged and assessed based on their individual progress—is precisely one of the determinant factors in judging whether a research group can be classified *a priori* as a group, and not a team.

²³ It is a matter for future study in another area to establish any relationships between a scholar's quality of research and quality of teaching, in the context of new graduate and postgraduate programmes within the EHEA (European Higher Education Area) framework.

²⁴ GREC is a Research Management application developed at the University of Barcelona and currently in use at several research institutions and bodies.

while the more qualitative information comes from a questionnaire devised by the authors and aimed at the directors of the research groups. The sample universe was made up of the 348 research groups at the University of Barcelona (RGUB), which are spread across twenty faculties and involve a total of 4,730 researchers (table I).

Table I: Study Fact Sheet

CHARACTERISTICS	POPULATION
Universe	348 Research Groups at UB
Selected Sample	169 Research Groups Sample selection was determined by which research groups responded to the questionnaire.
Geographical Area	Barcelona
Time Period	Winter 2005 and Autumn 2006
Data Studied	1994-2005

Source: Own elaboration

The methodology followed in the study can be summarized in five stages. The first stage involved study of each of the analyzed variables (a univariate analysis). Building on previous studies, it made use of variables allowing measurement of group composition, the characteristics or attributes of group tasks, and group efficiency. Identifying which variables influenced work teams involved dividing the *input* variables (from the IPO model) into two groups. The first group was comprised of the variables known as “biodemographic” and the other group included those related to task attributes (Gladstein, 1984; Hackman and Morris, 1975; McGrath, 1986; LaFasto and Larson, 2001) and organisational variables (Campion et al, 1996). Finally, these variables relate to the production of every group of research.

The biodemographic variables affecting groups were identified as age, sex, race/ethnicity, group size and group composition. The variables related to task attributes were found to be research area, group momentum, and number and percentage of civil servants in the group. The organisational variables included the existence within a work group of internal rules and regulations and of subgroups. Lastly, the production variables contain the output between 04-05, productivity, aggregated impact factor of their publications, the qualitative evaluation of these articles, number of read thesis, the average impact factor of each component.

Previous studies have gathered 31 variables defining the characteristics of research groups, and they can be split into the three areas set out in Table II.

Table II: Description of biodemographic variables, task variables and organisational variables

Biodemographic variables

Age (<i>average group age</i>)	Youth in the team can tend to facilitate communication by virtue of similar mindsets or knowledge levels (Tsui et al., 1992), and this could lead to lower membership turnover. Groups with the youngest researchers should be expected to be most aggressive in producing output and, as a result, groups of below-average age ought to achieve higher levels of output (Hambrick, 1994).
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<i>Sex; race/ethnicity; culture or nationality</i>	Following the literature, the second demographic variable to study is gender and its effects on teams (Rogelberg and Rummery, 1996).
Group size	Size is another variable characterising groups. (Dennis and Valacich, 1994). Two variables measured size: the first is the absolute <i>number of group members</i> and second is the <i>number of full-time equivalents (FTEs)</i> that make up each RGUB.
Group composition	In addition to the two group size variables, the composition of the group was also analysed: <i>number of chaired professors, number of professors, contracted teaching staff, visiting researchers and A&SS staff</i> . Also important is the presence of <i>international researchers</i> in the group as well as researchers from other areas, who bring an interdisciplinary approach.
	Another important aspect of group composition is the <i>number of doctoral theses and research grants</i> .

Task attributes variables

Research area	This variable contributes information on the number and quality of the group's <i>outputs</i> . Research groups were divided into two overarching groups, based on their proximity to the <i>sciences or the humanities</i> . Those two classical divisions—sciences and humanities—were used to assess the impact of area of knowledge on the research groups. The type of investigations (theoretical, empirical, o mixed) carried on in each group. Other variable that was asked to the main investigator was his/her own opinion about the kind of their developed research: theoretical, empirical, o mixed
<i>Research momentum or historical output levels</i>	This refers to the number of earlier studies. It acts as a momentum or experience variable (Guzzo et al., 1986) and reflects the learning curve of the groups that are most productive and have the greatest impact. With more projects and papers in hand, groups boost their ability to achieve greater successes in future.
<i>Total number and percentage of civil servants in group</i>	This variable analyses group composition. The literature on the matter is limited, because civil servants are widespread in Spanish organisations.

Organisational variables

Structure	These variables contribute information on group structure and organisation. The identified variables include written <i>rules and regulations in a group</i> , the <i>presence of subgroups</i> and their stability, the formality or <i>informality of communications</i> , the <i>existence of internal coordinators</i> or other similar figures ...
Group administration and updating tasks	This set of variables analyses how current the group's data are and how committed the group is to keep the information up to date. It reflects the quality of the update process used for GREC data.

Production variable

<i>Total output between 2004-2005</i>	Total output have been measured as a total of book chapters, doctoral thesis, papers, or papers accepted in congresses in the years 2004 and 2005.
<i>Productivity</i>	This variable provides information about the average production of each component of the team.
<i>Qualitative assessment of output (04-05)</i>	This is a measurement of the quality of the output. It is the number of articles published in SCI (Institute for Scientific Information) journals.
<i>Individual Qualitative assessment (04-05)</i>	With this information we want identify the average output quality for each researcher.
<i>Impact factor of output (04-05)</i>	This variable is gathering information about impact of output, without any consideration about how many researchers are in each group.
<i>Individual impact factor</i>	This variable is gathering information about impact of papers and output for each individual researcher.
<i>Impact/output ratio</i>	These variables give a measurement of the output impact.

Source: Own elaboration

The second stage of the study involved a factor analysis which was carried out in order to reduce the number of variables without information loss, limiting the initial variables of the study to a few driving factors. The factor analysis did not include all UB research groups, but rather focused on the 169 groups that responded to the questionnaire. From these 169 groups, the questionnaire collected full, valid data on all 31 variables under analysis.

Once the factors were established, the third stage involved a cluster analysis to identify the most common patterns of factors. The aim was to describe each cluster group clearly and to be able to separate out the Excellents groups.

In the fourth stage of the methodology, an in-depth study was carried out to identify how Excellents groups worked and why they were so successful.

Finally, in the last stage, the implication of internationalization is analyzed.

Results

Dimensions that define of the research groups.

Based on the sample, a factor analysis was carried out to reduce the number of variables under study. 169 groups proved to be useful and the 31 variables contributing data on them were reduced to six factors. The sampling adequacy of the KMO factor analysis was 0.706 and Bartlett's test of sphericity was significant at a level of .000. The method chosen to take the analysis forward was the principal components analysis with varimax rotation. Only four factors were extracted so as not to disperse the analysis too much, while capturing almost 70% of the variance.

The first factor (F1) positively incorporates the variables for the number of grant recipients, total grants received in the last two years, the presence of non-Spanish researchers and the number of A&SS staff connected to the research group. It negatively incorporates the percentage of civil servants and the average age of the research group. Without doubt, these variables all measure aspects related to age and

job stability. As a result, this first set of variables shall be designated the “youth or job stability” factor.

The second factor (F2) gathers variables that measure the number of people linked to each research group. Obviously, this includes the number of chaired professors and other professors. In addition, the historical output levels of the group to 2003 are an element, since the variable reflects the sum total of contributions made by the group since its inception. Since the second factor clearly includes all the variables related to group size, it shall be designated the “group size or stature” factor.

The third factor (F3) encompasses the variables that appear to be linked to the quality of scientific output: the impact factor of each individual group member and of the overall output in the period 2004-2005, the qualitative assessment of output in the same period, and the ratio of impact to output. All of these variables refer to the quality of the group’s published work (impact factor, qualitative assessment, etc) both on an individual level (by group member) and on a group level. A straightforward designation of this factor is the “quality” of output factor.

The fourth and final factor (F4) appears to gather the variables the describe the effort put into publication, that is, the output of selected groups, irrespective of quality, both on an individual level (each member’s productivity) and on the group level (total group output for the period 2004-05). It also includes the sum total of doctoral theses defended in the period under analysis. As a result, since the factor captures the group’s capacity for output, it shall be designated simply the “output” factor.

Clusters of research groups.

Next, using cluster analysis, the research groups were put into internally homogenous groups with statistically significant differences between them. The analysis of the conglomerates of k-means yielded three clusters. Applying the appropriate tests, it could be seen that the four factors were statistically distinct and that the means of each cluster, by factor, are as shown in Table III.

Table III: Analysis of cluster averages by factor

Cluster		F1 Youth	F2 Size	F3 Quality	F4 Output
1 Standard	Mean	-.23	-.30	-.192	-.41
	Std. Deviation	.869	.764	.533	.601
	N.	107			
2 Productive	Mean	.53	.68	-.40	.93
	Std. Deviation	1.075	1.190	.637	1.150
	N.	45			
3 Excellent	Mean	.04	.10	2.28	.15
	Std. Deviation	1.063	.892	1.126	.901
	N.	17			

Source: Own elaboration.

Table IV provides a picture of each cluster of research groups. The first cluster (Cluster 1) contains the research groups that are considered “standard” as they do not stand out either in terms of quality or quantity of output. This is the most numerous cluster and includes 107 groups, or 63% of the sample. The research groups in this cluster may be characterized as smaller and contain a greater percentage of civil servants in their ranks.

They have the lowest overall levels of output, productivity and quality. They also have fewer grants and doctoral theses in the last two years than the other groups do.

The second cluster (Cluster 2) brings together UB research groups that place concern on their volume of output, although output volume could also be attributed to group size. This group is labeled as “productives”. This cluster contains 45 research groups whose levels of individual and overall output are the most significant, leaving aside the quality of their output.

The third and final cluster (Cluster 3) is made up of the groups designated “Excellent” research groups. They stand out both because of the quality of their publications and in terms of the qualitative assessment and impact of their publications. This cluster contains 17 groups, representing 10% of the sample. In the final section of the paper, more detailed attention will be given to the Excellent cluster in order to make some interesting comparisons.

Table IV: Cluster profiles

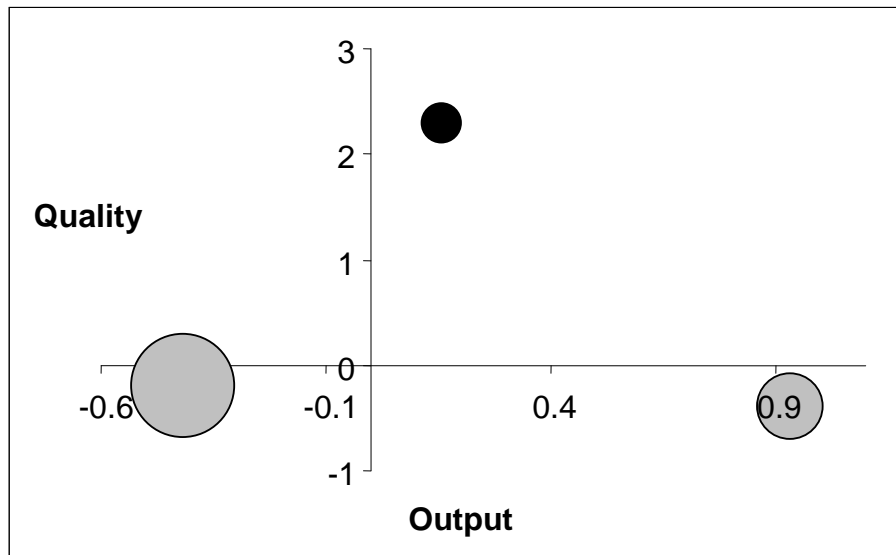
	Cluster 1 Standard	Cluster 2 Productive	Cluster 3 Excellent
Number of people in group	10.65	19.80	17.24
Percentage of men	39.33	41.82	42.50
Number of chaired professors	0.88	1.76	1.71
Number of other professors	2.94	5.29	2.12
Grant recipients	2.08	4.53	3.82
A&SS group members	0.34	0.73	1.00
Average group age	42.17	41.94	41.37
Contract academic staff	2.23	3.62	3.24
Visiting researchers	2.18	3.87	5.35
Total full-time equivalents	6.44	11.05	7.38
Total output between 2004 and 2005	33.83	101.04	73.24
Momentum: total output to 2003	343.75	783.18	824.59
Qualitative assessment of output (04-05)	5.40	11.76	35.82
Impact factor of output (04-05)	13.46	26.26	126.29
Individual impact factor	2.14	2.21	18.07
Impact/output ratio	0.55	0.27	1.91
Percentage of civil servants	40.90	39.65	24.59
Productivity	5.82	11.34	10.63
Specialisation	0.45	0.37	0.70
Sum total of grants in last two years	5.52	11.68	13.11
Sum total of doctoral theses defended in last two years	8.06	17.64	8.47
Presence of non-Spanish researchers	0.55	0.77	0.64

Source: Own elaboration.

In order to study the relative positions of the three clusters in terms of the four factors obtained in the factor analysis, each cluster has been plotted on axes representing the intensities of the factors. In the graph 1, the clusters are represented as bubbles, and the size of each bubble is proportional to the number of research groups contained in it. In other words, the largest bubble corresponds to Cluster 1 (with 107 groups), while the smallest bubble represents the least numerous cluster, which is made up of the Excellent

groups and only contains 17 in total. The *Excellent* bubble is further differentiated by appearing darker. The *Excellent* cluster stands out in terms of the quality of its output, whereas it is located in an intermediate position between the other two clusters in terms of the other factors.

Graph 1: Positioning three clusters against quality and quantity of output factors.



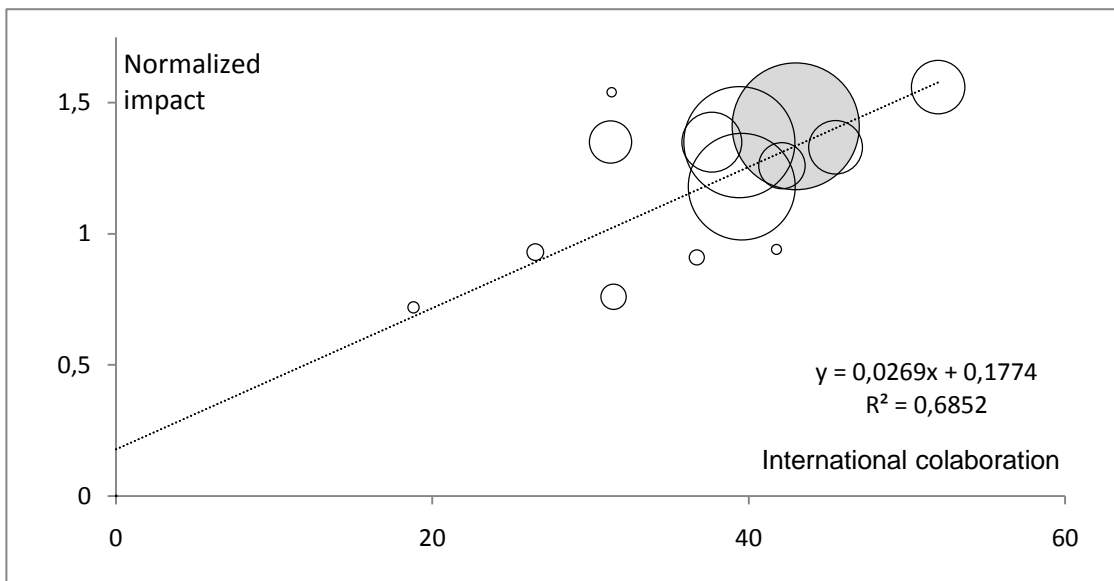
Source: Own elaboration

The positioning map above graphically supports the summary conclusion that quality of output is the factor that differentiates the *Excellent* cluster. As a result, quantity of output, group size and group youth are not explanatory factors.

Impact of internationalization in the quality of the research.

The analysis of the research of the catalane universities provides clues to claim that internationalization and quality research are correlated. Graphic 2 shows the internationalization degree of the universities (in the horizontal axis), the excellence of its research (vertical axis) and the total amount of scientific production (size of the bubble). The University of Barcelona is plotted in dark.

Graph 2: Positioning catalane universities in quality research measured in normalized impact and internationalization.



Source: Own elaboration, from Scimago Institutions Rankings (SIR) World Report 2010 data.

This arouses a new hypothesis. Are also the excellent groups in the University of Barcelona the more internationals? Two Mann-Whitney tests were conducted. The first concludes that the presence on international researchers does not impact on the quality factor (significance .930), while the second concludes that those groups with international researchers are more productive (significance .011).

Nevertheless, the excellent groups have 5.35 visiting researchers on average (while the standard groups 2.18 and the productive 3.87). The *Excellent* gropes also have more presence of non-Spanish researchers (0.64) than the standard groups (0.55), albeit the productive have 0.77.

Profile of excellent cluster and discussion

One factor they all Excellent groups have in common is that they belong to faculties in experimental areas linked to the sciences. This fact reaffirms the conclusion drawn back in phase two of the larger study (Triadó and Aparicio 2006), namely that the research groups most closely tied to the sciences achieved a higher rate of publication and could reach a higher level of excellence than research groups in the humanities. As these groups were created in 1993 on average, they may be said to have established a certain “track record in research”. After all, they average fifteen years’ experience in doing research.

Excellent research groups appear to demonstrate a high level of quality in their output both at a group level and at an individual level.

Regarding to the group composition, Excellent groups have an average of 17.24 members, and it is equivalent to 7.38 full-time. It is remarkable the presence of 5.35 visiting researches on average, as well as 3.82 grant recipients and one person providing administrative support.

In addition to any broader application of benchmarking afforded by the Excellent cluster profile above, Table V presents a comparison between the UB's Excellent research groups and the other UB groups divided by area of knowledge, in the widest sense. The groupings fall into human sciences; law, economics and social sciences; experimental sciences and mathematics; health sciences; and education sciences. The purpose of the comparison is firstly to analyze the composition of the research groups by area and then draw attention to the differences that now exist between the research groups in each area and the best-in-class groups.

Table V: Group profiles, by area

	Excellent Groups	Human Sciences groups	Law, Economics and Social Sciences groups	Experimental Sciences and Maths groups	Health Sciences groups	Education Sciences groups
Visiting researchers	5.35	2.83	1.53	3.23	6.04	1.83
Number of non-Spanish researchers	0.64	1.33	1.65	1.27	1.38	1.48
Average group age	41.37	45.86	43.69	39.06	42.87	46.57
Grant holders	3.82	1.68	1.14	4.48	2.94	1.63
A&SS team members	1	0.26	0.1	1.1	0.7	0.17
Sum total of grants received in last 2 years	13.11	6.45	3.61	10.64	10.29	4.38
Percentage of civil servants	24.59%	42.09	54.87	30.76	27.29	53.91
Number of people in group	17.24	10.75	11.73	16.48	16.55	11.94
Total full-time equivalents	7.42	6.08	8.07	8.77	6.70	7.57
Momentum: total output to 2003	824.59	119.31	150.08	151.6	153.53	167.13
Qualitative assessment of output (04-05)	35.82	0.26	2.43	15.97	16.85	3.69
Impact factor of output (04-05)	126.29	0.26	1.37	44.37	57.96	5.48
Total output between 2004 and 2005	73.24	40.72	57.18	50.98	42.21	72.42
Sum total of doctoral	8.47	11.32	7.09	11.68	8.97	14.35

theses defended in last two years						
Productivity	10.64	7.67	7.46	6.01	6.04	11.65

Source: Own elaboration.

The number of researchers in each RGUB varies between 10.75 and 17.24. The latter number is for Excellent groups, whose full-time equivalents are roughly 7.42 ± 0.95 . Another aspect of the composition of Excellent groups, as well as those in health sciences and mathematics, is that they have an A&SS person, while the other areas have only about 0.2 A&SS. As for visiting researchers, there is a similar disparity, although it is less marked. Lastly, the number of grant recipients and civil servants in each group is notable. Excellent groups contain 24.6% civil servants, the lowest level across all groups, while the maximum number of 54.9% arises in law and social sciences. The number of grants received repeats a similar pattern. Excellent groups received thirteen grants in the years 2005-2006, which is the highest number, while the approximate breakdown for the other groups was, by area, four for law and social sciences, six in human and social sciences and ten in mathematics and health sciences²⁵.

Discussion

The groups in the study are highly heterogenous and show broad differences across biodemographic, attribute and effectiveness variables. In our earlier papers (Triadó y Aparicio, 2005, 2006), three hypotheses were validated that form the basis of the current study:

- a) There is a positive relationship between average group age and a group's productivity. Similarly, average group age is positively related to a group's historical levels of output. By contrast, lower average group age boosts the quality of a group's output.
- b) There is a difference in the quality of publications between groups in the sciences and groups in the humanities. The faculties of Physics, Chemistry, Biology, Geology and Mathematics achieve the highest quantity and quality of output.
- c) Lastly, there is a direct, positive relationship between group size and output, and there is also a relationship of the same sign between group size and quality (both in number of articles and their impact factor).

Based on a factor analysis of the 33 variables in the information matrix, four factors were identified as follows: factor 1 was the "youth or job stability" factor; factor 2 related to group size or stature; factor 3 pertained to the quality of group output; and factor 4 captured the quantity of group output. The subsequent cluster analysis produced three clusters of research groups: standard, productive and Excellent.

The cluster studied in the greatest detail contains the Excellent research groups, whose main features are:

- a) Research in experimental areas linked to the sciences; this link is important.
- b) Fifteen years of track record, on average.

²⁵ The Excellent groups have been treated as a separate group and do not affect the averages of the five areas used in the analysis.

- c) Average group composition of 7.3 full-time equivalents and 17.24 group members (irrespective of level of dedication); 5.35 visiting researchers, 3.82 grant recipients, and an administrator; and a low percentage of civil servants, who make up only 24.59% of their ranks.
- d) High quality of output at a group and at an individual level (they have a group impact factor of 126.29 over the last two years and average individual impact factor of 18.07).

The last issue analyzed allows us to claim that the internationalization does not implies achieving better standard of quality, although the excellent groups are those who receive more visiting professors. The prestige of these groups is attractive for international researchers and faculty members.

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Key determinants of lean production adoption: evidence from the aerospace sector

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Introduction

There has been a significant evolution and expansion of Lean Production (LP) adoption outside its origins in the automotive industry (Womack et al., 1990). Companies in different industrial and service sectors have adopted LP, enabling them, in many cases, to improve their results and competitiveness (Womack and Jones, 1996).

However, adopting LP is a complex task that generally comes up against many obstacles (Scherrer-Rathje et al., 2009). Identifying the factors that explain LP adoption and potentially impact on the results of its adoption is therefore a priority for the companies that are beginning to adopt this management system (So and Sun, 2010).

There is a major current of research that has identified a series of factors that can act as facilitators or inhibitors during the LP implementation process (Karlsson and Åhlström, 1996; Hines et al., 2008). There are, however, few studies that have analysed the factors that might explain the reasons why companies adopt LP (Sohal and Egglestone, 1994; Kojima and Kaplinsky, 2004) and which prior factors are required to manage adoption successfully (Harrison and Storey, 1996; Kochan et al. 1997).

Identifying why and how companies adopt LP is therefore fundamental for ensuring that the adoption process is successful. In fact, having a prior knowledge of these explanatory factors before beginning LP adoption is crucially important (Yasin et al., 2003; Fortuny et al., 2008). For this reason, this study's research question is the identification of factors that might play a role in LP adoption and the interrelationships that exist between these.

To achieve this, the paper has been structured in seven sections, preceded by this introduction. The second section is devoted to analyzing the background to the research. The third section describes the methodology used in the research. The results are set out in the fourth section, while in the fifth we propose a model for adopting LP. Subsequently, we present a discussion of the results and the conclusion. Finally, we present the implications for management and the challenges that future research will have to address.

Literature review

Lean Production

LP is a direct descendant of the Toyota Production System. It has been evolving over a long period of time and will continue to do so in the future (Holweg, 2007). The main goal of this management system is to achieve maximum efficiency by carrying out operations at a minimum cost and with zero wastage. For this, the variability of the whole system needs to be minimised (de Treville and Antonakis, 2006; Shah and Ward, 2007).

LP adoption has spread to companies in different industrial and service sectors (Womack and Jones, 1996; Womack and Jones, 2005; Hines et al., 2008). However, LP adoption is a complex task that generally comes up against a large number of obstacles (Scherrer-Rathje et al., 2009). This has driven interest in research into the factors that explain LP adoption and into the prior factors required to enable companies to successfully manage its adoption (Jayaram et al., 2008; So and Sun, 2010).

In this respect, the prior literature has found a series of factors that are linked to the adoption of LP. On the one hand, the potential benefits that can be achieved with LP (Sohal and Egglestone, 1994), the search for a series of competitive advantages (James-Moore and Gibbons, 1997; Yasin et al., 2003), relationships with other companies that have begun LP adoption and a company's own readiness to embark upon improvement and training programmes (Kojima and Kaplinsky, 2004) have all been identified as triggers for its adoption.

With regard to the factors that are required beforehand for adoption to be successfully managed, research has identified the management's commitment to the Lean initiative (Sohal and Egglestone, 1994; McLachlin, 1997), a prior assessment of the company's situation and its context (Harrison and Storey, 1996; Kochan et al., 1997; Fortuny et al., 2008), the establishment of a culture of continuous improvement and organisational learning (Bayo-Moriones et al., 2008; Yamamoto and Bellgram, 2010) and the prior building of close relationships with the main partners in the supply chain (Jayaram et al., 2008).

However, most prior research has focused on analysing the influence that isolated factors have on LP adoption without using an integrated framework that might also show the interrelationships between these factors in the adoption process (Sohal and Egglestone, 1994; Jayaram et al., 2008; So and Sun, 2010).

Lean Production in the aerospace sector

Over the last decade, the world aerospace sector has been subjected to increasing global competition and the challenge of adapting to technological changes. Whilst in the past competitiveness in the sector was principally based on differentiation and technical issues, in recent years a series of competitive priorities have arisen that are turning into an enabling factor for competing in this sector (James-Moore and Gibbons, 1997; Smith and Tranfield, 2005).

Nevertheless, the inability to respond to unforeseen changes in demand and the long delays in delivery times in the sector demand greater flexibility and adaptation to customers' needs and the guarantee that personnel are as fully-trained as possible (James-Moore and Gibbons, 1997; Crute et al., 2003). For these objectives to be achieved, companies in the aerospace sector have begun to adopt LP and this, in many cases, has enabled them to improve their results and their competitive abilities (Womack and Jones, 1996; Smith and Tranfield, 2005).

The little research that exists into LP in this sector has focused on examining its applicability. There is a consensus that LP is appropriate in the aerospace sector, which is characterised by highly differentiated and hugely complex products, low production volumes and low repeatability (James-Moore and Gibbons, 1997; Murman et al., 2002; Crute et al., 2003).

There have been, however, very few studies that have analysed the factors that explain LP adoption in the sector (James-Moore and Gibbons, 1997; Crute et al., 2003). In this respect, the authors advocate more research on how companies in the sector learn how to be Lean (Smith and Tranfield, 2005), the exploration of how LP is transferred to the aerospace sector (Crute et al., 2003) and on the factors that might influence LP adoption (Murman et al., 2002).

Research methodology

Research design

The adoption of LP in a variety of industrial sectors, such as the aerospace sector, is an emerging research question and case studies are therefore an appropriate method in this context (Yin, 1994). In fact, this researcher argues that case studies are more suitable for answering “how” or “why” questions than other research strategies. Thus, the case study method seems appropriate as it provides the necessary depth for exploring why and how companies have adopted LP.

Exploratory case study research can be a major step towards theory building (Eisenhardt, 1989; Eisenhardt and Graebner, 2007). The multi-case method enables findings to be replicated, thus driving up the external validity of the research (Eisenhardt, 1989), guarding against observer bias (Meredith, 1998; Voss et al., 2002), aiding triangulation, improving the generality of findings (Voss et al., 2002; Yin, 2003) and making the overall study more robust.

Sample selection

To ensure the validity of the findings, the selection of the case studies was a major decision (Stuart et al., 2002; Yin, 2003).

We used a theoretical sampling model (Eisenhardt, 1989; Yin, 1994; Voss et al., 2002). The conditions used in this study were designed to elicit those firms that offered an optimal “opportunity to learn” (Yin, 1994; Stake, 1995) so that the resulting case studies would offer powerful and meaningful insights. Our strategy was based on achieving literal replication (Yin, 2003), using information-rich cases that were distributed for maximum variation (Miles and Huberman, 1994; Stuart et al., 2002). We therefore selected production plants that belonged to the prime contractors in the aerospace sector

that had begun LP adoption and had made advances in its implementation over a minimum period of a year. That the basic unit of analysis was the plant, even when plants could belong to a single group, is due to the fact that the key determinants of LP adoption might vary due to each production plant's own organisational factors. Plants have also been included that differ both in size and in products manufactured. Any possible bias from sampling could therefore be reduced.

The plants chosen as case studies belong to the Spanish aerospace sector. The company database provided by the *Fundación Hélice* (the 'Hélice' Foundation is the Andalusian aerospace cluster, a member of the European Aviation Clusters Partnership) to identify all the companies that make up the population of prime contractors in the aerospace sector. Said database was refined for the aims of our research. As a result we obtained a total of five production plants as case studies, all of which are members of the EADS consortium.

Data collection

An interview protocol was developed based on a review of literature on LP. Before beginning the field work, a preliminary version of the interview protocol was trialled and a pilot study run (Yin, 1994). The script was updated and improved with each visit that took place (de Weerd-Nederhof, 2001).

Both primary and secondary information sources were used in order to triangulate data sources (Easterby-Smith et al., 2002; Yin, 2003). The primary sources used were: in-depth semi-structured interviews, surveys, plant visits/factory tours and, in some cases, statements made by the management. The secondary sources used were: company documentation, company websites and similar sources.

Various respondents (two to three key respondents) were interviewed in all cases to ensure that the information gained from the interviews with the management was reliable. In all cases the plant manager was interviewed and the person in charge of Lean Production in the plant and other Lean Experts were also involved.

We also used multiple interviewers. To be precise, the lead researcher was accompanied by a second researcher in all cases which allowed data to be collected independently and ambiguous issues to be clarified during the data collection process. Apart from improving reliability, this also improves convergence of observations and raises confidence in the findings (Eisenhardt, 1989). The use of various interviewers also helped to limit any observer bias (Voss et al., 2002).

Data was collected between October, 2010, and March, 2011. Each semi-structured face-to-face interview lasted between 75 and 120 minutes. All the interviews were recorded and transcribed immediately afterwards. A database was developed that contained all the interview transcriptions, questionnaires, documents and extensive notes. This also helped to ensure reliability as it provided an easily auditable trail of events. Thus, the data collection strategy employed helped to control for the construct validity of the research.

Data analysis

We have adopted a range of measures to ensure the validity and reliability of the data analysis and interpretation process (Yin, 2003). A within-case analysis was conducted. Within-case analysis helps the researcher to start the process of progressively making sense out of the large amount of data collected (Eisenhardt, 1989). The emerging topics for exploration and explanation were identified in the analysis of the interview and the data, and the relationships between the variables that were identified were explored and defined in the subsequent interviews (Miles and Huberman, 1994).

Thus, triangulation has been sought both within cases (e.g. by comparing primary and secondary data) and between cases (e.g. by comparing the responses of manufacturing plants). The external validity of the research was controlled by confirming the findings with each of the subsequent cases. The various researchers who took part in the project also analysed the data from the interviews independently. Some details have also been confirmed by respondents after the interview. The manual analysis of transcripts was complemented by use of a qualitative research software package (Atlas.ti).

Research findings

Each of the factors identified is illustrated with a quotation from the interviews. Table 1 gives the explanations of the different concepts that we have identified regarding the concepts found.

In the majority of the plants analysed, the interviewees stated that the decision to adopt LP was taken in response to a series of external or environmental factors. To be specific, they mentioned as key determinants of LP the pressure and growing demands from their customers.

“Customers are a pull factor (...) In our plant we also had a production area where the customer demanded we got up to speed in LP... the customers required us to set the bar increasingly higher for a number of objectives, basically, cost reductions, improved delivery times, and quality KPIs. And that’s when we decided to adopt LP.” Plant Manager (P3).

Other external factors that were identified as leading to adopting LP were rivalry between existing competitors and the threat of new competition in the sector.

“We have more and more external competition, that’s obvious. What’s more, you can see there’s going to be ... in a few years time, the situation’s going to change completely. Companies are going to come in from outside. We can see the need for change. So, it’s obvious, that’s why we’ve got to get better and be more cost-effective and adopt LP.” Lean Manager (P5).

These external factors led to LP being adopted in the production plants analysed in two ways. Firstly, in three of the plants, internal motivation within the plant came first.

“The first thing that motivated us to adopt LP was the will to improve, on the plant level. The feeling came up among the management that we had to improve using some structured strategy and we got wind of LP. That was really our starting-point.” Plant Manager (P3).

The second way, in the other two plants, came directly from the strategic decision to adopt LP on the corporate level.

“The motivation behind our adopting LP came from a decision on the group level.” Plant Manager (P2).

What is true is that the strategic decision to adopt LP on the corporate level had important repercussions for adopting Lean Production at all the plants as it gave the initiative a strategic vision, the creation of a Lean organisational structure, coordinated and integrated Lean deployment and, in some cases, the change of plant CEO.

“With the Lean adoption initiative on the division level, you set out to provide a conceptual model for the organisation of LP, the Lean Production department is then created –we hadn’t had one up to then (...) During the first years of adoption it was a kind of experiment that we were running on the plant level and basing ourselves purely on improvement. But when the initiative got backing at division level, that’s when we began to structure it, and now we’re talking about something different to what we had initially been thinking about, which was improving, what we proposed was a change to our production model.” Plant Manager (P3).

In all the cases that were analysed, the interviewees stated that the commitment and leadership of top management were factors of vital importance for LP adoption.

“When it was adopted here, it was because the new Plant Manager was convinced that it was the way to go.” Lean Manager (P5). “The commitment of the top managers is fundamental. You either do it and show that you’re really convinced or no one’s going to change the way they behave... And if the top managers don’t support it and don’t show they support it day-in, day-out, nothing changes; it’s no good for anything.” Plant Manager (P5).

Another factor identified as influencing adoption was the creation of a Lean organisational structure that was closely linked to the drive behind the initiative on the corporate level.

“If you haven’t got the resources, you can’t get Lean Production to work. Several of us heads here at the plant had practically been making these changes part time previously... and we used some of our own time for it, too; but it’s really obvious that an initiative like Lean Production is only possible if you’ve got resources 100% set aside for it. So, creating a Lean organisational structure has been one of the success stories in its adoption.” Plant Manager (P4).

The role of the Lean Leader was also identified as one of the factors for a successful adoption. The appearance of the figure of the Lean Leader converged in time with the creation of the Lean Organisational Structure.

“The people in charge of Lean Production at every plant have played a major role in LP adoption. For me it’s one of the factors that has most driven the change.” Lean Manager (P2).

It was also detected that a prior culture in the plant with deep roots in Total Quality acted as a catalyst for the LP adoption process. A cause-effect relationship was also

seen between the role of top management as a driver of the Total Quality initiative and this preceding deep-rooted culture.

“In the past in this plant there have always been lots of Total Quality-related improvement processes... I started an improvement team focused on continuous improvement and on the back of that it was the catalyst for adopting LP. That meant that when we adopted LP we already had a core group of people who were dedicated to it full time..., we already had continuous improvement teams out there all in line with a vision that we generated at that time.” Plant Manager (P5).

Another factor that was identified was institutional support. The interviewees stated that the Public Administration gave great support to the sector and its modernisation and this enabled them to overcome prior structural inertia.

“The facilities are new and we got support from the Public Administration. This allowed us to make a layout oriented towards Lean. We had a blank sheet to work on during the design stage and that let us design the layout for Lean. In the old facility we were pretty restricted when it came to reconfiguring the processes and creating flow”. Lean Manager (P4).

“The Public Administration is backing our activity heavily. In fact, when we came to these new facilities we got support, you know, with the industrial land, etc., for industrial development. And we also changed the layout as we were already thinking in a more Lean way.” Lean Manager (P2).

Apart from the trigger factors and the factors that were found to impact on the success of LP adoption we also identified a number of factors that companies have had to control during the adoption phase.

The first control factor identified is linked with unionisation. A cause-effect relationship can also be seen in the role that top management plays in controlling this factor.

“There’s a really important factor and that’s social representation. In fact, we’ve been doing the whole implementation in close association with social representation right from the outset (...) Then we set up a number of committees to carry out this whole lean production implementation process. They’re joint committees, between social representation and the management, to do things in a harmonious and agreed way. In fact, it was the Chairman of the Works Committee who kicked the presentation on Lean Production off to the workers and I was the one who finished it, at the same meeting, the both of us together. The force of that is really tremendous!” Plant Manager (P3).

The second control factor that was identified was everyone’s resistance and initial scepticism and this was stated in all the cases under study. A cause-effect relationship can be seen for this factor between the role played by top management and the plant’s Lean Leader and the control of unionisation.

“At the beginning people think that Lean Production is just a fad, something new you want to implement, and the same thing as always will happen, you’ve wanted to implement something and it’ll go out of fashion. At the beginning, there’s this bemusement, resistance and scepticism.” Lean Manager (P2).

LP adoption model

A model can be deduced from the analysis that includes all the factors that were identified and their respective interrelationships. As can be seen in the model, all the factors that were identified can interact with each other and at the same time with the decision to adopt LP.

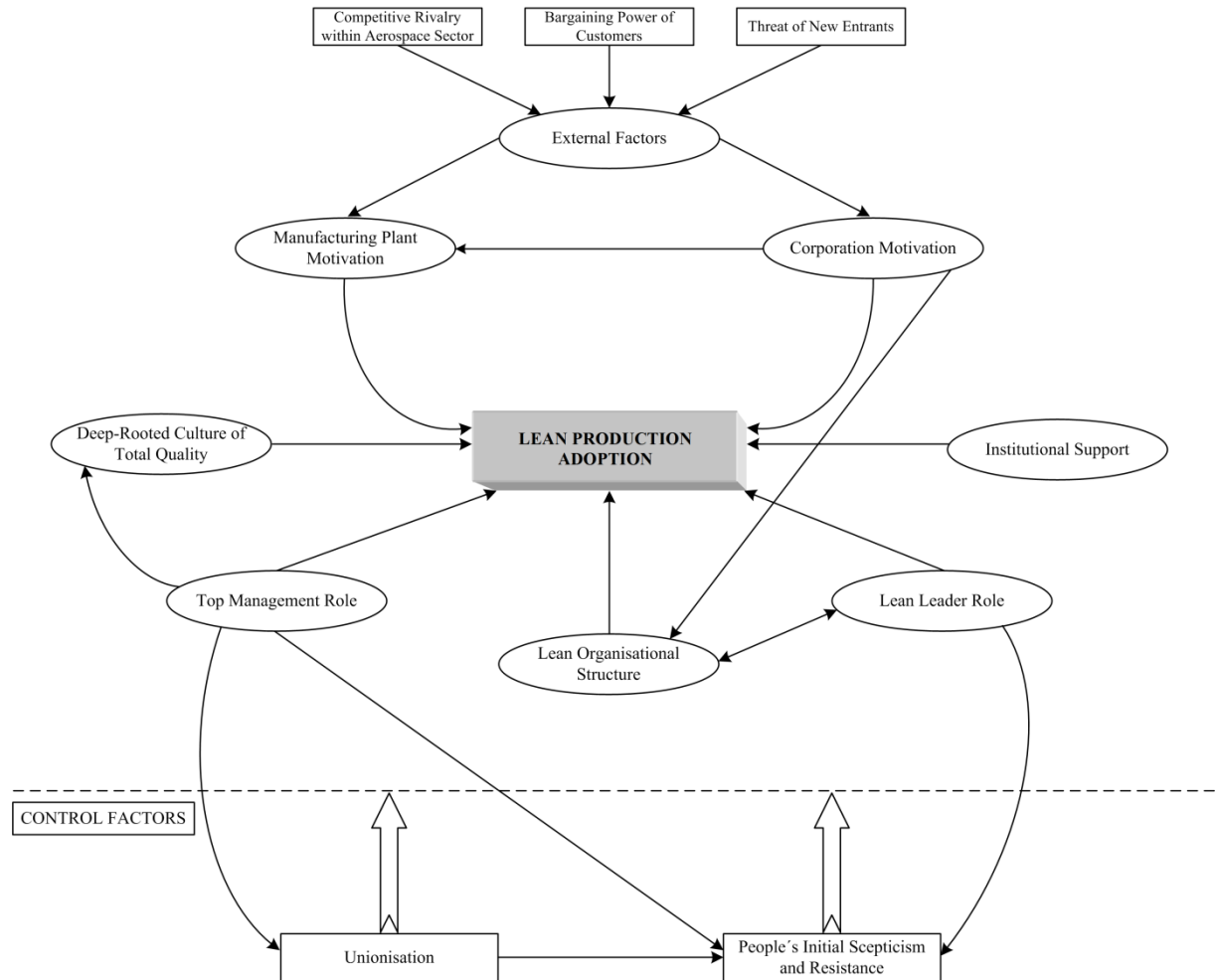


Figure 1. LP Adoption Model

Table I. Factors linked to LP adoption

Key Determinants of LP Adoption	Key Issues
External Factors	
Bargaining Power of Customers	<ul style="list-style-type: none"> Increased customer demands for improved delivery times, more reliable deliveries, cost reductions and improved quality KPIs as factors that trigger LP adoption (P1, P2, P3, P4, P5). Customers pressuring for LP adoption (P3, P5).
Competitive Rivalry within Aerospace Sector	<ul style="list-style-type: none"> Increased competition in aerospace sector as a trigger for adopting LP (P1, P5).
Threat of New Entrants	<ul style="list-style-type: none"> Future threat of new competitors from emerging countries in

aerospace sector as a trigger for adoption (P5).

Manufacturing Motivation	Plant	<ul style="list-style-type: none"> • Need for improvement and decision by plant top management to adopt LP (P3, P4, P5). • Reasons: improved efficiency, increased profits for both company and customers, motivate and engage plant personnel, increased productivity, reduced costs, better quality, improved delivery times, improved delivery reliability, reduced inventory, improved usage of plant capacity. • Experience of Plant Manager in implementing Lean Production in the global aerospace sector (P5).
Corporation Motivation		<ul style="list-style-type: none"> • LP adopted in plant due to decision to adopt on corporate level (P1, P2). • Over time, the initiative to adopt Lean Production on the company level in all plants (P1, P2, P3, P4, P5). Change of company business model, company strategic initiative. Initial Lean Assessment in all plants and definition of a common Lean Production adoption strategy in the plants, not only in manufacturing, but also in design and development, Lean Procurement and the rest of the organisation. • Provision of Lean organisational structure: Lean Leader on corporate level, creation of Lean Production Department on corporate level and at each of the plants, provision of specific resources for the Lean initiative (Lean Leader, Lean Experts, Change Agents). • In some cases, change of plant CEO (P2). • Contracting of personnel (Lean Leaders, Lean Experts, Change Agents) experts in implementing LP in the automotive sector (P1, P2, P3, P5).
Deep-Rooted Total Quality	Culture of	<ul style="list-style-type: none"> • Prior initiative by Plant Manager to adopt Total Quality initiatives as catalyst for LP adoption (P3, P5). • Critical mass of people with organisational culture for improvement, higher degree of teamwork maturity and multifunctional integration as catalysts for LP adoption (P3, P5).
Top Management Role		<ul style="list-style-type: none"> • Full commitment and engagement of top management as catalyst for Lean Production adoption (P1, P2, P3, P4, P5). • Leadership, giving an example to the rest of the organisation and deploying Lean culture in the organisation (P1, P2, P3, P4, P5).
Lean Structure	Organisational	<ul style="list-style-type: none"> • Creation of Lean organisational structure and having full time resources involved in the initiative acted as a factor for success in LP adoption (P1, P2, P3, P4, P5).
Lean Leader Role		<ul style="list-style-type: none"> • Role of Lean Leader as one of the factors that has most developed the change, convincing the rest of the organisation of the need for change and of the benefits of LP adoption (P1, P2, P3, P4, P5).
Institutional Support		<ul style="list-style-type: none"> • Support from Public Administration for siting of new facilities, allowing layout reconfiguration and elimination of inefficiencies and wastage in plant design phase (P1, P2, P4). • Industrial development of sector as a whole (including suppliers) as a

	facilitating factor for overcoming inertia (P1, P2, P3, P4, P5) and favouring modernisation of sector and adoption of new management systems (LP).
Unionisation	<ul style="list-style-type: none"> • Need to control unionisation before adoption of LP is begun, modifying historical social aspects to favour adoption and achieve an agreed adoption of Lean Production (P1, P2, P3, P4, P5). • Creation of Joint Management-Social Representation Committees, joint negotiation prior to LP adoption (P1, P2, P3, P4, P5).
People's Initial Scepticism and Resistance	<ul style="list-style-type: none"> • Initial thinking that LP is just another craze (P1, P2, P5), that it cannot be applied to the aerospace sector (P3), linked to other previous initiatives that failed (P1) and lack of confidence in management's track record (P1). • Role of top management and Lean Leader in convincing rest of organisation of need for change and of benefits derived from LP (P1, P2, P3, P4, P5). • Change in role of top management (greater communication, transparency and contact). (P1, P2, P3, P4, P5). • Top to bottom change of mentality. Chain of command's leadership and commitment (P1, P2, P3, P4, P5). • Training programmes directed at changing people's mentalities and overcoming initial resistance and scepticism (P1, P2, P3, P4, P5).

Discussion and conclusions

Our aim with this paper is to contribute on prior research on the key factors for adopting LP.

Our results indicate a series of factors in the environment that act as triggers for the adoption of LP. To be precise, we found three of Porter's (1980) five competing forces. Nevertheless, we found a greater consensus among respondents that adoption was triggered by an increase in customer demands and pressure to adopt Lean Production.

We also identified the search for a series of competitive priorities ratifying and broadening those found in the literature as a trigger of LP adoption (James-Moore and Gibbons, 1997; Crute et al., 2003).

In other respects, all the respondents that had adopted LP as an internal plant motivation stated that with the corporate initiative their initial concept of Lean Production adoption focused on specific initiatives for improvement changed to one of a strategic vision. This conclusion is in line with successful LP adoption requiring a holistic and strategic vision (Hines et al., 2008).

Another vitally important factor for LP adoption identified was the leadership and commitment of top management, corroborating previous findings (Sohal and Egglestone, 1994; Crute et al., 2003). One factor detected as a catalyst for the adoption of Lean Production was a deep-rooted culture of total quality (Bayo-Moriones et al., 2008) driven by the top management. However, once companies had reached a high

degree of maturity in Total Quality they opted for adopting LP as a competitive strategy to drive up their competitive capacities.

We detected two factors that facilitate the adoption of LP that have received less attention in the literature. To be specific, the creation of a Lean organisational structure that converged in time with the creation of the figure of Lean Leader. All the respondents stated that these two factors were drivers of Lean Production adoption.

We also detected another factor that has received little attention in research, institutional support. Support from the Public Administration gave the sector a boost and accelerated its industrial development and modernisation. This was seen to be an important facilitator for overcoming inertia and for adopting new management systems such as LP (Sousa and Voss, 2008).

In other respects, we found two factors that companies controlled before adoption. The first was unionisation, which was managed through the setting up of joint Management-Social Representation committees in order to achieve joint agreement on adoption and change certain historical social aspects that might have hindered LP adoption. This finding sheds light on prior research on the role played by unionisation in LP adoption which did not show any conclusive evidence (Kochan et al., 1997; Shah and Ward, 2003). In this regard, we found that the management of unionisation before commencing adoption is a prerequisite for guaranteeing that Lean Production is adopted successfully.

The second control factor that was identified was people's initial scepticism and resistance (Smith and Trandfield, 2005). The companies that were analysed managed this factor mainly through the role played by top management and the Lean Leader in convincing the rest of the organisation of the need for change and the benefits derived from LP. The control of unionisation also had an effect on the ability to overcome initial resistance and scepticism.

Managerial implications and future research

In the following we offer a series of implications that might be useful for managers responsible for the LP adoption process.

Firstly, company top managers who are proposing to adopt LP must from the outset demonstrate their leadership and full commitment to the initiative. This is absolutely essential if the adoption is to be successful. Secondly, companies with a prior Total Quality culture that wish to augment their competitive capacities have great inertia that might facilitate their Lean Production adoption process.

In other respects, companies that embark on a Lean Production initiative can accelerate the adoption process by creating a Lean organisational structure or, at least, having a series of people, such as Lean Leaders, at their disposal who are devoted full time to the adoption process and its structuring and deployment as a mechanism for ensured success.

Before initiating the LP adoption process companies should also attend to a series of factors which, if not appropriately managed, could hinder or curb the adoption process. In this respect, we especially highlight achieving joint and agreed negotiation with

unionisation as a prerequisite for LP adoption. Similarly, we issue a call to managers who decide to adopt LP to pay special attention to initial scepticism and resistance and to use a variety of mechanisms to overcome these and ensure the success of adoption, as without the engagement and commitment of the whole organisation to LP, the initiative is doomed to failure.

Our study is not without limitations. Firstly, it is qualitative and exploratory and, therefore, the generalisation of our findings is limited. Secondly, we have managed to identify a series of interrelationships between the factors found, but it has not been possible to measure their intensity.

These limitations do open interesting avenues for further research. Suggested future research would therefore be the validation of the model in other industrial and geographical contexts. Further research is also proposed to assess the intensity of the interrelationships between the factors that were identified.

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ISO 9001:2000 application according to TQM in SMES: an empirical research

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Category: Case study and research paper.

Backgrounds and objectives

ISO 9000 series of standards first emerged in 1987 with the aim of being a credible indicator of the application of some quality management practices in companies. This initial version of ISO addressed quality issues in categories such as quality policy, quality documentation and quality planning. Many authors studied this new management tool and found that ISO offered a reasonable first step toward implementing quality (Bradley, 1994; Taylor, 1995; Tummala and Tang, 1996; Stephens, 1997; Skrabec, 1999; Sun, 2000; Yusof and Aspinwall, 2000; Escanciano *et al.*, 2001; Withers and Ebrahimpour, 2001; Claver *et al.*, 2002; Gotzamani and Tsiotras, 2002). However, many authors also contended that the quality issues were addressed in a disjointed way scattered throughout the ISO document in various categories. The general impression at the time was that there did not seem to be an overarching TQM framework that guided overall ISO adoption. Consequently, many others raised issues contentiously about how well such a standard would compare with the overall TQM system (Goetsch and Stanley, 1998). It is true that there are common dimensions between ISO and TQM, and they rest largely on their emphasis upon process management and statistical tools. However, one consistent message that has come through in the writings of various authors (Reimann and Hertz, 1996; Lee *et al.*, 1999; Zhu and Scheuermann, 1999; Gotzamani and Tsiotras, 2001) is that companies that were certified under ISO 9000 would still fall far short of implementing a TQM system. Several authors (e.g., Goetsch and Stanley, 1998; Martínez-Lorente and Martínez-Costa, 2004) have presented a discussion of such comparisons between ISO and TQM.

In December 2000 a new version of the standard was approved with important changes that approach it to a TQM system. In this sense, authors such as Dobb (2004) and Schlickman (2003) point out that the key change in the new version is its adoption of the systems perspective inherent in TQM. ISO 9001:2000 has introduced the principle of continuous improvement that was conspicuously missing in the previous versions. This previous version was often referred to as a quality assurance system at best, but the new version includes elements of TQM philosophy that separates it from a mere quality assurance system. The new ISO 9001:2000 is poised to fill the gaps of its predecessors and ultimately serves as a definitive first step toward a higher level of quality management and performance. However, a question still not answered is how much of what has been intended in the new version would actually affect the quality management practices in the companies that adopt it. For instance, Choi and Eboch

(1998) point out that, when the motivation for implementation is “institutional” as is the case of ISO standards, the impact of the implementation might not be as immediate or direct as one might suspect. Taylor and Wright (2003) affirm that the impact of ISO 9000 certification on TQM can be argued in both ways. On the one hand, ISO 9000 can be regarded as a stepping stone to TQM. Alternatively, it can create a conformance culture that is the antithesis of continuous improvement.

This problematic is aggravated when the company that implements the standard is small or medium sized. Before moving towards TQM, majority of SMEs prefer implementing ISO systems (Urbonavicius, 2005). SMEs have less financial resources to invest in quality management practices and consequently have to choose the one that can provide the fastest results at a minimum cost. In this sense, Aldowaissan and Youssef (2006) appoint that efforts to convince these businesses to buy into ISO 9001 have focused on underlining the benefits of registration and finding ways to reduce the cost of consultation/registration. To reduce cost, some consultants would cut on development time, force the use of pre-prepared documentation templates, minimize employees’ involvement and training, and suggest registrars who are document auditors rather than quality auditors. The outcome is an affordable ISO 9001 certification at the expense of quality”.

However, there is an important reason to convince SMEs about the importance of implementing a “real” quality management system. This is found in the literature regarding ISO 9000, which highlights the importance of implementation motivation for obtaining higher results. Companies applying ISO 9000 by external motivation, such as either a customer pressure or a promotional tool, saw fewer benefits from it than those companies that were convinced of ISO 9000’s possibilities to improve management practices and, consequently, performance (Huang, 1998; Van der Wiele, Dale and Williams., 2000; Withers and Ebrahimpour, 2001; Singels et al., 2001). The only way of recovering the investment that the company has done with the ISO 9000 implementation is obtaining higher performance, and, in this sense, Corbett et al. (2005) found that firms that received certification did not, on average, see an improvement in their absolute performance. They did see an important improvement in their relative performance, compared to their uncertified peers. So, by implementing ISO they will avoid losing customers but not gaining new ones, what would increase their performance.

In this paper we intend to make a contribution to help SMEs to obtain the maximum from their ISO 9000 implementation by doing it according to TQM philosophy. In this way, companies will upgrade their quality management system, that will not only serve to show third parties that the company is ISO certified but also to really improve quality management internally, providing them the opportunities to get higher performance.

Since the standard is quite generic (applicable in service and manufacturing companies for all sectors) it is not possible to create a model of implementation for all kinds of companies. In this sense this work focuses in furniture SMEs companies.

Exploratory study

We decided then to follow a case study research design, which has been chosen because it is well suited to understand a phenomenon (i.e. quality management practices) in its

real-life context (Yin, 2003). Case research is therefore useful when a phenomenon is broad and complex, where the existing body of knowledge is insufficient to permit the posing of causal questions, when a holistic, in-depth investigation is needed, and when a phenomenon can not be studied outside the context in which it occurs (Bonoma 1985; Benbasat et al. 1987; Yin 2003). Thus, this method provides to identify common or presenting themes in furniture industry with the intention of identifying opportunities to improve its quality management practices. Our choice is a multiple-case study since this approach increase external validity and reliability (Martínez-Costa, 2003).

The cases of this research were 27 furniture companies of Murcia (a south-east region of Spain). These companies were selected from SABI database. The SABI database contains financial statement information for more than 500,000 Spanish and Portuguese firms.

Personal interviews were used to capture information on the quality management system. This method allows the researcher to pose more complex questions and explain possible misunderstandings. According to Yin (2003) interviews are a flexible way of collecting data and it focuses directly on the case study topic. Interviews were the main source of data collection for each case, supplemented by documentation about the organizations from SABI database (such as economic and financial documents).

Data were collected between September 2005 and December 2005 by means of personal interviews. The interviews were aimed at quality managers. These interviews were generally of half to two hours duration.

In order to ensure the validity of this research, in the interviews a semi-structured questionnaire was used. This was formulated from the emerged frame of references in order to answer to the research problem and the research questions. The interview guide used was read and commented by several researchers in order to test the comprehension of the questions and in order to improve the formulation of the questions. This questionnaire was divided into several sections (general question, communication and marketing actions).

At least two interviewers visited each company and make careful notes during the whole interview and in order to ensure the validity both researchers made their own notes. Furthermore, in order to ensure the reliability of this research, a tape recorder was also used during the interviews. This enables the researchers to double check that the respondents had relevant answers in regard to the actual questions. This provide us also with the opportunity to double check our answers and made us sure that we did not miss any important information. Also during the evaluation and handling of the data collected the researchers tried to be as objective as possible to ensure the reliability of the research.

The postal survey

Using the case study and the literature review, a model of application of ISO 9000 according to the principles and practices of total quality management and according to the specific characteristics of the furniture sector was developed (see appendix). In order to measure TQM implementation the point of departure was mainly the scale of Flynn et al. (1994). It is appropriate for manufacturing companies and is validated and

accepted as a good measurement of TQM in the literature (Malhotra and Grover, 1998). We depurated and changed some of the items to adapt it specifically to our findings in the case study. For example, we found that statistical process control (SPC) is difficult to apply in these furniture companies since they do not produce large series of the same product. Therefore, we deleted the item of Flynn et al. (1994) questionnaire related to SPC. Regarding performance, managers were asked on how their companies compared with their competitors on different measures of results (see appendix).

We choose a 5 point-scale for questions of the ISO-TQM model because according to some authors (Lissitz and Green, 1975), scales with more than 5 points are less reliable, and also because our pre-test proved that 5 point scales were easier to answer and they could improve the response rate. However, regarding performance, as the last two questions asked the manager to position himself from strong worsening to strong improvement in the company from the certification/TQM implementation, companies would probably only answer from the middle of the scale to the end. Consequently, with a 5-point scale we would only have had 3 points. With a 7-point scale information would be richer. In the pre-test this suspicion was confirmed so we decided to apply the 7-point scale just for performance measurement.

Population was comprised by Spanish furniture companies with more than 20 employees and included in the “SABI” (Sistema de Análisis de Balances Ibéricos) database. Total population was comprised of 874 companies.

Data was gathered by a postal questionnaire sent to the companies in the population. This methodology is widely recognised for confirmatory studies in operations management since publications in more rigorous scientific journals apply it, being quality management and specifically, ISO 9000, one of the five premium areas of interest (Rungtusanatham et al., 2003). Questionnaires were sent to the attention of the “quality manager” without specifying the name of the manager, since the database did not contain this information. Inside each envelope we included a presentation letter, a questionnaire and a pre-paid addressed envelope to be returned with the fulfilled questionnaire. In the letter, quality managers were offered a future summary of final conclusions.

The first sending of the questionnaire was made in June 2007. In October 2007, with the objective of improving the response rate, as advised by Frohlich (2002), a second sending was done to 619 randomly selected companies that had not responded the first time. The number of valid received questionnaires was 128. It constitutes a response rate of almost 15%. Although it is a low response rate compared to ideal, it is a very good one taking into account that our questionnaire was sent to small and medium companies.

Results

Reliability and validity

The first step in our research is to evaluate if the scales of measurement are reliable and valid. Internal consistency is the most common applied way of measuring reliability. However, as it has been shown by several authors (Diamantopoulos and Winklhofer, 2001, Diamantopoulos and Sigauw, 2006) this is not appropriate when the scale is

formative, as we consider is our case. We consider that our scale is reliable since it has been previously tested doing a multiple case study.

Content validity in our research can be assumed since the TQM scale has been previously accepted in the literature (Flynn *et al.*, 1994).

Convergent validity is theoretically grounded on the basis that one scale used to measure one concept is correlated with another with the same purpose. In our questionnaire we introduced a direct question about the implementation of TQM with this objective. We are able to test if both measurements are correlated. As one of them is a categorical variable we did an analysis of variance (ANOVA) comparing the means of values for each scale, dividing the sample into companies that said to be applying TQM and companies that did not. Table I shows the results.

Table I: Convergent Validity

		N	Mean	F	Sig.
Management support	<i>Do not apply TQM</i>	105	2,9794	9,510	,003
	<i>Apply TQM</i>	25	3,4910		
Information	<i>Do not apply TQM</i>	105	2,6757	14,972	,000
	<i>Apply TQM</i>	24	3,2282		
Process control	<i>Do not apply TQM</i>	105	3,5474	4,391	,038
	<i>Apply TQM</i>	25	3,9100		
Customers orientation	<i>Do not apply TQM</i>	105	3,4452	6,455	,012
	<i>Apply TQM</i>	25	3,8160		
Suppliers relationship	<i>Do not apply TQM</i>	105	3,9460	,378	,540
	<i>Apply TQM</i>	25	4,0400		
Design	<i>Do not apply TQM</i>	105	3,1672	3,860	,052
	<i>Apply TQM</i>	24	3,4070		
Human Resource Management	<i>Do not apply TQM</i>	105	3,1929	11,014	,001
	<i>Apply TQM</i>	25	3,6368		

Except for suppliers relationship the rest of dimensions present significant differences (design at the 10% level). This output leads us to think that the rest of dimensions of the scale have convergent validity because, despite not having used two scales to corroborate it, the scale converges towards a measure that is supposed to converge. The reason because there are no important differences in the dimension of suppliers relationship between companies that say to apply TQM and companies that not could be that the recommendations on this topic are so widespread amongst companies that are applied for a majority of them. This reason is supported by the fact that the mean of suppliers' relationship is higher than the rest of means of the other TQM dimensions. Therefore, and in order to increase the interest of the analysis, we decided to maintain this dimension.

Sample Bias

Once collected the information, there are possible bias that can be tested. First of all, it could be thought that respondents are more interested in quality than non-respondents and this could mean that respondents have higher levels of quality management than non respondents. This problem was faced assuming in first place that quality levels of non respondents are similar to the levels of the latest respondents. The averages for each dimension of total quality management of both the first respondents and respondents of the second wave were then compared. No important differences were detected. It was also tested if there were differences in size (number of employees), income or profits with the same result.

Another possible bias is the person who answers the questionnaire. We compared the means of size, income or profits amongst all the possible respondents and did not find any difference.

Consequently, it cannot be affirmed that our sample is biased in those aspects. However, we can not defend that the sample is not biased by another fact that could not been checked.

Test of the model

An Analysis of variance was made in order to examine possible differences in quality levels for companies applying ISO or not. Table II shows the results:

Table II: Levels of Total Quality Management for companies applying ISO 9000.

	ISO	N	Mean	F	Sig
Management support	Yes	63	3,0745	0,076	0,784
	No	64	3,0374		
Information	Yes	63	3,0092	17,963	0,000
	No	64	2,5398		
Process Management	Yes	63	3,7579	4,862	0,029
	No	64	3,4528		
Customers orientation	Yes	63	3,7079	12,625	0,001
	No	64	3,3055		
Suppliers relationship	Yes	63	3,9603	,044	0,835
	No	64	3,9349		
Design	Yes	63	3,2756	1,685	0,197
	No	64	3,1493		
HRM	Yes	63	3,4575	12,141	0,001
	No	64	3,0901		

These results show that, at least for 4 of the 7 TQM dimensions, ISO 9000 companies are being managed taking into account the TQM recommendations in a greater degree than non ISO 9000 ones. This could mean that managers of ISO 9000 companies have seen that the certification process is an opportunity to introduce TQM in their companies. This could also mean that companies that previously apply TQM have more odds of passing the certification process and decide to do it. Possibly, the explanation could be a mixture of these two suppositions. The explanation of the lack of significance of the differences between ISO 9000 and non ISO 9000 companies could be:

- a) Management support. Although not all managers want the ISO 9000 certificate for their companies, managers of both ISO and non ISO companies are aware of the importance of quality and tried to implicate employees in its improvement. Maybe not all of them agree in the proper way of improving quality (using ISO 9000 or not) but they all agree that management support is crucial to improve quality. This agreement is supported by the literature since all researchers include management support amongst TQM dimensions.
- b) Suppliers' relationship. As we have said before, this can be a TQM dimension that is so widespread amongst companies that the fact of applying TQM or ISO 9000 is not relevant in its application.
- c) Design. This is a key dimension for furniture companies since the customer's decision for this kind of products depends in a great degree of the design of the product. Therefore, as it happens with the other two dimensions, all types of companies try to apply these recommendations independently of the application or not of ISO 9000. Moreover, the case study showed that in many cases the design was subcontracted and, therefore, the control on the design process was lesser. This fact could be independent of being certified or not and, therefore, could create noise in the data.

An ANOVA was done to look for differences in the levels of performance between companies certified and not certified companies. Table III shows this analysis.

Table III: Differences in performance between ISO and non-ISO companies

	N	Mean	F	Sig.
ISO	63	5,2249	6,987	0,009
NO ISO	64	4,8752		

The analysis indicates a small but significant better performance of certified companies, being therefore a support of getting the certificate by furniture companies.

It has also been analysed if there is a positive correlation between the application of the different TQM dimensions and performance (see table IV).

Table IV: Correlations of TQM dimensions with performance

		Management support	Information	Process management	Customer orientation	Suppliers' relationship	Design	HRM
Performance	Pearson	0,281	0,447	0,474	0,349	0,368	0,411	0,494

correlation							
Sig.	0,001	0,000	0,000	0,000	0,000	0,000	0,000
N	128	127	128	128	128	127	128

The results shown in table IV indicate that there is a positive relationship between application of all TQM dimensions and performance. This fact supports the literature on TQM, showing again the positive effects of this management system. However, since our model was designed thinking in a specific industry, it adds a new contribution to the knowledge on TQM. However, since there was a positive relationship between being certified and performance and there also was a positive relationship between being certified and the application of some TQM dimensions, the explanation of the results shown in table IV could be that the positive effect is due not to TQM implementation but to the fact of being certified. Therefore, we analysed the correlation between the TQM dimensions implementation and performance only for certified companies. Our results are shown in table V.

Table V: Correlations of TQM dimensions with performance for ISO companies

		Management support	Information	Process management	Customer orientation	Suppliers' relationship	Design	HRM
Performance	Pearson correlation	0,233	0,308	0,319	0,104	0,307	0,278	0,407
	Sig.	0,066	0,014	0,011	0,416	0,014	0,028	0,001
	N	63	63	63	63	63	62	63

Table V data support the previous results of table IV, since the relationship is positive and significant in all cases except Customer orientation. This implies that although the certification has its own benefits, the performance can be increased applying in more degree TQM dimensions. Only the Customer orientation dimension of TQM appears to be completely fulfilled with the application of ISO 9000.

Conclusions

This paper has explored the phenomena of ISO 9001 and TQM applied to a specific industry, the furniture sector. A model of application of TQM valid to get the ISO 9000 certification and specifically designed for furniture companies has been proposed and tested. Two research methodologies have been applied in order to design and test the model. In order to design the model a multiple case study was developed with the collaboration of 27 companies. In order to test the model a postal questionnaire was sent to 874 companies and 128 of them finally sent their data. This mixture of these two

research methodologies lead to the researchers to get the best of each one, improving the quality of the research.

Our model was based upon a previous model, Flynn et al. (1994) one, introducing the changes derived of the information got with the multiple case study and maintaining its same TQM dimensions. The use of previously published models in prestigious journals contributes to create a more solid structure of knowledge since we built on previously built theories and add a new flat to the TQM theory.

The analysis of the data shows that our model of 7 TQM dimensions is reliable and valid. Therefore, a model of TQM according to ISO 9000 and valid for the furniture industry has been finally proposed.

Using this model other two questions have been checked:

- a) ¿Are ISO 9000 certified companies applying really a better system of quality management than non certified ones? The answer could be yes, they are, since certified companies apply in a greater degree 4 of the 7 TQM dimensions of the model: Information, Process Management, Customer orientation and Human Resource Management. However, our research cannot test the cause-effect since it is not longitudinal. Therefore, the reason because ISO 9000 companies have a higher mean on these dimensions could be that they had it before the certification process and this was a help and incentive to get the certificate.
- b) ¿Is our model correlated with performance? As previous models of TQM have shown, our model is also correlated with performance, being therefore a new corroboration of the TQM benefits, in this case, for furniture companies. However, correlations do not demonstrate a cause-effect relationship. However, we consider that the contrary cause-effect relationship –greater performance implies greater application of TQM dimensions- has not support in the TQM theory.

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Appendix

Mark your level of agreement/disagreement in these statements (1: completely agree; 5: completely disagree)

All major department heads within our plant accept their responsibility for quality	1	2	3	4	5
Managers are truly compromised with the quality objectives					
The top priority is evaluating plant management in quality performance	1	2	3	4	5
top management strongly encourages employee involvement in the production process	1	2	3	4	5
Workers are rewarded for quality improvements	1	2	3	4	5
We pay a group incentive for quality improvement ideas	1	2	3	4	5
Our plant has a annual bonus system based on plant productivity	1	2	3	4	5
Non financial incentives are used to reward quality improvement	1	2	3	4	5

Processes in our plant are designed to be “fool proof”	1	2	3	4	5
Workers don’t allow a defective product to pass to the next section					
We make extensive use of statistical and non-statistical tools (Pareto charts, Ishikawa diagram..)to improve processes	1	2	3	4	5
Charts showing defect rates are posted on the shop floor	1	2	3	4	5
Charts showing schedule compliance are posted on the shop floor	1	2	3	4	5
Charts plotting the frequency of machine breakdowns are posted on the shop floor	1	2	3	4	5
Workers are always told when they do a good job	1	2	3	4	5
Preventive actions are taken to avoid potential non-conformities (possible defects in products that could appear, still not present)	1	2	3	4	5
Workers participate in the determination of preventive actions	1	2	3	4	5

Our plant emphasizes putting all tools and fixtures in their place	1	2	3	4	5
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We take pride in keeping our plant neat and clean	1	2	3	4	5
Material circulation in the plant is perfectly planned	1	2	3	4	5
Our workers are disciplined and do their tasks according to requirements	1	2	3	4	5
Plant can be controlled visually	1	2	3	4	5
Preventive maintenance plans are strictly applied	1	2	3	4	5
Machinery is rarely broken	1	2	3	4	5
Workers participate in the daily maintenance of the machinery that they use	1	2	3	4	5

We frequently are in close contact with our customers	1	2	3	4	5
Fairs attendance is the main mechanism to determine customers needs	1	2	3	4	5
All members of the organization are conscious of the importance of satisfying customer needs	1	2	3	4	5
Our customers often visit our plant	1	2	3	4	5
Our customers give us feedback on quality and delivery performance	1	2	3	4	5

We strive to establish long-term relationships with suppliers	1	2	3	4	5
Quality is our number one criterion in selecting suppliers	1	2	3	4	5
We rely on a small number of high quality suppliers	1	2	3	4	5

New product designs are thoroughly reviewed before the product is produced and sold	1	2	3	4	5
Customer requirements are thoroughly analyzed in the new product design process	1	2	3	4	5
We usually test prototypes in a small sample of consumers	1	2	3	4	5
Competitors actions are taking into account at the time of designing new products	1	2	3	4	5
Product quality is more important than cost	1	2	3	4	5
Quality is more important than schedule concerns in the new product development process	1	2	3	4	5
Direct labor employees are involved to a great extent before introducing new products or making product changes	1	2	3	4	5
Our suppliers participate in the new product's design	1	2	3	4	5
There is little involvement of manufacturing and quality people in the early design of products, before they reach the plant	1	2	3	4	5
We work in teams, with members from a variety of areas to introduce new products	1	2	3	4	5

We use ability to work in a team as a criterion in employee selection	1	2	3	4	5
We use problem solving ability as a criterion in selecting employees	1	2	3	4	5
We use work values and ethics as a criterion in employee selection	1	2	3	4	5
Our plant is organized into permanent production teams	1	2	3	4	5

During problem solving sessions, we make an effort to get all team members' opinions and ideas before making a decision	1	2	3	4	5
Our plant form teams to solve problems	1	2	3	4	5
There is a description for every job in the company	1	2	3	4	5
We often congratulate people or groups that do successfully their jobs	1	2	3	4	5
We try to get that our workers are polyvalent, so they can do different jobs	1	2	3	4	5
We evaluate training provided to workers	1	2	3	4	5
Workers have autonomy and flexibility to do their jobs	1	2	3	4	5
The company provides training in a continuous basis	1	2	3	4	5
We plan training systematically according to the workers' needs	1	2	3	4	5
Communication between management and workers is frequent and fluid	1	2	3	4	5
In the past three years, many problems have been solved through small group sessions	1	2	3	4	5

Please, select in which competitive position is your company in comparison with its competitors relating to these performance measurements (1: Much worse, 7: Much better)

	Much worse						Much better
Unit production costs	1	2	3	4	5	6	7
Fast deliveries	1	2	3	4	5	6	7
Flexibility to change production volume and inventories	1	2	3	4	5	6	7
Cycle time	1	2	3	4	5	6	7
Design quality	1	2	3	4	5	6	7
Manufacturing quality	1	2	3	4	5	6	7
Customers satisfaction	1	2	3	4	5	6	7
Employees satisfaction	1	2	3	4	5	6	7
Market share	1	2	3	4	5	6	7
Company's image	1	2	3	4	5	6	7

Shopping frequency and maximal customer satisfaction in Spanish food retailing: Implications and managerial opportunities

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Introduction

Customer satisfaction represents a key aspect for firm survival, prompting extensive analyses by practitioners and academics in the customer research field (Ciavolino & Dahlgaard, 2007; Chowdhury, 2009; Churchill & Surprenant, 1982; Day, 1984; Hennig-Thurau & Klee, 1997; Westbrook, 1987), as well as in the services domain (Bodet, 2008; Lenka, Suar & Mohapatra, 2009; McCollough, Berry, & Yadav, 2000; Oliver, 1997; Rust & Oliver, 1994). In this latter context, several studies indicate that satisfaction constitutes an antecedent of loyalty (Bodet, 2008; Sivadas & Baker-Prewitt, 2000; Yu & Dean, 2001), which has vital importance for establishing and maintaining tight bonds with customers (McCollough et al., 2000).

Food retailers may be especially conscious of the importance of customer satisfaction for the success of their commercial strategies (Al-Awadi, 2002; Gómez, McLaughlin, & Wittink, 2004), so they look constantly for resources and capacities on which to base competitive strategies while still taking into account customers' satisfaction and needs (e.g., Davis, Mentzer, & Stank, 2007; González-Benito, 2002). A literature review identifies several store attributes that customers use to differentiate food stores from competitors. That is, key store attributes identified by marketing literature are relevant enough that food retailers can to differentiate themselves from their competitors among their end markets (e.g., Ganesh, Reynolds, & Luckett, 2007; Gómez et al., 2004; Martínez-Ruiz et al., 2010). We therefore attempt identify the factors that underlie these attributes by analyzing the relation between customers' perceptions of the key factors and their satisfaction with their purchase. This focus appears especially relevant in response to studies in the services domain that call for a greater understanding of the relationship between perceived service quality and satisfaction (e.g., Spreng & MacKoy, 1996).

However, most research does not identify store attributes or analyze their influence on customer satisfaction, including the maximum level of customer satisfaction –which should be the objective of any retail manager in the industry – (e.g., Al-Awadi, 2002; Barsky, 1995; Spiller, Bolten & Kennerknecht, 2006) –, and the different aspects of retail patronage behavior. This research line holds great interest for retail store managers, and because food retailers strive to achieve a maximum level of customer satisfaction, they usually make decisions based exclusively on their search for customer

satisfaction, which may cause them to underestimate some of the associated costs. Food retailers need a clearer understanding of the relationships between store attribute perceptions and customers' willingness to patronize a store (Carù & Gugini, 1999). Furthermore, as services providers, these food retailers also must determine whether their main objective is to satisfy consumers through their performance or deliver the maximum level of perceived service quality (Spreng & MacKoy, 1996).

In addition, several previous works detect strong relationships between store attribute perceptions and variables of retail patronage behavior, including the frequency of visit (Baker et al., 2002; Gehrt & Yan, 2004; Pan & Zhinkan, 2006). In turn, this research analyzes how the perception of different store attributes, and their underlying factors, affect the maximum level of customer satisfaction (in contrast to any level) by examining the differences according to a crucial retail patronage behavior variable, namely, shopping frequency. Figure 1 illustrates the research's conceptual model. (Figure 1)

In the next section, we review some characteristic attributes of food stores identified in relevant literature, after which we consider the data we obtained from a sample of 422 customers, gathered in retail food stores in a representative Spanish city (La Caixa, 2008). We establish the factors underlying these attributes and propose hypotheses pertaining to the influence of perceptions of these factors on customer satisfaction. To test our proposed hypotheses, we then perform a binary logistic regression analysis to confirm which factor has the greatest influence on the maximum level of customer satisfaction. Our empirical analysis includes the shopping frequency, such that in addition to formulating a general model about the effects of diverse factors on the maximum level of customer satisfaction (Model 1), we derive an alternative model with different subsamples of customers, distinguished by the frequency of their visits (Model 2). We discuss some interesting conclusions and recommendations relative to managing food stores, mainly regarding the attributes and factors of the store that customers value to a greater extent and the sources of differentiation for food retailers.

Attributes Characteristic of Food Stores

The conditions for business survival in different industries largely relate to the ability to satisfy customers with an offer that is somehow better than that provided by competitors (Al-Awadi, 2002; Carù & Gugini, 1999; Valdani & Busacca, 1992; Zeithaml, Berry & Parasuraman, 1996). Differentiation constitutes a key element of success in the food industry; if food retailers can convince consumers to perceive their establishment and offer as superior to those of the competition, it should initiate greater satisfaction with the purchase. Marketing literature identifies several store attributes that differentiate retailers and have positive value for clients. Therefore, the more positive customers' perceptions of these attributes, the more satisfied they will be with a purchase at the store.

Price remains an important element for determining consumers' perceptions of a store. Retailers often employ price strategically to obtain a certain image in consumer markets. Many food stores design their price strategies to obtain a discount price positioning, featuring reduced prices for the products and product categories (i.e., loss leaders) that seem most important to consumers. This strategy often targets customers who exhibit greater price sensitivity (e.g., Dunne & Kahn, 1997). However, no research

confirms the role of consumers' price perceptions absolutely. Lichtenstein, Ridgway, and Netermeyer (1993) show that price offers a positive cue because it indicates quality, prestige, or status. Yet Dodds (1995) argues that consumers perceive price negatively as an economic sacrifice. In both positive and negative respects, price perception operates as marketplace cues that aids consumers in their decision-making process in complex market situations (Dodds, 1995).

A discount price policy, whether in the form of low price levels or sales promotions, can benefit the retail distributor (Martínez-Ruiz et al., 2008) by increasing sales in a product category, accelerating purchases in the retail store, or creating traffic in the store (e.g., Blattberg, Briesch, & Fox, 1995; Martínez-Ruiz et al., 2006; Arnold, Oum & Tigert, 1983; Walters & Rinne, 1986). However, retailers also must note the adverse effects, such as the potentially positive relationship between the price paid and perceptions of product quality (e.g., Dodds, Monroe, & Grewal, 1991; Rao & Monroe, 1989). Consumers with limited information resources tend to use price as an indicator (Rao & Monroe, 1988). Therefore, consumers might choose retail stores that sell at higher prices to reinforce their expectations of quality when they face conditions of uncertainty (Tellis & Gaeth, 1990).

Other attributes also relate to perceived quality, and retailers can use these criteria to differentiate their establishments too (Binninger, 2007; Pan & Zinkhan, 2006). For example, the quality of the merchandise sold influences the value perceived by consumers and constitutes an essential component of consumers' evaluations of the establishment (e.g., Baker et al., 2002). Thus, the merchandise that a store offers influences the retailer's reputation and consumer purchases (Darden & Schwinghammer, 1985; Pan & Zinkhan, 2006).

The assortment—that is, the variety of products and number of different items offered by a retailer (Levy & Weitz, 1995)—also helps define the retail strategy and serve the tastes and preferences of different clients (Buchanan, Simmons & Bickart, 1999; Dhar, Pain, & Thomas, 2001). Greater variety helps the retailer attract more consumers and stimulate those consumers to make more purchases. An ample product range also can diminish perceived costs (e.g., travel time, effort) associated with purchasing and facilitate the purchasing task by enabling a comparison across stores (Baker et al., 2002). Thus, a retail distributor that offers greater variety likely improves the convenience of the purchase situation and should thereby increase customer satisfaction (Dellaert et al., 1998).

A private-label represents a strategic asset for retailers, because it increases the variety of stock and can support other positioning objectives in the long term. Binninger (2007) and Gómez & Rubio (2006), among others, note that retailers consider own brands as a means to obtain superior benefit margins because of the flexibility they have to fix prices and establish promotions. A distributor brand also provides a powerful tool to create a favorable image of the establishment, because it can offer more information about products and promise a good quality–price relationship (Corstjens & Lal, 2000). In the modern retailing environment, distributors promote their own brands for reasons of both profitability and to manage their brand identity. To consolidate this brand identity, distributors may intensify their efforts to increase the quality of their brands, as well as the presence of competing brands and their marketing communications (Medina, Méndez, & Rubio, 2004).

Consumers' attention is another attribute of the retail establishment. Certain consumer groups enjoy speaking to and socializing with others during purchases, to attain a social experience (Tauber, 1972; Williams, Slama & Rogers, 1985). Generally, these consumer groups experience the motivation to associate with similar people to reduce feelings of boredom or solitude. In this context, purchasing provides an activity that consumers perform to alleviate that sensation of solitude (Rubenstein & Shaver, 1980). The desire for human interaction can prompt consumers to visit stores where they find amiable, communicative personnel. No doubt that in building good customer relationships, it is essential that customers feel that service employees are friendly and exhibit personal warmth (Huang & Shyu, 2009).

Other services offered by the retailer rely on self-satisfaction perceptions, which demand convenience. Convenience is a key modern benefit, and customers' perceptions of it (e.g., opening times, proximity, parking) exert a positive influence on their satisfaction with the service (Al-Awadi, 2002; González-Benito & González-Benito, 2005). The perception of time and effort they must expend to shop also influences perceptions of service convenience (Berry, 1995), and retail facilities can affect these perceptions. For example, a location nearer the customer's home reduces transaction costs (e.g., transportation, time spent) associated with the purchase.

Finally, the atmosphere of the store represents a distinctive element. Kotler (1973) observes that the atmosphere of a commercial establishment, as experienced by the senses—sight, sound, scent, and tactile—constitutes a retail element that has a significant influence on the decision to buy. Investigations in shopping centers indicate consumers tend to make purchases according to their attitudes toward the atmosphere (Finn & Louviere, 1990, 1996; Gentry & Burns, 1977). For example, recreational buyers who enjoy buying for leisure might impulsively buy because of the appealing décor of an establishment (Bellenger & Korgaonkar, 1980). Lambert (1979) suggests that establishments should provide rest areas and a suitable ambient temperature. The ambience of an establishment can intensify both pleasure and displeasure; therefore, time spent and purchase amounts likely diminish in disagreeable environments and increase in pleasant environments (Donovan et al., 1994).

Data Description and Hypotheses Development

From the information we gathered in our data collection, we determine the importance that consumers attribute to different attributes that are characteristic of the commercial establishment, and we identify factors that underlie these attributes. Using these factors, we establish hypotheses pertaining to their influence on consumer satisfaction.

Sample and data collection

We administered the study questionnaire during March 17–31, 2008, through personal interviews with customers in various retail food establishments that employ diverse formats located across the city of Cuenca (Spain). This city's size is representative of most cities in Spain (La Caixa, 2008). We used a convenience sampling approach, in which we approached potential respondents during both morning and evening sessions as they left retail outlets. The interviews took place outside different types of retail

stores, including hypermarkets, supermarkets, discount stores, and convenience stores. We gathered 422 valid questionnaires (see the technical specifications in Table 1).
(Table 1)

Questionnaire, variable measurement, and hypotheses development

The questionnaire included questions designed to obtain general information about customer satisfaction, the purchase experience, and customers' profiles. Specifically, the first question dealt with overall satisfaction, and questions 2–11 measured store attribute perceptions. Respondents rated the store from 1 (poor) to 5 (excellent). Because our interest is in the maximum level of customer satisfaction, not any other level, we obtained a dichotomous variable from the overall satisfaction measure to determine the maximum level of customer satisfaction. This latter variable, obtained a posteriori, equals 1 if the customer was totally satisfied with the purchase and 0 otherwise. To elaborate on the focal questions, we addressed main attributes identified in previous studies (e.g., Al-Awadi, 2002; Gómez et al., 2004; Spiller et al., 2006). Finally, question 13 asked about the respondent's shopping frequency. Table 2 summarizes these variables and indicates whether they are explanatory, endogenous, or classification, as well as their scales and denominations.

(Table 2)

Considering the relationships among the explanatory variables in the second group of questions and their high degree of correlation, we followed the methodology proposed by Gómez et al. (2004). By applying a factorial analysis of the main components, we identified a reduced set of factors without correlations that explains the greatest degree of variability in the answers. However, prior to conducting this analysis, we verified the sampling adequacy with the Kaiser-Meyer-Olkin (KMO) coefficient. In this case, the KMO measure is 0.760, greater than the established limit of 0.5. In addition, Bartlett's sphericity test reveals a high value that, with a level of meaning of 0.000, rejects the hypothesis of no significant correlation and ensures the analysis of main components applies to the focal variables. (George & Mallery, 1995).

We provide the factor loadings for a three-factor solutions in Table 3. These three factors, which account for 56.45% of the variation in the ten attributes, are: customer services and convenience (CSC), which accounts for 24% of the variance and relates to assortment variety, proximity to the home, attention to customer, additional services, store atmospherics, and opening times; quality image (QI), which accounts for 17.8% for the variance and is associated with perceived quality of the products offered and brand; and economic value of the purchase (EV), accounting for 14.7% of the variance, which is associated with reduced price and sales promotion. Internal consistency for all factors was assessed by Cronbach's alpha coefficient. Internal consistency was found to be good for factor 1 (Cronbach's alpha coefficient = 0.75) and factor 3 (Cronbach's alpha coefficient = 0.7) and moderate for factor 2 (Cronbach's alpha coefficient = 0.65). In practice, a level of alpha that indicates an "acceptable" level of reliability has traditionally been 0.70 or higher (e.g., De Vaus, 2002; Nunally, 1978). However, interpretation of alpha in particular contexts such as social sciences, is generally more complicated than that, and some use smaller levels.

(Table 3)

These findings align with those obtained by previous works, which indicate the importance of services offered to the client, the quality image, and the monetary value of the purchase. For example, Gómez et al. (2004) identify these three factors as determinants of the retailer's ability to differentiate between competitors.

Although Grace & O'Cass (2005b), Martensen (2000) and Szymanski & Henard (2001), among others, noted how the drivers of customer satisfaction are industry specific, the literature review suggests that perceived value in the previous factors is the most significant predictor for customer satisfaction (e.g., Ciavolino & Dahlgaard, 2007). As a matter of fact, Binninger (2006) not only emphasizes the direct influence of perceived product quality on customer satisfaction but also finds an indirect effect, such that perceived quality increases the value that the customer associates with the distributor's brand. Grace and O'Cass (2005a) highlight the relationship between the economic dimension of the purchase and satisfaction, as do Zeithaml (1988) and McDougall and Levesque (1994). The latter authors posit that the monetary value of the purchase is an antecedent of satisfaction and perceived quality, because customers who perceive that they receive value for money they spend are more satisfied than customers who do not.

Hence, there is no denying that these factors might represent important antecedents of customer satisfaction (e.g., Al-Awadi, 2002; Berné & Martínez, 2007; Binninger, 2006; Gómez et al., 2004; Mittal, Ross, & Baldasare, 1998). To analyze the potential influence of these factors on the maximum level of customer satisfaction with a purchase, we propose the following hypotheses:

H1: Customers' superior perceptions of the services and convenience offered by a food retailer enhances the customers' maximum satisfaction.

H2: Customers' superior perceptions of the quality image offered by a food retailer enhances the customers' maximum satisfaction.

H3: Customers' superior perceptions of the economic value offered by a food retailer enhances the customers' maximum satisfaction.

The hypothesis testing considers different subsamples of customers, which we distinguish according to their shopping frequency.

Model Development and Analysis of Results

We conducted a binary logistic regression analysis using the customer database to test the hypotheses. This technique is suitable for cases in which we want to explain the behavior of a dichotomous endogenous variable according to other explanatory variables, as in our study. Specifically, we hope to predict the dichotomous variable using three factors: customer services and convenience, quality image, and economic value. To determine the parameters of the model, we rely on the maximum verisimilitude method.

The Cox-Snell and Nagelkerke statistical pseudo- R^2 values attempt to quantify the proportion of variation explained by the model of logistic regression, similar to R^2 in a linear regression model. The probability of the observed results, given the estimations of the parameters, is verisimilitude. Because verisimilitude is a small number and less than 1, most research uses -2 times the logarithm of the verisimilitude to measure the adjustment of the model to the data. A good model produces significant verisimilitude in the results (i.e., reduced value of the -2 log of the verisimilitude).

In Table 4, we present the pseudo- R^2 and $-2 \log$ of the verisimilitude values for the total sample of customers. The former measures are reasonable; the factors in the realized model predicts between 9.9% and 14.7% of the variability in the maximum level of customer satisfaction. None of these statistics can explain variance in an way analogous to the R^2 coefficient of the linear regression though.

(Table 4)

We provide the results of the analysis for all respondents in Table 5. The data pertaining to the estimated parameters indicate that the factors that most influence the maximum level of customer satisfaction are services and convenience offered by the retailer and then quality image (confidence levels of 99% and 95%, respectively). Differences in the values of the coefficients show that though services make the greatest contribution to satisfaction, image has the smallest effect. We do not detect any significant influence of the economic value of the purchase on satisfaction.

(Table 5)

These findings support H1 and H2; for the total sample of customers, services and convenience and quality image influence the maximum level of their satisfaction with the purchase experience.

However, the results differ when we investigate customer subsamples. As we show in Table 6, with respect to services and convenience, we find the highest average among customers who purchase weekly and the lowest among those whose shopping frequency is smaller than fifteen days. The same pattern holds for perceived quality, that is, the highest average for weekly purchasers and the lowest for those who take more than fifteen days. Finally, with respect to economic value, the highest average occurs among customers who purchase once every two weeks, whereas the lowest emerges for those whose frequency is less than fifteen days. The Kruskal-Wallis test shows that the different subsamples are independent and reflect different populations.

(Table 6)

Tables 7 and 8 contain the pseudo- R^2 and the parameters estimated for the different customer subsamples. The values of Cox and Snell's and Nagelkerke's pseudo- R^2 are reasonable; the model with the greatest explanatory capacity contains consumers who purchase daily and can predict between 30.5% and 45.1% of the variability in the maximum level of customer satisfaction. The smallest explanatory capacity appears for the model with consumers who purchase once every two weeks.

(Tables 7 and 8)

For customers who purchase daily, the factor that contributes most to the maximum level of customer satisfaction is services and convenience, followed by image. The same trend appears for customers who buy several times per week. However, among customers who purchase weekly, only services and convenience influences the maximum level of customer satisfaction. Finally, among customers who display the lowest shopping frequency, the only factor that influences satisfaction is economic value.

We find support for our second hypothesis, pertaining to the quality image of the establishment, among customers who visit the store daily or several times per week. We also can confirm the first hypotheses about perceptions of services and convenience for customers who purchase every day, several times per week, or once a week. The perception of economic value hypothesis receives support only among customers whose shopping frequency is every two weeks or less. In Table 9, we summarize these results. (Table 9)

Therefore, a higher shopping frequency indicates a greater propensity to value the convenience, services, and quality image factors offered by the food retailer more. The more frequently consumers shop, the greater their awareness of the attributes that constitute these factors. In contrast, when consumers shop less frequently, they are more aware of the economic value offered by the retailer. Thus more frequent consumers (who probably purchase smaller baskets of goods) appear to attribute greater value to convenience and services, as well as quality images. Less frequent shoppers likely purchase larger baskets, and they are the ones who prioritize the economic value the retailer offers. Taking these tendencies and value preference into account, it seems plausible that retailers could use improved convenience, service, and quality image offers to increase and enhance consumers' shopping frequency.

Conclusions, Further Research, and Strategic Implications

This research recognizes the influence of customer satisfaction—especially satisfaction due to customer perception of certain store attributes—on food retailers' ability to differentiate themselves from other competitors and thereby obtain a strong position in consumers' minds that in turn supports firm survival and competitiveness. Therefore, we attempt to determine the influence of factors that underlie store attribute perceptions on the maximum level of customer satisfaction, because this goal should be the focus of any retail manager.

The findings have great relevance, especially in the important food retailing sector. Retail operators need to find ways to maintain and even improve their competitive position in their dominant area. Many retail companies constantly search for resources and internal capacities on which they can construct competitive strategies, in addition to developing the abilities necessary to determine how customers perceive them.

To determine which factors customers value most as means to differentiate food retailers, as well as their relations to satisfaction, we have conducted a descriptive investigation. In particular, we considered key attributes identified by prior literature as relevant and then obtain main factors that underlie these attributes according to a factorial analysis of the main components. Our overall objective has been to analyze which of the factors displays the greatest influence on the maximum level of customer satisfaction, which should be of great interest to retail managers.

Furthermore, we analyze a sample of 422 consumers who purchased from different types of self-service food establishments in a representative Spanish city. Our analysis includes shopping frequency as a key variable of retail patronage behavior, and the results confirm that for the total sample of customers, perceptions of service and convenience, along with a quality image, have positive and significant influences on the

maximum level of customer satisfaction. However, we also find some significant differences depending on the subsample of customers we assess.

Among customer subsamples with different purchase frequencies, we find that perceptions of service and convenience have positive and significant influences on the maximum level of customer satisfaction for consumers who make daily, weekly, or multiple weekly purchases. People who shop daily or several times a week also express more maximum satisfaction based on their perceptions of the quality image of the establishment. Finally, the economic value of the purchase has a positive and significant influence on the maximum level of customer satisfaction when customers purchase less frequently.

Therefore, we show that higher purchase frequencies suggest a greater influence of services and convenience and quality but a lesser influence of the economic value of the purchase. Hence, more frequent consumers –probably shopping smaller baskets of goods –seem to attribute greater value to convenience and services, as well as quality images. In turn, less frequent shoppers –who likely purchase larger baskets –appear to prioritize the economic value offered by the retailer.

This study therefore offers some interesting recommendations for managing establishments. First, we identify factors that customers value most. These particular factors facilitate managers' ability to define their strong and weak points and determine the areas they may need to improve to maintain their competitive position in the market. Second, our study reveals a group of underlying factors and determines the influence of each on the maximum level of customer satisfaction. Thus, managers can better design and implement marketing strategies that support the amplitude and range of products and brands, services and convenience offered, the quality image of the establishment, or the monetary value of the purchase, as appropriate.

Third, because this study considers both a total sample of customers and different customer subsamples derived on the basis of their shopping frequency, it offers additional value. Specifically, it notes elements that can help retailers construct a sustainable competitive advantage through differentiation and suggests the designs of marketing strategies that may increase clients' satisfaction, depending on the type of establishment and customer profiles. More specifically, it appears reasonable that retailers use improved convenience, service, and quality image offers to increase and enhance consumers' shopping frequency.

Many open questions remain in relation to this topic. For example, further research should analyze the impact of the detected factors on the degree of customer loyalty toward certain commercial formats and specific establishments. We also consider the interesting possibility that the identified factors may influence the degree of selection of certain product categories, particularly according to shopping frequency.

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Figure captions

Figure 1. Research’s conceptual model

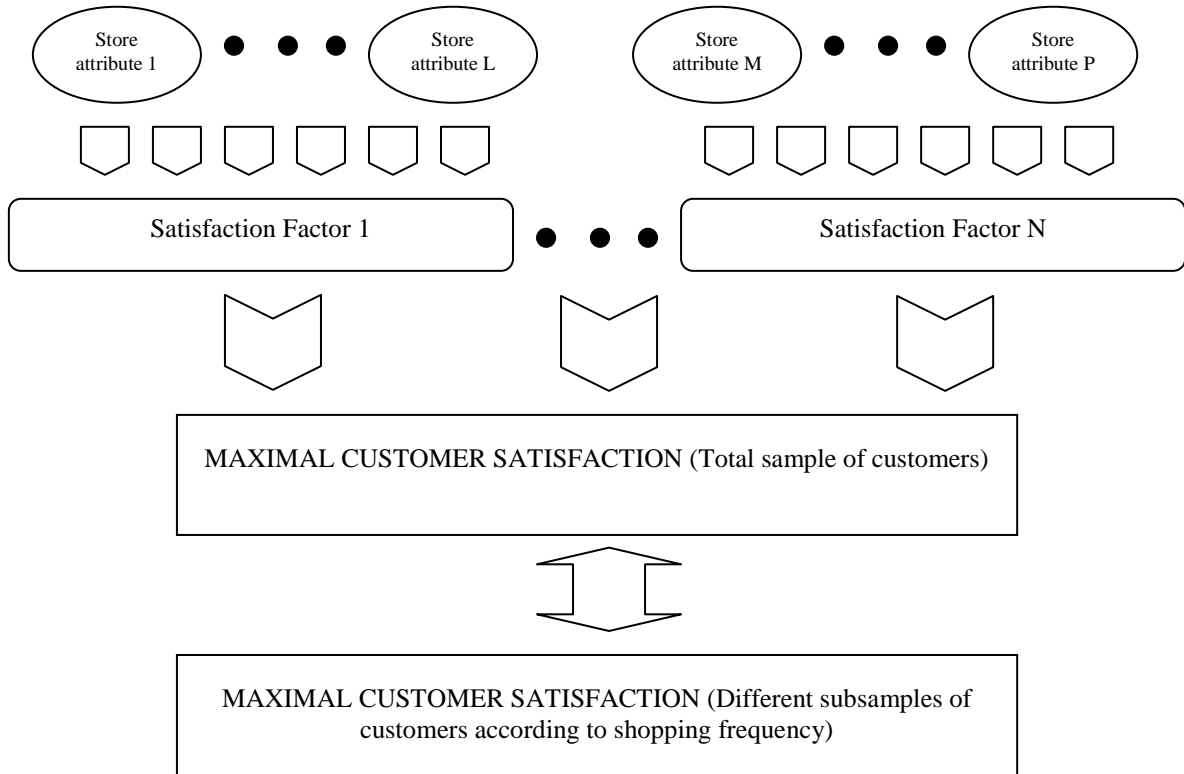


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Table 1. Questionnaire specifications

Universe	52,980 individual residents in the city of Cuenca (Spain)*
Unit sample	Consumers older than 18 years (40,075 people)
Geographic scope	Cuenca capital
Method of information collection	Personal survey
Place for carrying out the survey	Retail food store establishments located

	in the selected metropolitan area.
Sample size	422
Sample procedure	Non probabilistic: By convenience
Date of field work	17–31 March 2008

**According to La Caixa (2008).*

Table 2. Variables used in the study

Name of variable	Measurement scale	Type of variable in the model	Definition
Overall satisfaction	Metric	Endogenous	Satisfaction after shopping: Poor (1) – Excellent (5)
Reduced price	Metric	Explanatory	Price perception regarding the whole shopping experience (5 point scale): Poor (1)- Excellent (5)
Sales promotions	Metric	Explanatory	Sales promotion perception regarding the whole shopping experience (5 point scale): Poor (1)- Excellent (5)
Quality of the offer	Metric	Explanatory	Quality perception regarding the whole shopping experience (5 point scale): Poor (1)- Excellent (5)
Commercialized brands	Metric	Explanatory	Brand perception regarding the whole shopping experience (5 point scale): Poor (1)- Excellent (5)
Proximity to the home	Metric	Explanatory	Proximity perception regarding the whole shopping experience (5 point scale): Poor (1)- Excellent (5)
Assortment	Metric	Explanatory	Assortment perception regarding the whole shopping experience (5 point scale): Poor (1)- Excellent (5)
Customer Attention	Metric	Explanatory	Customer service perception regarding the whole shopping experience (5 point scale): Poor (1)- Excellent (5)
Additional services	Metric	Explanatory	Additional services perception regarding the whole shopping experience (5 point scale): Poor (1)- Excellent (5)
Store atmospherics	Metric	Explanatory	Store atmospherics perception regarding the whole shopping experience (5 point scale): Poor (1)- Excellent (5)
Opening times	Metric	Explanatory	Opening times perception regarding the whole shopping experience (5 point scale): Poor (1)- Excellent (5)

			scale): Poor (1)- Excellent (5)
Shopping frequency	Categorical	Classification	Shopping frequency of the consumer: (1) Daily (2) Several times a week (3) Once a week (4) Every two weeks (5) Less
Notes: Because our interest is the maximum level of customer satisfaction, we obtained a dichotomous variable from overall satisfaction, equal to 1 if the customer was totally satisfied with the purchase and 0 otherwise.			

Table 3. Store factors

Identified Factor	Reliability Alpha	Survey Elements: Specific Attributes	Factor Loading
<i>Customer services and convenience (CSC)</i>	.75	Assortment variety	.540
		Proximity to the home	.564
		Customer services	.604
		Additional services	.661
		Store atmospherics	.823
		Opening times	.742
<i>Quality image (QI)</i>	.65	Quality	.650
		Commercialized brands	.772
<i>Economic value of the purchase (EV)</i>	.70	Reduced price	.849
		Sales promotion	.837

Table 4. Model summary: Total sample of consumers

-2 log of the verisimilitude	R ² Cox and Snell	R ² Nagelkerke
431.610	.099	.147

Table 5. Relation of explicative variables and maximum level of customer satisfaction: Total sample of consumers

	Estimated Parameters
Constant	1.223***
CSC	.711***
QI	.288**
EV	.24
* $p < 0.10$; ** $p < 0.05$; *** $p < 0.01$	

Table 6. Descriptive statistics

Explanatory Variables: Factors	Sample Total (N = 422)	Frequency: Daily (N = 36)	Frequency: Several times a week	Frequency: Weekly (N = 187)	Frequency: Every two weeks (N = 33)	Frequency: Inferior (N=27)	Significance ^a
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(N = 139)

Average CSC	-.186	-.359	-.044	.160	-.113	-2.665	
(standard deviation)	1.05	.764	1.073	.929	1.120	1.049	
(variance)	1.114	.584	1.153	.863	1.256	1.101	
(median)	.083	-.333	.024	.289	.285	-.007	***
Average QI	-.022	.021	.095	.005	-.153	-.370	
(standard deviation)	1.240	.995	.962	.961	1.145	1.218	
(variance)	1.538	.991	.927	.925	1.312	1.486	
(median)	.052	.042	.094	.038	.246	-.363	***
Average EV	-.024	.160	-.093	.064	.184	-.400	
(standard deviation)	.984	.871	1.078	.925	1.047	1.095	
(variance)	.969	.760	1.163	.856	1.097	1.199	
(median)	.047	-.001	.048	.068	.411	-.402	***

^a Analysis of variance by Kruskal-Wallis; H0: The k medians are all equal; H1: At least one of the medians is different.

* $p < 0.10$; ** $p < 0.05$; *** $p < 0.01$.

Table 7. Model summary: Consumer subsamples according to shopping frequency

Frequency of store visit	-2 log of the verisimilitude	R ² Cox and Snell	R ² Nagelkerke
Daily	27.405	.305	.451
Several times a week	114.777	.110	.180
Once a week	190.207	.134	.195
Every two weeks	34.721	.113	.163
Less	33.803	.124	.166

Table 8. Relation between explained variables and maximum level of satisfaction: Consumer subsamples according to shopping frequency

<i>Estimated Parameters</i>	Daily	Several times a week	Once a week	Every two weeks	Less
Constant	2.243***	1.757***	1.022***	.960**	-.076
CSC	1.728**	.760***	.957***	.245	.268
QI	1.156**	.485**	.115	-.286	.132
EV	.452	.237	-.137	.712*	.735*

* $p < 0.10$; ** $p < 0.05$; *** $p < 0.01$.

Table 9. Summary of hypotheses results

Models	Sample	Hypotheses
Model 1	Total sample of 422 customers	H1 supported, H2 supported, H3 rejected

<p>Model 2</p>	<p>Different customer subsamples according to purchase frequency</p>	<p>Daily frequency: <i>H1 and H2 supported; H3 rejected.</i> Several times a week frequency: <i>H1 and H2 supported; H3 rejected.</i> Weekly frequency: <i>H1 supported; H2 and H3 rejected.</i> Every two weeks frequency: <i>H1 and H2 rejected; H3 supported.</i> Inferior frequency: <i>H1 and H2 rejected; H3 supported</i></p>
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THE RAPID RESULTS INITIATIVE: The Missing Loop

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Category: Literature Review

Introduction

The clamour and pressure for public sector to improve the quality of its public good/offering even in the face of declining global economic fortunes is irresistible as governments and parastatals are being pushed to levels unknown before. So governments must continuously invest in methodologies that will render efficiency in the quality and delivery of such public good.

Halachmi (2011) contends that current pressure to increase transparency and accountability on one hand and complementary burdens to demonstrate the efficiency and effectiveness on the other hand in order to justify future allocation of resources make the use of performance measurement very attractive. There is need to ensure that managers and organizations retain enough capacity – in particular the introduction of performance management should not be allowed to inhibit innovation and reasonable experimentation with alternative modes of delivering public service. Likewise, the Editorial (2011), contend that the development and growth of twenty-first century organizations will be increasingly tied to not only organizational capability of being efficient, in order to produce competitive outputs; but more and more on organizational ability to comprehend and manage the links between the organizational business processes and the external environment.

In Kenya one of the approaches that widely acclaimed to deliver and currently promoted by the World Bank is the Rapid Results Initiative (RRI), otherwise known as the Rapid Results Approach (RRA). Obongo (2008) indicates that since 2003 there has been three waves of RRI initiatives moving from being a mere tool for generating results within 100 days to being a robust tool for transforming the public service from process orientation to results based management culture; establishing public service values and providing a mechanism that supports the achievement of Economic Recovery Strategy (ERS), the attainment of Millennium Development Goals (MDGs) and the Vision 2030 – Kenya's flagship strategy for public service renewal. In praise of these approach Brown *et al.* (2005) contend that capacity to fulfil its responsibility and responsiveness to citizens' needs and rights are key to RRIs in the public sector. Similarly, WBIFP (2003) contends that RRIs unleashes existing capacity through strengthening accountability at all levels, creates a goal-oriented context for leveraging outside capacity input, accelerates the learning and discovery process of capacity issues; requirements and constraints and reduces hidden risks inherent in long-term strategies and generates stimulus and momentum for change. In sum, if these sentiments are representative of RRIs experiences elsewhere then it would appear that there exists a strong case for the RRI methodology.

While it would appear from the foregoing that RRIs have had a positive impact in Kenya, what is in doubt though is whether such gains have been sustained or are sustainable in the medium to long-term stretch, given the ad hoc nature of RRI conception, design and implementation in the public sector.

This paper seeks to explore whether and/or how the current RRIs methodology inculcates a culture of continuous improvement and sustainability of positive gains made. RRIs in Kenya are used as a frame of reference and are scrutinized to adduce evidence and provide a case for suggestions of modifications to the existing framework.

Rapid Results Initiatives

Although literature on the RRI methodology appears generally scanty; nonetheless, Obongo (2008a) suggests a 4-step model comprising of seven sessions:

- **Shape phase – is about shaping up the RRI initiative (planning and giving appropriate team debrief) comprising of three sessions:**
 - **Session 1 – leadership group prioritization – this is a buy-in stage where the sponsors (where the RRI will be implemented) are sensitized on the value and need for the RRI approach,**
 - **Session 2 – The leaders to oversee the RRI wave are recruited to mobilize support,**
 - **Session 3 – team leader of the RRI wave is identified and recruits team members,**
- **Launch phase – with an initial launch session that kicks off the RRI initiative towards a desired outcome/appropriate interventions,**
- **Management process phase – comprises of two sessions: the mid-point review session (where interventions executed are reviewed and corrective action considered) and the wrap-up review session (where the problem area is reviewed to establish whether a solution was availed with 100 days as planned and whether such a solution is indeed a good cure to the problem),**
- **Scale-up phase – here the leadership of the RRI initiative is scaled-up by applying the methodology in other problem areas as the circumstances permit.**

While it is clear that phases 1 through to 3 are progressive; one following another, what is not clear is how the knowledge gained through the execution of the RRI wave particularly, at the wrap-up review stage is ploughed back to benefit and refine the solution already provided, even though the RRI wave may have been concluded within the provided 100 days as envisaged at design stage.. Nor is there evidence of proper knowledge management where lessons learnt during the implementation of the first wave of the RRI are captured, passed on and applied in future waves of RRIs, given the temporal nature of such RRI teams – as constitution of such teams varies from project to project.

Considering that by design RRIs are one-off (non-iterative) exercises, such knowledge may be lost and with it the organization loses corporate memory – an opportunity to store knowledge for future reference, and potentially, the skill sets acquired during the first RRI wave.

Osiche (2008) on the other hand citing (PSR&DS, 2006) advances a five step model comprising:

- Orientation - **introduce RRA to strategic leaders, ensure high level buy-ins and conduct preliminary orientation,**
- RRI identification – **clarify challenge, identify and mobilize RRI team and orient team and train RRI champions,**
- Launch – **finalize RRI goals and develop preliminary work plan,**
- Implementation support – **implement work plans, provide guidance in implementation and review progress and disseminate learning,**
- Scale-up – **escalate successful RRI and adjust portfolio of activities and RRI in strategic plan,**

Likewise scaling-up successful RRI isn't tantamount to ploughing back knowledge gained and there is no evidence that such knowledge is in effect captured and applied to improve a just-concluded RRI. As with the case with Obongo's 4-step model it can only be presumed that such knowledge is captured by the respective organization and passed on to teams handling new RRI. Unfortunately there doesn't appear to be any evidence that points out to some form of capturing and storing this knowledge for future use (knowledge management) in organizations where RRI have been implemented in Kenya or indeed elsewhere.

It's perhaps with these limitations in applications in mind that several users of the RRI methodology in Kenya, have sounded challenges specific valid challenges. SR&MC (2010) list the following as key challenges: lack of understanding of the programme mandate, inadequate succession planning & mentoring for key staff, lack of conflict resolution and low capacity to monitor and document progress and key results attained during programme implementation. Similar views are expressed by KACC (2007) who asserts that the key challenge reported in implementing RRI in Kenya was its sustainability – the methodology provides for no means of sustaining the gains made. These limitations makes de Waal (2010) argument all the more worthwhile that equal attention should be paid to the instruments and behavioural dimensions of management systems, which when careful managed results in higher competitive performance. As such there is need to combine the instrumental (responsibility structure, content, integrity, manageability and alignment) and behavioural (accountability, management style, action orientation and communication) dimensions to create a successful performance-driven organizations – something that a refurbished RRI methodology should be capable of doing.

Interestingly, a closer look at RRI methodology reveals some semblance with the Deming's cycle famously known as the PDSA cycle (ASQ, 2011) applied in diverse settings to inculcate a culture of continuous improvement. The only, exception is this similarity is that while the PDSA is a closed loop, the RRI methodology isn't. The PDSA four-step quality model's attributes are:


- **Plan** - recognize an opportunity and plan a change.
- **Do** - test the change. Carry out a small-scale study.
- **Study** – also known as check is about reviewing the test, analyzing the results and identifying what has been learnt.
- **Act** - take action based on what you learned in the study step: If the change did not work, go through the cycle again with a different plan. If you were

successful, incorporate what you learned from the test into wider changes. Use what you learned to plan new improvements, beginning the cycle again.

The Deming cycle is a closed loop (iterative approach) that allows for ploughing back knowledge and expertise gained so as to improve and/or refine the solutions already executed, thereby sustaining quality gains and inculcating the culture of excellence (Marwa *et al.*, 2009b), the RRI methodology isn't. A comparative analysis of the RRIs steps relative to the PDSA's cycle reveals that RRIs steps don't stretch that far to close the loop (Tab. 1) - apparently the steps only stretch as far as step 3 (Study) leaving out step 4 (Action) as there isn't any evidence of ploughing- back knowledge/expertise to improve on current RRI performance.

While both of the RRIs approaches advocate for mid-term review of implementation (supposedly to establish whether execution is going as per plan) there is no evidence/indication that such reviews actually benefits existing initiative(s) or projects since by design RRIs are a one-off activity rather than repetitive, which if applied then would hopefully perfect performance. It is not equally clear what is done to the "reservoir of knowledge" and experience gathered by the implementation team, given the lack of continuity of the teams and the tendency to escalate RRI waves to the next project without necessarily retaining the same team.

Table 1: Comparative analysis of RRIs steps versus the PDSA cycle

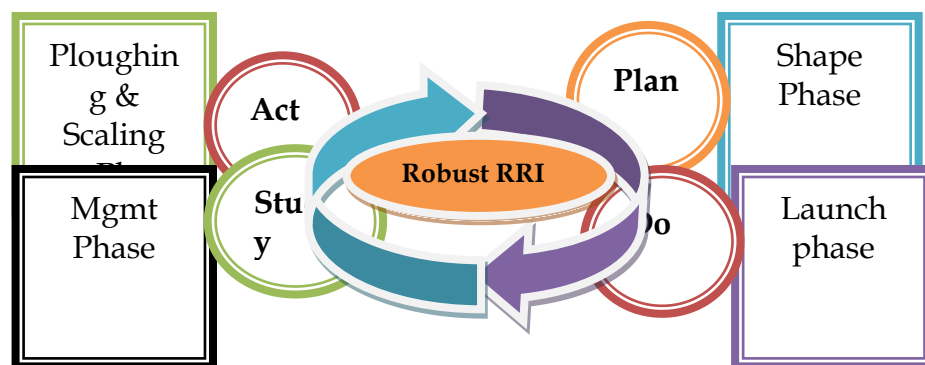
	Obongo	Osiche		Modified RRI	PDSA Steps	Missing Loop
1	Identify RRI areas	Orientation	1	Identify RRI areas – combine's Osiche's step 2	Plan	✓
2	Launch	RRI identification	2	Launch – Combines Osiche's step 3	Do	✓
3	Mid-term review	Launch	3	Mid-term review/ End-term review and Osiche's step 5 scaling-up	Study	✓
4	End-term review	Implementation support				
5	Scale-up	Scale-up	4		Act	?

Towards closing the RRIs performance loop

As argued out by Osiche (2008) a blind, stand-alone and/or a one-off reform and non-strategic adoption of RRI practices per se is not likely to enhance service delivery, nor will it produce sustainable and visible results that improve public service delivery. The solution lies in adopting and adapting the RRI approach to suit respective settings of application. This view is reinforced by Matta (2011) who justifies customization of the RRI approach and argues that each of the rapid results story is a work in progress; much more experience is needed to refine the approach and ensure that it is able to support

progress. As the work moves forward it is important that it be done in an experimental, empirical fashion and this is where the PDSA cycle becomes handy as it allow for multiple experimentations/cycles of each RRI, rather than being a one-off event. With an integrated RRI/PDSA methodology (fig. 1), each wave of experimentation is informed by experience and knowledge gathered so as to allow for the molding of the RRI approach to suit settings of application, is suggested for application in Kenya. The refurbished RRI methodology as a results' based management framework can have its potential stretched to unleash the creativity and capacity of the users. The revised RRI methodology thus is an effective means towards closing the apparent performance loop:

Fig. 1: A Robust RRI Methodology



According to the proposed model (fig. 1), the four phases of the initial RRI methodology are reorganized as follows:

- a) **Shape phase** – this face is essentially the planning phase in the PDSA cycle. Here plans are made (relevant to an initiative) prior to launching an RRI initiative. The objectives, schedules, resource requirement and management are all brought to bear,
- b) **Launch phase** – this is equivalent to the Do phase in the PDSA cycle, where an organization commits resources to execute plans devised. Due care must be given to project management principles least the RRI will flop,
- c) **Management phase** – the management of the RRI is undertaken alongside implementation and involved performance measurement – gauging the extent to which interim results reflects targets specified in the plan. It's basically a study phase in the PDSA cycle that pauses to ask how implementation is fairing relative to plans so corrective actions are considered to bring the RRI to bear expected results,
- d) **Ploughing and scaling-up** – the results of the management phase are then used to refine the outcome/solution of the RRI. By acting on the management phase results, (equivalent to the Act in the PDSA cycle) an organization, takes corrective action and ploughs back the knowledge gained – so far to improve the outcome of the RRI. Being cyclical rather than one off implies that the outcome/solution can be refined over a number of iterations and only when the best results are achieved and the knowledge gained ploughed back to improve existing outcome that the RRI wave can be scaled-up to new initiatives and where possible retaining the same teams to spear-head further series of initiatives.

Essentially, the suggested robust RRI methodology is somewhat similar to Obongo's RRI methodology (in terms of phases), except that the revamped RRI methodology (Fig. 1) provides for:

- a) The incorporation concept of continuous improvement - the PDSA cycle in the methodology converting it from being a one-off initiative to being iterative/cyclical thereby allowing for the ploughing-back of knowledge gained/lessons learnt in the initial wave to refine/improve the solution realized after 100 days of the initial wave prior to scaling-up or repeating the exercise in new initiatives/projects). It's about having several iterations/cycles of improvements to perfect the results/outcome prior to scaling-up the same in other initiatives. The attraction of this repetitiveness is that it allows for perfection of the solution, by allowing the team to master the art and possibly reduce the circle time for future waves from say 100 to 75 days (or shorter than that) – which potentially makes a huge saving on future waves/projects.
- b) Knowledge management - storage of nuggets of knowledge acquired/lessons learnt in the initial wave for future reference as well as usage of the same for training teams that will be involved in future RRIs,
- c) Retention of initial team members (rather than disbandment of such teams) to serve as champions who trains other staff members and supports them through future initiatives.

Incorporating the concept of continuous improvement in the RRI methodology is particularly critical, since it's important to refine initial results to avoid settling for suboptimal solution likely inherent in one-off exercise. The downside to organizations is that such one-off exercise is that it denies user organization an opportunity to optimize initial solution prior to scaling-up the RRI wave to other projects.

Effective deployment of the suggested robust RRI methodology calls for organizations to:

Create a reservoir of knowledge (KM)

A culture of sustainability of gains made and continuous improvement is partially possible where there is a deliberate attempt by organizations to capture, store and disseminate knowledge gained from execution of projects and ploughing-back such to refine interventions/solutions executed and bolster existing and future outcomes. There thus has to be a deliberate effort by the Kenya government and parastatals to create “reservoirs of knowledge “(knowledge management) in a bid to fortify the RRI methodology. Such knowledge should then be ploughed-back to improve/refine RRI interventions already executed as well as inform the conception, design and implementation of new RRIs. As Herriot *et al.* (2002), evidence suggests, the solution towards improving public sector performance in Kenya and by extension bolstering the RRI methodology is in creating pockets of excellence within ministries and parastatals and knowledge management is a step in the right direction. Likewise Walker and Christenson (2005) contend that excellence lies in organizations transforming themselves into learning organization through creation of centres of excellence. Therefore at the heart of bolstering RRIs in Kenya should be an attempt to create centres of excellence at either ministerial or parastatal level to capture, store and disseminate nuggets of knowledge –that ultimately impacts positively on RRIs outcomes.

Integration of RRI with Quality Cycles

A quality circle is a volunteer group of employees from the same work area who meet together to discuss workplace improvements. The circle is empowered to promote and bring quality improvements through to fruition. Quality circles have the advantage of continuity; the circles remain intact from project to project (have a reservoir of experience which they can bring to a new challenge/RRI initiative) (Vectorstudy, 2011). The quality circle meets regularly to identify, analyze, and solve public sector service delivery and production problems. In Barbados where quality circles called Internal Reform Committees (IRCs) have been extensively applied in the public sector (Braithwaite, 2011), there has been a remarkable increase in home grown reform initiatives that meets the needs of the Barbados public. Such IRCs are reputed to have inculcated and/or improved: a team culture and team environment, flow of ideas, customer relations and service delivery, levels of communication, operational efficiency and created problem prevention attitude.

Leadership

Leadership is the key to harness the potential of civil servants attempts to improve on public service offerings. Matta (2011) contends that sustainability of RRIs results is possible if leaders can grow capacity by challenging and motivating the team, which should become a hands-on developmental opportunity for government officials. As amplified by ambulatory care experience in Germany (Bandolier, 2011), the need for senior civil servants (management) to accord quality circles, IRCs or RRI coaches constant support, facilitation and professional advice during the currency of public sector improvement initiatives is crucial. In the case of Kenya, there may be a need to attach the design, development and deployment of revamped RRIs in the public sector with a local university or consortium of universities (as the case may be) that specializes in quality improvement/performance management – where the revamped RRI curriculum will be subjected to constant review and revamping (informed respective entities knowledge management experiences) to embed a culture of management for results in the public sector. Similar sentiments are echoed by Matta (2010) who suggests that: right sponsorship, right team, proper context, coaching and facilitation support, are critical towards a new revamped and bolstered RRIs.

Capacity development

Expectations for superior public sector good must be matched by superior capacity development and provision. Anyango (2011) argues that public servants capability building - staff training is key to the success of RRI and the impact of such training programmes must be measured through appropriate appraisal systems. Likewise, Obongo (2008b) contends that in a push towards sustainability the Kenya government had committed to train a core pool of up to 350 public servants as RRA coaches within the 2007-2008 fiscal. Such training regimes must be continued and the curriculum should contain formal problem solving methods such as: brainstorming, histograms, flowchart, scatter diagrams, Pareto, cause and effect analysis, check sheets, control charts ...etc which will expand civil servants capacity to diagnosis and prescribe accurate interventions to prevailing performance

challenges in their own settings. Evidence from RIAM (Rwanda) suggests that twinning such training programmes with a local university may deliver far greater value to the public service than would otherwise be the case (Aide-Memoire, 2009). The Kenya government and parastatals must leverage the power of teamwork and create capacity across the board. Matta (2011) notes that most worthwhile results do not come neatly aligned with government units, rather, they require the collaboration of multiple diverse institutions often spanning several sectors.

Institutionalization

KACC (2007) contends that RRI needs to be institutionalised into the public service as a way of providing services, improving systems and integrated with other approaches currently being applied to improve public sector results. Nueys Eritrea (2010) argues that a sense of ownership of an RRI projects helps to underwrite its sustainability. In the proposed new RRI dispensation, quality circles will be responsible for creating reservoirs of knowledge and dissemination/sharing of such knowledge and best practices within and without to support effective management of RRIs (Braithwaite, 2011). Importantly, for the proposed RRI coaches turned quality circles to be effective there has to be a culture of trust between staff and senior managers, supported by a democratic structure, good two way communication and a delayered organization. Local empowerment and accountability should be the currency of RRIs (Matta, 2011).

Stakeholder involvement

RRIs must adopt a stakeholder approach for balanced satisfaction of stakeholders needs. Taylor (2011) observes that quality improvement including quality circles programmes are being implemented in many organizations without the involvement of an important partner in these programmes – the unions. Without union support public performance improvement programmes tend to fail. In a number of firms (particularly in the private sector) management has simply installed quality circles with only a minimum consultation with the union. The consequences were predictable; union saw the circles as just one more attempt to extract increased productivity from the workers without sharing the rewards, or as an attempt to win loyalty on workers away from the union. It follows thus, that in implementing quality circles, the Kenya government and/or its parastatals management have to work very closely with the civil servants unions to gain their support and avoid horse trading, which is potentially harmful to such initiatives.

Benchmarking

Choudhury (2008) suggests that entities should never stop learning; instead they should continually access available knowledge base (from best practice entities), rethink their improvement strategies and apply them. Cutting wastes and harvesting best practices from other organizations and using them must be the “modus operandi” in today’s public service (Adam, 2008). Parastatals’ should learn from best practice, competitors and be open; the more an entity is open, the more it stands to benefit from a benchmarking initiative (Coombe, 2008). Vargo and McDonough (1993) argue that by seeking out the best practices of other governments and parastatals; can serve as an eye-opener for the public sector in areas with potential

for improvement to zero in on. This way, the Kenyan civil service will be able to provide the best value for money and superior public good will be the driver that catapults Kenya's public service into a success meeting the growing aspiration of Kenyans.

Conclusion

The promulgation of a new constitution in Kenya has raised Kenyans appetite for superior civil service offerings (as enshrined in this constitution) and there is no letting up. There is a wave of growing pressure worldwide by citizens trying to hold their governments accountable and deliver (as aptly amplified by events in North Africa and M/East) and the clamour for better public services will continue to be noisier even in Kenya. The Kenya government and parastatals cannot afford to puncture/lower such expectations, but must continue to invest in renewal and improvement of existing methodologies to stay in tune with the needs of its citizen. Certainly the RRI methodology has a critical role to play in enabling Kenyans to realize the "Kenyan dream" and revamping the methodology and is a sure way to ensure it stays current and relevant, which is what this paper is all about.

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Analyzing the gap between practice and literature regarding the use of Quality function deployment (QFD) and Kano model in a new product development process

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Introduction

In today's global markets, New Product Development (NPD) is often referred to as a suitable strategy to create competitive advantage and long-term financial success (Costa & Jongen, 2006). It has been well recognized that one of the primary factors for having a successful new product design and development is understanding and fulfilling customer needs (McKay et al., 2001). Therefore Interpreting the voice of customer and dealing with their satisfaction have become one of the main challenges for manufacturers (Xu, Jiao, Yang & Helander, 2008). Among different methods and techniques which enable interpretation and implementation of voice of the customer, Quality Function Deployment (QFD) and Kano model are the basis in this study.

Quality Function Deployment is used to ensure quality during every step of product development, starting from the design stage. The aim in QFD is satisfying customers by translating their needs in to design specifications and major quality assurance points that need to be considered throughout the production process; by this way the method develops a design quality (Akao, 1990). On the other hand, Kano model is an effective tool for categorizing and prioritizing customer needs based on the impact they have on customer satisfaction (Kano *et al.*, 1984). This model indicates which product or service attributes bring more than proportional satisfaction to customers. Further it identifies requirements of the product which do not bring satisfaction when present but do bring dissatisfaction in case not fulfilled (Tontini, 2007).

Not only the outcomes of using such methods are defined as design quality during NPD processes but also they are followed by a number of organizational benefits such as encouraging teamwork and communication, as well as helping organizations become stronger, more secure and more able to expand (Griffin & Huaser, 1992; Lockamy & Khurana, 1995; Cohen, 1995). Looking at Kano and QFD as applications of Total Quality Management (TQM), their internal success requires factors such as top management commitment and organizational motivation for adopting these methods (Griffin, 1992; Lockamy & Khurana, 1995, Govers, 1996; Cristiano, Liker & White, 2001). Therefore implementing such methods under conditions enabling deriving their

full potential is an important challenge for manufacturers while developing new products.

Considering the implication of Kano model and QFD for NPD processes, by taking a case study of developing a Muesli dispenser, following questions is addressed within this research work:

- To which degree are the requirements for implementing Kano and QFD fulfilled in the case of Muesli dispenser?
- How did Kano and QFD method alter new product development activities in the studied case considering both design and organizational aspects?

The answer to these questions provides the contribution of Kano and QFD model in the studied development process which is compared with what is expected accordingly in literature to define the gap. The existence of the gap is justified to the degree to which implementation requirements for each Kano and QFD have been followed.

Frame of Reference

Customer led New Product Development

According to a number of empirical researches benefits such as higher degree of product newness, reduced innovation risks and more precision in resource spending are the results of the integration of customer contribution in new product development (Kohli & Jaworski, 1990; Brockhoff, 2003; Callahan & Lasry, 2004). Further this integration can provide a better understanding of the market in which the firm is evolving in, a better understanding of the customer and higher chances of successful product development projects (Kok, Hillebran & Biemans, 2001). This customer centricity is also known as customer-led new product development, the concept was introduced in the beginning of the 1990 (Urban and Hauser, 1993). The aim in customer-led business is developing products or services which satisfy expressed needs of customers in their served markets (Slater & Narver, 1998), while it is divided into four steps: need identification, idea development, product development and market introduction (Urban and Hauser, 1993). This approach greatly enhances the chances of successful innovation and NDP processes.

However today's highly competitive environments has made the task of bringing new products matched with customer needs, more challenging than ever. Therefore companies, within their innovating processes utilize different tools and methods to assure customer needs fulfillment. QFD is one of those methods acting as a customer-oriented approach in customer-led NPD process (Augusto & Miguel, 2007; Tontini, 2007), another example is Kano's methods used for understanding customer-oriented quality (Berger et al., 1993).

Review on Quality Function Deployment (QFD)

The concept of Quality Function Deployment (QFD) was first introduced in Japan in 1966 by Dr. Yoji Akao. QFD was first used at Mitsubishi heavy industries in 1972, during 1970's by applying this method, Toyota and its suppliers were able to reduce the start-up and preproduction cost by 60% (Iranmanesh & Tabrizi, 2009). QFD was first introduced in USA in 1983, discovering the usefulness of this tool for converting customer needs in to engineering characteristics, today over 100 major organizations in

USA such as Motorola, General Motors, Kodak, NASA, Ford, Xerox and HP are applying the method (Iranmanesh & Tabrizi, 2009; Deng & Kuo, 2008). Taking QFD as a cross-functional planning tool, it can be applied as a highly effective methodology within product development and quality improvement area (Deng & Kuo, 2008). According to Sullivan (1986) QFD can be defined as a tool, enabling translating customer requirements in to proper technical characteristics in different stages of product development and production. QFD has been also defined as a proactive technique, which is designed for recognizing, prioritizing and deploying the voice of customer in to different organization levels (Martins & Aspinwall, 2001).

The most important phase in QFD is building the House of Quality (HOQ). HOQ usually contains a set of standard matrices in which customer requirements (CR) will lead to design characteristics (DC) by mapping their relation. Later DCs will be prioritized based on their correlation with CRs and the CRs' importance rating (Govers, 1996). In the next phase DCs will act as input to establish further manufacturing operation. Within HOQ the roof matrix represents interaction between design characteristics and the bottom matrix is used for technical competitive benchmarking and setting target values for DCs (Iranmanesh & Tabrizi, 2009.)

Looking at QFD approach as a complete project, Govers (1996) reveals that different rules for project management such as project definition and team selection are followed in an organized QFD. Further better results within this action needs expertise oriented cross-functional teams; meaning QFD shouldn't be limited to actions of just one department.

Review on Kano Model

Kano model of satisfaction which is a very useful tool for categorizing customer needs was developed by Prof. Kano and his colleagues (Kano *et al.*, 1984). Product attributes are prioritized by Kano model based on how they are perceived by customers and how they affect customer satisfaction (Xu, Jiao, Yang, Helander, Khalid & Anders, 2007). This model identifies three main types of attributes for products and services based on the degree of satisfaction they bring:

Basic (Must-be) attributes are the ones expected by customers, they do not provide satisfaction, but if they are missing it will create a great dissatisfaction. *Performance (One-dimensional)* attributes are the ones for which customers usually explicitly show their interest. They bring satisfaction in case being fulfilled and dissatisfaction if not fulfilled, so it's proportional. *Excitement (Attractive)* attributes go beyond what the customer expects. Customers do not demand these attributes but are very satisfied if they are there. If they are not, customers are not dissatisfied since they are not aware of what they're missing. Incorporating these attributes in products or services will bring a high level of satisfaction (Berger *et al.*, 1993; Tan & Shen, 2000) Other than the main items there are two more attributes called as *Neutral* and *Reverse*. While the former group can never bring satisfaction, the latter group brings satisfaction when not included in the product or services; the less of such attributes the better (Berger *et al.*, 1993)

The Kano model takes in consideration the non-linear relationship between product or service performance and customer satisfaction, which was not the case before. By use of this method customer needs are identified, analyzed and categorized. Kano model can

be seen as a support tool for development teams following competitive strategy.

Integrating Kano & QFD

The conventional QFD process is involved with an inherited vagueness mainly because it carries following assumptions:

- Customers have previous experience about the product or process that is being developed.
- According to product requirements customers are capable of evaluating their importance and the degree of satisfaction they bring.
- The relationship between importance (attribute performance) and satisfaction is linear and independent. (Tontini, 2007)

These assumptions may lead to imprecise prediction of customer needs since for products with new requirements customers are not capable of rating requirement importance further there may be some product characteristics that bring extreme customer satisfaction although containing low performance degree and other way round. Therefore assuming a linear relationship between performance and satisfaction may lead to inaccurate results (Tan & Shen, 2000; Sireli, Kauffmann & Ozan, 2007)

In order to enhance QFD ability to identify and understand customer requirements, several researchers have associated Kano model with this method (Matzler & Hinterhuber, 1998; Tan & Shen, 2000; Lai, Xie & Tan, 2004; Hou & Chen, 2005). Tontini (2007) has introduced a model for integrating Kano in to QFD method in which customer importance ratings in HOQ are replaced by the result of the following equation:

$$\text{Adj. Factor} = \text{Max} (|SI| , |DI|) \quad (\text{Tontini, 2007})$$

SI and *DI* are satisfaction and dissatisfaction indexes which are calculated based on Kano categorization of each of customer requirements (Berger *et al.*, 1993). The same model is used for integration of Kano and QFD in this study.

Benefits of QFD and Kano Model

The great amount of advantages caused by QFD application make it an effective and important tool regarding new product development. Lockamy and Khurana (1995) represent a rather exhaustive list of the benefits that QFD offers considering design and organizational factors. According to their study QFD enhances the design process since it enables fewer and early design changes, shorter development time, fewer start-up problems, less start-up cost, fewer field problems, more customer satisfaction and indicating a competitive analysis of products by indicating their comparative strengths and weaknesses. Govers (1996) claimed, through using QFD design intent is carried through to manufacturing and by this way “Quality” is built in upstream.

Factors such as reduced design cycle and lead times, minimized start-up and project costs, large efficiency, decrease in pre-launch time and after-launch repairing, more satisfied customers and market share and more stable quality assurance planning are also reported by QFD users (Sullivan, 1986; Hauser & Clausing, 1988; Griffin & Hauser, 1992; Tan, Xie & Shen, 1999).

QFD is also capable of enhancing the organization in which is being implemented. Based on Lockamy and Khurana study (1995), Organizational benefits from QFD include encouraging marketing, design, engineering and manufacturing knowledge documentation in a consistent and objective manner (Vonderembse & Raghunathan, 1997) as well as encouraging team work and participation. The enhancement of team work and communication among organizational departments as a result of QFD is what that has been claimed by other researchers as well. Based on a field comparison of QFD, Griffin and Hauser (1992) concluded an increase in team communication on all non-administrative aspects of product development since the projects are carried out by cross-functional teams. Raharjo, Brombacher and Xie (2008), Chan & Wu (2002), and Govers (1996) also pointed out effective communication between divisions and better knowledge transfer among cross-functional teamwork as QFD benefits. Improving the ability of decision making is another organizational impact of QFD. The methodology is a decision making technology which aims at responding customer needs and creating profound competitive advantage and is able to integrate technology, organizational policies and customer requirements in to a profitable product (Mehrjerdi, 2008). Cristiano, Liker & While (2000) through their study on companies in U.S and Japan implementing QFD showed that U.S companies report great relative advantages in the area of facilitating rational decisions and creating unity among team members.

Regarding enhancing innovation in product development processes, there isn't still any consensus on whether the method is appropriate (Augusto & Miguel, 2007). Actually one of the criticisms of QFD is that it restricts the ability of the team to innovate as part of development process, although there are people who discuss that it can enhance innovation (Cristiano, Liker & While, 2000; Curtis & Ellis, 1998)

Further when rating different requirements, customers tend to rate their basic needs with higher importance, therefore in traditional QFD higher priority is given to such requirements while the innovative ones will be ignored (Tontini, 2007).

On the other hand Tan, Xie and Shen (1999) have claimed that the role of QFD in product innovation can be analyzed through two factors, i.e. cross-functional teams and the roof matrix which both have significant impacts on developing innovative products.

Very few articles in the field of the Kano model refer to its relative benefits especially regarding organizational factors. Chen and Ghuang in their study of Integrating the Kano model in to a robust design approach (2008) have defined the contribution of this model in to product development by bringing up Kano's benefits in product design. Kano model provides a valuable guidance for carrying out trade-offs during development phases, helping the team to target areas which are most effective in customer satisfaction. Further Matzler and Hinterhuber (1998) showed that better understanding of customer requirements is among advantages Kano model brings when it is used for classifying customer needs. In cases of multiple criteria decision making Kano model can be used to establish the importance of individual product criteria and therefore create the optimal prerequisite for product development activities (Matzler & Hinterhuber, 1998).

Implementation requirements for successful QFD

A company's ability to observe any measurable benefit from QFD may be influenced by the way this method is implemented (Griffin, 1992). In a study by Cristiano, Liker, and White (2001) based on a 1995 survey of more than 400 companies in U.S and Japan applying QFD (Cristiano *et al.*, 2000), key factors for reaching a successful implementation of this method have been identified and categorized under Organizational characteristics and Data sources attributes (as discussed in the following part). Further results from a study on QFD usage in Japan in 1986 by the Japan Quality Control Association (Akao, Ohfuji, & Naoi, 1987) revealed that the ability to capture, understand and organize customer requirements, the size of the matrices as well as long duration for QFD adaptation are major implementation barriers. Philips, Sander & Govers (1994) relate most QFD problems to organizational circumstances such as project definition and project management as well as team selection and team building.

Organizational Characteristics

Internal motivation for using QFD: As discovered from both Japanese and American companies, the main motivation for implementing QFD is bottom up and raises from the base of the organization which is completely opposite from being motivated because of competitors or the direction of company presidents and headquarters (Cristiano *et al.*, 2001). The primary motivation for incorporating QFD in to development processes should be internal and can be originated from internal champions (facilitators) of QFD (Govers, 1996). This conclusion is inconsistent with what Griffin (1991) has mentioned about successful QFD applications with champions from inside the organization. Further dictation of this method usage by the management often leads to failure in QFD application (Griffin, 1992).

Management support for QFD: The support of top management as a key factor in the success of QFD studies has been identified by a number of researchers (Cristiano, Liker & White, 2001; Govers, 1996; Dika, 1993; Griffin, 1992). One criterion for management commitment is whether QFD is viewed as an investment and relative time, space and money is allocate (high commitment) or viewed as an expense which should be minimized (low commitment), (Griffin, 1992). It has been discovered most of the companies viewing QFD as an investment, either had successful application of this method or they have been influenced positively by QFD. On the other hand projects in which management viewed QFD as an added expense, largely either led to failure or having no effect (Cristiano *et al.*, 2001). Support from management should be in terms of both empowering the people and making market research and resources available to smooth process implementation (Dika, 1993; Griffin, 1992).

Cross-functional involvement in QFD project: A number of case studies have been carried out by American practitioners in different companies; Chrysler is an example (Dika, 1993), these studies have focused on actual application of QFD and have documented success as well as implementation lessons learned (Cristiano *et al.*, 2000). A need for strong cross-functional involvement in QFD project team was mentioned in almost all these cases (Dika, 1993; Govers, 1996; Hales, 1994). Using cross-functional teams with staff from design, planning, engineering and quality control throughout the whole design and development process makes downstream functions to be able to impact design decisions at the point which there is a large capability of change and the

cost is minimal (Cristiano et al., 2001). Further regarding problems associated with team building in QFD implementation, Govers (1996) suggests to consider the rank of team members while they possess different areas of expertise and look for receptive, open-minded people who have positive attitude toward new approaches.

Data sources

QFD driven data sources: Investing sufficient resources to gather new data and accessing customer data which is specifically collected for QFD is considered as a factor that has positive impact on QFD application (Cristiano et al., 2001). To have this approach the definition of “Voice of the Customer” should be correctly understood and implemented. This term doesn’t mean an internally specified set of customer requirements, but information should be completely derived from a quality-oriented market research; for doing so, simply one should start by talking to the customers and asking about their needs (Kaulio, 1998).

Methodology

Case study

A case study was chosen as the research method both by necessity and convenience. It was necessary due to nature of the research questions and it was convenient because the possibility to take part in the product development team was offered to the authors. This was the opportunity “to go native” in a team, but also as participants.

The case study was a development team consists of ten students (including the authors) working on the Muesli Machine Project. The Muesli Machine which is a new product both for the development team and the project sponsor (Lantmänen Cerealia AB) is supposed to provide customers with customized muesli, meaning using this machine they can choose all ingredients within their muesli mix. Considering the aim which was creating complete design of the machine, the project included the complete process from concept development to designing and sketching all parts of the machine. At the end of the project, Muesli machine inner structure and outer design were displayed in the form of CAD drawings and the FLASH programming for the machine touch screen as well as all other customer interfaces were defined.

The project team consisted of a project manager and nine other members acting in different groups. The whole development process was divided in to two phases of Concept Development and Machine design for which the project group organization differed. In the first phase the team was split in to three sub-groups named as Design support group with the responsibility to assure all the required specifications from sponsor are fulfilled, Technical support group, responsible for machine technical aspects and Marketing group responsible for customer research and assuring fulfillment of their needs in all development phases. In the Machine design phase based on design aspects the team was divided to Inner-design (focusing on the interior components of the machine) and the Outer-design (focusing on the exterior design) subgroups. In both phases some of the members were at the same time acting as coordinators among sub-groups in order to keep track for and integrate different activities.

Implementing Kano and QFD model

Both Kano and QFD methods were implemented during Concept development phase of the project. The concept development process followed in Muesli machine project was based on the book “Product Design and Development” by Ulrich & Eppinger (4th ed., 2008). The Kano model was implemented in order to get customer needs’ importance rating based on the amount of satisfaction they bring, while the QFD methods was implemented in two phases (the first phase resulted to relative weight of muesli machine technical characteristics and the second phase led to importance rating of machine parts) to define the most crucial components of the machine regarding customer perspectives. Due to conventional QFD deficiencies already mentioned in Frame of reference, based on the integration model presented by Tontini(2007), the integrated form of QFD and Kano model was used in this project.

Data gathering

The required data for comparing practical work with literature regarding the use of Kano and QFD methods was gathered mainly by direct observation of the project group and evaluation of end results. As mentioned earlier since the authors had the opportunity to participate in the development project, data collection was therefore facilitated, despite a great level of objectivity needed. The contribution of Kano and QFD method in Muesli machine development processes as well as group members’ perception toward the usefulness of such methods was observed and reflected upon.

Besides observation another source of data was a questionnaire sent to whole group members at the end of the project by email. The aim of the questionnaire was to gain the group overall view about customer satisfaction methods and it contained eight questions concerning the impact of Kano and QFD on different product development aspects such as quality, innovation and decision making ability.

Results

Observations from Kano & QFD implementation in the case study

At the very beginning of the project, Marketing group conducted an internet based questionnaire in order to get a broad view of customer needs and consumption habits. Two groups of questions were made. The first one was about the consumers’ habits and trends. While the second one was more specific; interrogating consumer about the muesli machine concept’s characteristics. While marketing members had the feeling that this survey is going to be useful, their initial interest and enthusiasm to learn from customers was observable. Without management incentives they took initiatives to send out the survey to people, since they had high motivation to achieve this task.

The first survey revealed the need for more customer knowledge and design aspects that achieve best satisfaction, therefore Kano and QFD were introduced. This further customer investigation, although caught the interest of market research team, some team members didn’t see the need and thought it would be a waste of time.

Identifying customer needs

The complete list of customer needs included needs identified through the internet survey as well as requirements from the sponsor and the probable demands of supermarkets from a muesli dispenser. Unlike the first survey, completely carried out by marketing team, all members from Design and Technical support groups participated in defining all customer needs. In order to assure the defined requirements are what customers have actually revealed, the whole group agreed to consider results from the primary customer research as the basis to refer, when it wasn't easy to reach consensus.

Implementing Kano Model

Once reaching the complete list of customer needs, it was tried to include all the main requirements in the Kano questionnaire, although needs from the sponsor were removed since they were all considered as Must-be attributes which should be fulfilled as long as they correspond to project resources. Kano implementation was the main responsibility of marketing group, but the whole project team was encouraged to participate by the project leader since he did feel the necessity for carrying out such a method to prioritize the large number of defined customer requirements and carry-out trade-offs where ever needed.

As for the group members, their interest for learning new methods for discovering customer needs importance was observable. Not only marketing staff but also people from technical support with engineering backgrounds participated in designing Kano questionnaire and sending them out. Once customer responses were analyzed, results were revealed to the whole group in the form of Kano categorization of requirements. It was observed since members from different subgroups had participated in setting and sending out Kano questions they were also interested about hearing the results; however their motivation toward other processes within Kano such as data analysis wasn't as much. Among different people, project manager was the one with most concern about Kano outcomes. He also encouraged group members to value these findings and try to apply them while developing muesli machine concept.

Implementing QFD method

Input data for QFD was also based on the market research carried-out at the beginning of the project. QFD matrix contained the same set of needs examined through Kano study, since the integration of these methods was applied. Although QFD results were frequently communicated with the project leader and other team members, but the main study was performed by marketing group. The main reason was that one of early phases of product development concerned defining needs metrics (Ulrich & Eppinger, 2008) for which members from different subgroups had participated and did a great amount of brainstorming. Since metrics act the same as product specifications in QFD matrix, due to the tight schedule project leader didn't intend to involve other groups than the Marketing to perform activities which seemed repetitive.

Same as the Kano case, CR members didn't have previous experience with implementing QFD, therefore the method was thoroughly introduced and explained for which although they showed interest to learn but this curiosity wasn't as much as in the case of Kano.

Once the results from QFD study was revealed to the project team, it was observable that project leader was the only one who cared the most for the outcomes, since they were needed to form the groups in following phases. Obviously more resources should have been allocated for components with higher relative weights. What was understood from the project leader attitude toward this method was that while he did perceive QFD findings critical for pursuing the development process; he wasn't adequately motivated to allocate sufficient time for applying the method thoroughly with all its phases.

It's worth mentioning while marketing people took initiative to fill out QFD matrixes; the same motivation wasn't observable among other group members. Especially people engaged in engineering tasks didn't perceive QFD application as an obligation in the development process. Therefore there were times which some group members felt this method was an additional effort consuming extra time and energy form the team.

Muesli Machine Project outcomes

As the QFD matrixes underlined the core components of muesli machine concept, in the design phase resource allocation by the project manager was done according to this importance. The decision was not made only based on these matrixes; technical difficulty and available competence were considered, however, the matrixes operated as a decision support.

Core functions and components have been investigated and technical solutions were brought during the design phase. The team worked always having in mind the customer requirements and needs. Therefore it was settled as an initial goal that the team had to satisfy these standards. The final muesli machine concept satisfied all the Must-be requirements according to Kano The final Muesli machine concept satisfied all the Must-be requirements defined by Kano categorization (easy to use, cleanness, diff. amount of diff. ingredients) as well as most of Attractive ones (such as quick process, large choices of ingredients and sequential pricing). Further trade-offs were carried out based on the amount of satisfaction each attribute brings according to Kano study. Trade-off between number and visibility of ingredients is an example; the design of the inner parts of the machine (portioning and compartments) led to several problems, especially to put all the ingredient compartments on front. Therefore development group prioritized the number of ingredients, as it was defined as an attractive attribute while ingredient visibility was classified as In-different, when it was questioned in the form of machine attractiveness.

Another trade-off was the mixing function, although the first customer survey revealed the importance of visible mixing process, since the group lacked related competence also having a mixed muesli was defined as In-differential, the function was limited getting the muesli mixed during transporting ingredients to packaging.

Final feedback from the development team

One week after the project closure a questionnaire was used to get feedbacks from both the inner and outer design groups concerning the use of Kano and QFD methods in the project. This was an opportunity to learn more from the team members, since while observations are subject to wrong interpretation, written answers are clearer. The

questionnaire contained open questions inviting people to reflect on the work done during the project.

The first reflection on the questionnaire results is that the opinions in the group are very diverging. Considering the necessity of applying Kano and QFD, while the project leader and outer design members found them crucial for development processes and were unanimous that they could not be skipped, some people from inner design didn't see methods as much useful and informative.

"I think relying on customer needs is very important if you want your product to be a success, which I think we wanted, without customer needs it's always easy to go the easier way" when you develop a product" claimed an Outer design member.

"We didn't learn much new information, but it was good to have confirmation of things we took for granted" answered a member of Inner design.

Further, the majority of the team believed customer satisfaction methods were good decision making tools and more time could have been spent on collecting customer information. The rest of the team thought the time spent could have been used in a more efficient way.

"Better planning would have been highly efficient" suggested a member of the Outer design group.

Regarding the influence of Kano and QFD application on the quality of the project, the manager believed both methods had great impact on the results by bringing credibility as well as confirmation for the solutions. However rest of the group didn't possess same reflections. From their perspective, especially in the case of QFD the impact was slight and the results could have been used to a higher extent. Finally, when the team members were asked about the difficulty of implementing these methods, the overall answer was that while following guidelines is a simple task, the challenge is to customize methods to the group needs.

"Finding a fast and effective approach with the right focus is the most challenging" answered a member of the inner design team.

Indeed the group had a hard time deciding to which degree the guidelines for each method should be followed, and how deep the analysis should be conducted. This was a source of time loss.

Analysis

To which degree are the requirements for implementing Kano and QFD fulfilled in the studied case?

Earlier it was defined the use of QFD driven data sources as well as organizational characteristics such as internal motivation for using QFD, management support and the involvement of cross-functional teams are the factors with positive impact in successful application of QFD (Cristiano et al., 2001). These factors have been considered as implementation requirements which their fulfillment in the studied case have been examined. Due to the fact that there aren't many researches referring to Kano model application conditions, QFD implementation requirements are used as the main reference for both methods; in other words key factors in successful application of QFD have been broaden for Kano model as well, which also allows a comparison between the two methods.

It's worth mentioning the studied project group wouldn't represent all characteristics of an actual organization due to its limited number of members and functions. Still the goals followed by applying customer satisfaction methods in Muesli machine project are the same as in a project group in real organization. Also having subgroups with different areas of expertise including marketing, technical and design support provided the chance to have a similitization of an organization with different functions. Therefore studying the project group according to organizational characteristics seems reasonable.

Internal Motivation

What was interpreted from Muesli machine project group was that motivation for learning and applying methods related to customer satisfaction including QFD and Kano was not equal among all group members. While members involved in marketing tasks and later in machine outer design had great motivation for learning new methods and obtaining customer data, it was not the same for the rest of the group specially the ones with technical expertise. Comparing the two methods overall motivation for applying Kano model was higher, meaning the bottom up motivation recommended in literature (Griffin, 1992; Govers, 1996; Cristiano et al., 2001) was more observable in the case of Kano rather than QFD method which can be explained by the following reason.

Ranked technical characteristics resulted from QFD first phase were subjective in many cases (such as ergonomics of the machine, quality of the mix, attractiveness,..) which didn't provide detailed and explicit measurements required for design of the machine, therefore the group was encouraged to implement the second phase in QFD to get importance ranking of machine components. This action took place while members specialized in mechanical solutions didn't feel the necessity of customer involvement in defining core functions of the machine and preferred to rely on their own technical knowledge. As a result Kano model putting all the emphasis on customer requirements instead of technical characteristics was perceived as a more novel and informative method, for which there were higher utilization incentives.

Management Support

Within muesli machine project, the leader strongly supported all the efforts involved with Kano implementation. As mentioned earlier in the case of QFD, one criterion for this commitment is whether the manager is viewing the method as an investment bringing the company added value or as an expense which should be minimized (Griffin, 1992; Griffin, 1991). This was true for Kano since its contribution in making reliable trade-offs made the leader view it as a crucial part of new product development process and intended to allocate sufficient time and resources for it. The whole group was convinced by him to participate in designing Kano questionnaire and sending them out to potential customers. Further he trusted the obtained results and encouraged members to put them as basis in their decision makings.

On the other hand the main reasons for lack of managers' incentive regarding QFD technique was the method long implementation time inconsistent with project tight schedule as well its overlaps with concept development phases. Although the complete list of customer needs and relative metrics (technical specifications) were already

defined in early development phases, still considerable amount of time was required to fill out the relationship, planning and the roof matrix. Since defining customer needs and relating them to specifications were also parts of QFD process, the leader viewed this method as an extra effort for which minimum time and number of people should be allocated. In general the method suffered from management lack of commitment which itself caused the restricted application of its outcomes.

Cross-functional teams

Kano and QFD implementation were basically marketing group responsibility, but the idea was to have whole group brainstorming for getting relative main decisions. This was made possible for Kano core activities which benefited from management support. Considering marketing, technical and design support groups as different functions it can be said the method was implemented through cross-functional team involvement. Kano questionnaire was defined having members possessing different skills which made it possible considering various aspects of customer requirements such as ergonomics, attractiveness, machine usability, cost, etc. The questionnaire was also spread out by everyone; however as mentioned earlier cooperation degree was different. Unlike marketing group, technical support staff was not motivated as much to contact customers and asking about their needs.

Although cross-functionality is one of the basic requirements for QFD application, the project wasn't successful accordingly. While requirements and relative specifications were defined having all group members participated, filling out QFD matrixes and results evaluation were mainly carried out by the marketing group. It was interpreted, due to project leader these steps were viewed as extra effort and there was no intention to involve more than one function.

New data sources

Muesli machine is an innovative product, new to both customers and the development team for which the group didn't have access to any pre-defined customer demands. Therefore the group had no choice but to start with customer research and gather new information. In fact the primary survey was conducted following this aim. Customer requirements used in QFD first phase were based on the results of this survey, so was the questionnaire used for Kano study. Results from Kano model were integrated in QFD matrix in order to omit the impact of customer unfamiliarity with product on importance rating of needs. Internet based survey weren't the only methods utilized to get new data from customer, in design phases focus groups were used by marketing group to have a more realistic view about their requirements.

Therefore it can be said within both QFD and Kano application, the requirement for new data sources was successfully met. However what was concerned by the project group was not only accessing new data but also its effective interpretation. The difficulty to understand and organize customer needs has been defined as one of the significant challenges in methods such as QFD (Akao, Ohfuji, & Naoi, 1987), which was also experienced in the case of Muesli machine project.

“It is hard to find suitable people willing to be involved in investigations. This is what I think the most difficult. Interpretation of the results is also a complex task. Formulating question is also challenging, there is always a great risk that the

questions are misinterpreted. This makes the use of answers hard” mentioned one of marketing group members.

How did Kano and QFD method alter new product development activities in the studied case considering both design and organizational aspects?

Within Muesli machine project, it has been tried to reach a customer-led new product development. Indeed the starting point of the developing process is the customer, the first step of the project was to learn and investigate customers’ needs. According to Costa and Jongen (2006), the second pillar of customer led NPD is that the goal of the team must be to satisfy customer needs, which has been the goal of the muesli team all along the project. The Kano and QFD methodologies have been used to that purpose. They have enabled the group to make sure that the products components and functions meet customers’ requirements.

The contribution of Kano and QFD to NPD will be analyzed by comparing it to the expected outcomes suggested from literature on this topic. As mentioned earlier there are very few researches regarding organizational benefits that Kano model application can bring. Therefore the same as in the previous section, QFD related discoveries will be used as a reference in the case of Kano application and a few discovered Kano design benefits will be examined on QFD outcomes as well, which also enables comparison between two methods. According to the resulted design and organizational benefits, illustrated in the frame of reference, Table (I) shows the contribution of Kano and QFD in the case study.

Table (I): Design and Organizational benefits of QFD and Kano model application.

Design Benefits	QFD	Kano model
Fewer and early design changes	Major components of the machine were identified very early in development process.	Goals were fixed at an early stage.
Shorter time in development	Not observed	Less time spent elaborating product specifications but time consuming to collect and analyze the results
Fewer start-up problems	Not observed	Prioritization of attributes was made easily, leading to vary few arguments or debate among the team.
Minimized start-up and project cost	Not observed	Not observed
More satisfied customers	Machine components were prioritized based on customer satisfaction and more resources were allocated accordingly.	Final design contained all Must-be and one-dimensional attributes in addition to a number of attractive ones.
Better understanding of customer requirements	Low; since customers rate requirements which aren't familiar with.	High; for each attribute the team explicitly knew how much satisfaction it brings.
Allow trade-offs during development phases	Not observed	Visible mixing process and ingredients were revoked due to complexity and less satisfaction they bring.

Indicating products' comparative strengths and weaknesses with respect to competition	Many competing product such as coffee machine & internet-based services were benchmarked.	Bench marking was made regarding attractive attributes.
Enhanced Innovation and creativity	Not observed	The questionnaire allowed group creativity and innovativeness, leading to easier brainstorming.
Improved overall quality of results	Not unanimous	
Organizational benefits	QFD	Kano model
Encouraged teamwork and participation	Low interest from the group and project leader (except from marketing function)	The whole group participated in planning and sending out questionnaire while everyone was eager to know the results.
Improved documentation	The group documented decision making process as well as marketing and design work.	
Enhanced decision making	Made it easy to allocate resources for every task.	Gave the group confidence when making decisions especially for trade-offs

Design Benefits

It can be noted that for many design criteria, the expected benefits have not been observed especially in the case of QFD. For instance, shorter development times, fewer start-up problems, allowing trade-offs during development phases and enhanced innovation due to the use of QFD, have not been seen (although it was in the case of the Kano model);

Less time in development and fewer start-up problems were not observed in the case of QFD, as very few project members took part in this method. Other members did not feel involved and perceived the task as time consuming. Although compared to Kano, QFD is known as a more participative method, suffering from low management support it was affected by lack of team involvement. As a result it did not reduce start-up problems such as disagreements and ambiguities, further the outcomes were used to a really low extent; only to prioritize components and allocate resources. Unlike QFD, Kano application involved all group members, although in general people working in different functions didn't hold same view about the necessity of customer satisfaction methods. The team was asked if too much time was spent on these methods;

“I think we could have given this process both more time and resources to make sure it was done thorough” – Outer design team member

“We used too much time, but this is due to a low efficiency” – Inner design member

Enabling trade-offs was another factor which was observed just in the case of Kano. Deciding which solution to choose and which function to remove was something faced by the project team a number of times (such as the case of mixing process and visible ingredients). The explicit categorization of attributes by Kano made it much easier for the group to make such decisions.

Regarding **Enhanced Innovation and Creativity**, it cannot clearly be said that Kano model helped group members to generate new ideas, but it surely guided and structured the brainstorming. The result was that most of the ideas issued from brainstorming satisfied the satisfaction criteria from the Kano model's findings. This was less observable in the case of QFD, since customer requirements and relative technical specifications were defined in early development phases and QFD implementation mainly concerned filling-out rest of matrixes which didn't require high levels of creativity. In the final questionnaire the team was ask if they believed the use of such methods helped them generate new ideas or whether it had a negative effect, for which they responded despite lowering the level of innovation, methods acted as good vectors to canalize ideas and bring them some realism.

The most important criterion is perhaps **customer satisfaction**, as it is the ultimate goal of both methods. It was not possible for the development team to measure the success of the product among customers, but the team compared the final results to the specifications and recommendations from Kano and QFD. This comparison revealed most constraints were respected in the final concept.

A controversial criterion concerns the **overall quality of the results**. Despite the fact that not all team members agreed that QFD or Kano participated in improving the quality of their work, it was easily seen that the final product had incorporated all the specifications (except a visible mixing phase) QFD and Kano recommended. The final questionnaire revealed some members of the Muesli machine team felt that either the methods had very little impact or that their results could have been used to a higher extent. This is very true regarding QFD that wasn't successful in gaining project manager support. Regarding Kano this is very controversial because all the outcomes from Kano are visible on the final product. However the project manager, which has a good visibility on the overall work, clearly stated the benefits of the use of customer satisfaction methods.

Organizational Benefits

Regarding organizational benefits, Kano was a success whereas QFD was less advantageous compared to the expected benefits mentioned by researchers (Lockamy & Khurana 1995; Griffin & Hauser, 1992; Govers, 1996; Xie, Tan & Goh, 2003).

What was observed was that QFD didn't lead to any improvements in **teamwork and participation**. Due to the low interest of the group in general and poor management support, the dedication level to this method was restricted. In other words there is much more to gain from QFD. Design support function which later acted as Inner-design group didn't feel the obligation of customer involvement through QFD, so did the project leader due to project time restrictions. Therefore if QFD encouraged any teamwork and participation it was only for the people working with it, which didn't enhanced communication through whole project team.

On the other hand Kano was very benefic. While an enthusiasm among the group concerning this method was observable, every member participated in different implementation levels. The team was eager to learn a new method and even more to

discover the results. The method was implemented very early in the project which brought cohesiveness in the newly formed team.

Both Kano and QFD had a significant role in **improving documentation** of marketing and design work in a consistent manner. The project leader insisted on a well-documented process and therefore every task within each method was immediately documented after completion. The files contained primary market research findings and design sketches as well which made it easy for everyone to access to group knowledge and recent inventions.

Regarding **enhanced decision making** although QFD appeared as a structured method helping the project leader to legitimate resource allocation, but compared to Kano had less contribution in group decision makings in the case of trade-offs. Trade-off decisions, for example the positioning of the compartments, were facilitated by relying on Kano study. It was technically speaking easier to put them in the back, which was the solution that inner design group supported. The group thought that for aesthetic and user friendliness it would be better in front. Referring to the Kano results, customer satisfaction would be much higher if the ingredients were placed in front and made visible. Therefore the group dedicated more time into designing a more complex solution but that would improve the results.

Conclusions

Application of customer satisfaction methods such as Kano model and QFD under conditions enabling deriving their full potential within new product development processes is an important challenge for manufacturers. Regarding the implication of QFD and Kano model in NPD, this paper has presented the difference (or the so-called gap) between application of these methods in practice and what is expected accordingly in literature. The gap has been analyzed based on a case study of developing a Muesli dispenser which is an innovative product due to the type of services it offers the customers.

The contribution of Kano and QFD in Muesli machine project was observed and resulted benefits were classified as either design or organizational. The Kano model has been very benefic for the development team; many design benefits were identified. Criteria of customer satisfaction were specified much early in development process leading to quick elaboration of product specifications. Based on Kano categorization trade-off decisions were guided through design phases and creativity was enhanced when planning for the questionnaire. Organizational benefits have also been observed, it was noticed that group cohesiveness was improved due to the necessary participation of the development team. Decision-making was enhanced: the Kano results gave confidence and legitimacy to the results. On the other hand few benefits were observable as a result of QFD application. Regarding design the main advantage was fewer design changes at the beginning of the project. In addition QFD was an opportunity to perform the benchmarking of several similar concepts. Concerning organizational features, QFD implementation facilitated recourse allocation related decision makings.

These observations prove that the benefits identified in the case study are very different from the ones described in literature. This difference or gap is important in the case of

QFD. Indeed for the Kano model, the expected benefits from literature were mostly observed in the Muesli Dispenser project, revealing no gap between practice and research. As for QFD, the expected benefits of literature were only partially gained or almost not met in the case study. In other words Muesli Dispenser project was not able to gain the full potential (described in literature) of QFD.

Further the degree to which implementation requirements were fulfilled in each case of Kano and QFD application was examined for which the results reveal the same gap. Muesli dispenser project wasn't able to satisfy organizational requirements necessary for successful application of QFD. Although neither in the case of Kano or QFD, project team didn't possess the bottom-up internal motivation recommended by literature, but this lack of interest was much more observable in the case of QFD especially among Inner design members with technical specialties. QFD was not successful to gain management commitment either, there was no incentive from project leader for all group members to participate in implementation processes; as a result the method suffered from lack of cross-functional involvement and was mainly performed by marketing staff. On the other hand, Kano model was viewed as a crucial part of new product development by project leader and the whole group was convinced to participate in designing Kano questionnaire and sending them out to potential customers. This made it possible for the method to benefit from cross-functional team involvement, though cooperation degree varied among members from different functions.

What is concluded from evaluation of Kano and QFD outcomes in the studied case and analysis of organizational conditions under which each of these methods was implemented reveals that there is an obvious link between fulfillment of organizational application requirements of such methods and their resulted benefits.

It is worth mentioning due to the small size of the studied project team and limited duration of project execution, one should attend the concluded results of this research will best fit narrow scoped development projects carried out in rather organic environments and may not be generalized to large organizations with several previous product development experiences.

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Effects of well organized working environment in human reliability

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Introduction

Many companies throughout the world base their strategies for growth on excellence based on the application of quality management theories. Quality has been recognized as a source of competitive advantage (Goodstein and Burke, 1991; Ho, 1999; Powell, 1995). Furthermore, human reliability is a key dimension of quality. There are two approaches to improve human reliability: the person approach and the system approach (Reason, 2000). The person approach focuses on the errors of individuals. The system approach focuses on the conditions under which people work and tries to build defences to prevent errors or mitigate their effects. Both, quality and human reliability are keys to reaching excellence.

However, an in-depth understanding of how quality and human reliability work to create value for the company is required. Human errors contribute to the majority of workplace accidents and quality mistakes in organizations. The importance of human error is extremely relevant in accidents: 58% in medicine (Leape et al., 1991); 70% in aircraft (Hawkins, 1993) and 80% in shipping (Lucas, 1997). Many of these mistakes generate important costs for organizations, workers and customers. But in most of them, the actual causes remain unknown. More research is needed to know more about the human mistakes and how to explain the causes of errors. Organizations can improve but only if error sources are known. Conventional ways using ideas of process robustness, training of workers, and redundancy of activities have been implemented. In this research, a new way to tackle the problem of how to improve human work perfection is analyzed. The objective of this paper is to analyze the impact of well organized working environment upon quality and human reliability.

Experiments with humans were selected for the study. The work environment based on order was chosen for this paper. Order means a well organized working environment (WOWE). In this sense, WOWE would be defined as the environment of work where everything is orderly and organized in the right place. And the not well organized working environment would be defined as the environment of work where something is

untidy and disorganized. A work environment in this research may never affect directly the work post and those effects and tools that workers need to do their job. Reference is always made to things that could indirectly affect the workers.

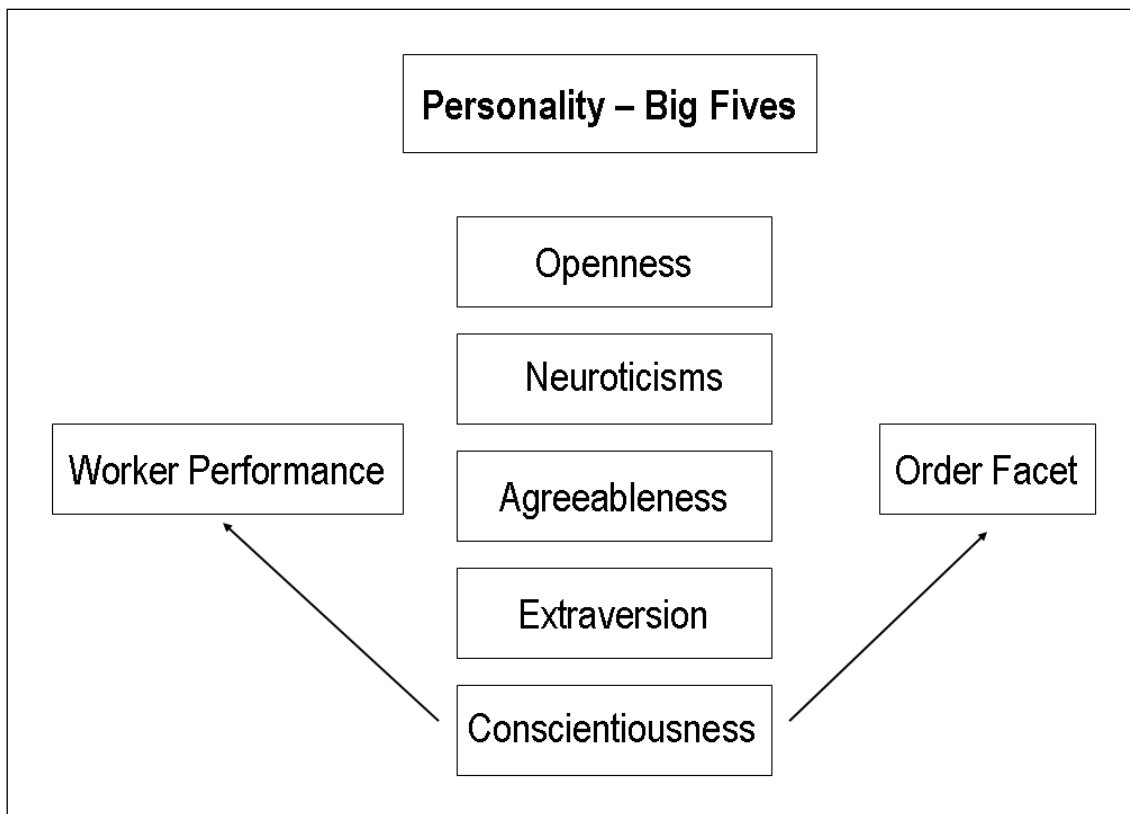
The remainder of this paper is divided into five main sections. A theoretical framework of the characteristics of order and their implications in system approach is firstly presented. Then, the research methodology section includes the steps carried out in the experiments. Next, the data analysis section illustrates how the main findings of the research were obtained. A discussion section is included to analyze the yielded results. Finally, conclusions and future research proposals are presented.

The oretical framework

Order from the Psychology Field

From the psychology field, the relationship between personality and job performance has been frequently studied in the last decades. The Big Five refers to a type of taxonomy or personality traits classification system used to describe personality dimensions (Goldberg 1990, John 1989). The Big five dimensions are Extraversion, Agreeableness, Conscientiousness, Neuroticism, and Openness. Conscientiousness has been identified by many authors as the most appropriate factor to explain differences in personal work performance (Mount et al., 1998, Mount et al., 1999, Barrick et al., 2001). Costa and McCrae (Costa and McCrae, 1995) have suggested that, within each personality dimension, there are facets (essentially first-order factors) that combine to form the entire construct. They described six facets for each domain. The names for each facet are derived from the items that contribute to it. The conscientiousness facets are order, dutifulness, competence, achievement-striving, self-discipline, and deliberation. Figure 1 outlines the relations between person and order facet from the psychology field.

Figure 1: Relation between personality, worker performance and order facet.



As these conscientiousness facets of personality are keys to explain worker performance, we studied order facets more indepth. The research question is whether working environment based on order (well-organized) can alter or modify worker reliability. Hence, this paper aims to research if there are interactions among a work environment based upon order and worker mistakes.

There is no research in our bibliographical review that has studied if there is some relationship between a well-organized working environment and worker reliability or quality. According to Costa and McCrae (Costa and McCrae, 1992, 1999, 1998), high scores on the order facet are characterized by being neat, tidy, clean and well-organized; i.e. keeping things in their proper places. Order as a tendency to keeping one's environment tidy and well-organized is a familiar from several personality inventories (Costa et al., 1991). Low scorers might therefore be described as dirty, messy, untidy and disorganized (Costa and McCrae, 1998).

In a WOVE, workers could focus their attention exclusively on their job. Because of that, they could increase their attention and reduce the likelihood of distractions and reduce the probability of accidents, incidents and mistakes. The WOVE could help keep the worker's brain focussed on tasks in hand. Furthermore, this can give a sense of order and professionalism that increases the wish to do a better and more careful job.

The impact of working environment over quality had been studied in cases of physical conditions such as temperature, light, humidity but no study has been developed about well organized working environment. Our proposal is to know more about their quantitative impact. This could open new perspectives to researchers from psychology, management and ergonomics fields.

Order from Management Field

Many worldwide firms manage their production activities with a tool named 5-S (Seiri, Seiton, Seiso, Seiketsu, Shitsuke) (Hirano, 1996; Imai, 1986; Osada, 1991). This tool is oriented to improve the work place with respect to the activities of sorting, straightening, sweeping, standardizing, and sustaining.

The first S (Seiri), means to put things in order – separate the necessary and the unnecessary things.

The second S (Seiton), means neatness – there should be a place for each thing and each should be in its place.

The third S (Seiso), means sweeping – keep the workplace tidy and clean.

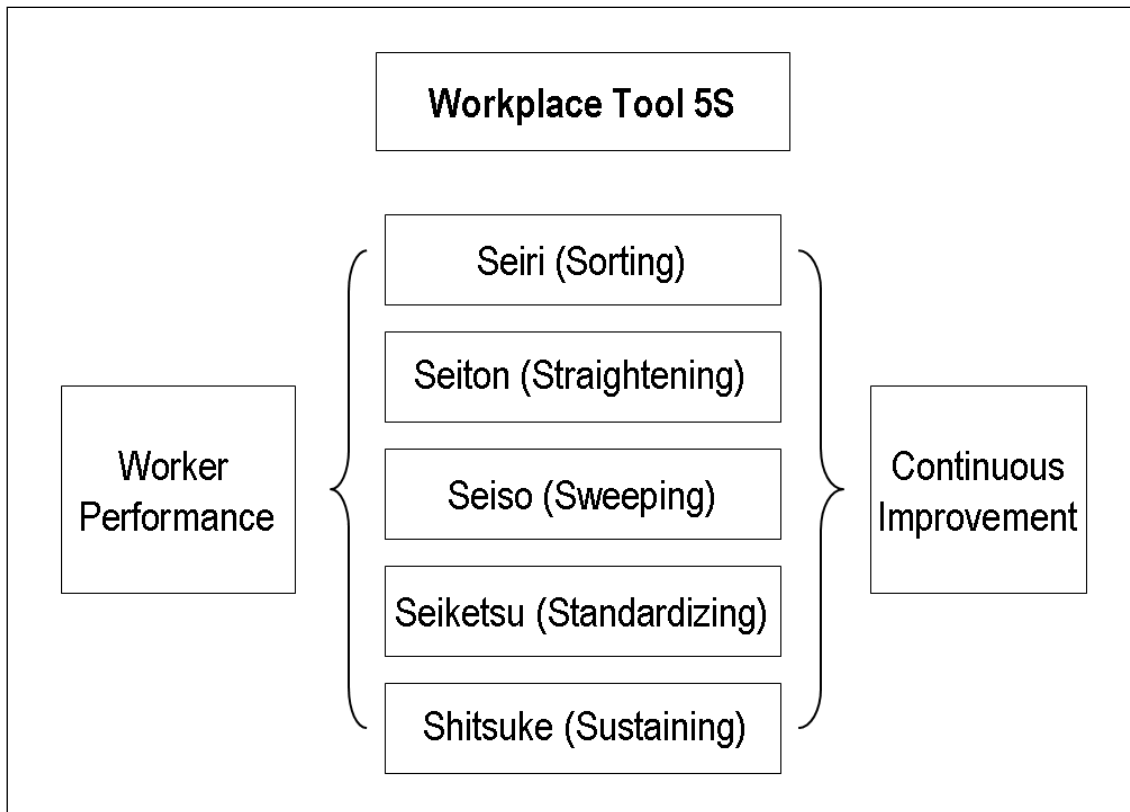
The fourth S (Seiketsu), means standardisation – maintain the level of the first three S.

The fifth S (Shitsuke), means sustaining – review and improve standards.

The tool named 5S was introduced in Japan from a social culture in which order and discipline had developed between the people. In 1980 many Japanese firms used the 5S as a way to develop an integrated system of production. Its characteristics of order, housekeeping and standardization of workplace helped workers to organize their daily activities in a more perfect way and develop continuous improvement. Important companies such as Toyota introduced it as a strategic tool for their operations. The relationship between 5S and continuous improvement is described in figure 2.

In the Western firms, the tool has been used extensively as a mechanism to keep the workplace tidy. Kobayashi et al. state that “organisations in the UK and the US are likely to consider that 5S is directly associated with work and management by improving their workplace through organization and cleaning activities” (Kobayashi, Fisher, & Gapp, 2008). However, few organizations have considered it as something strategic to their production systems.

Figure 2: Relation between 5S tool and continuous improvement.



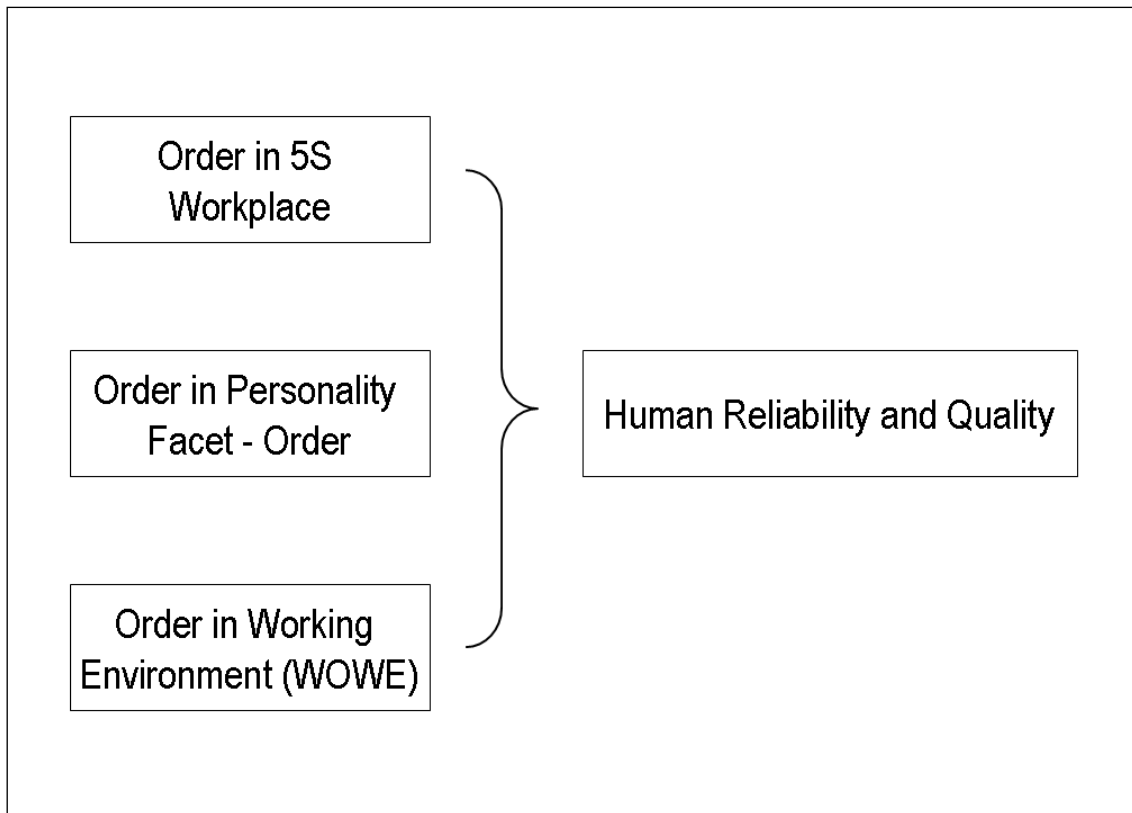
Few scientific researches have addressed the tenets of this tool. Order is a key characteristic that affect operations. More in depth studies for analyzing the consequences of order in people are needed. The importance that 5S has given to order is extraordinary. Several of the S features are focused on getting a job to be well-organized. One reason for this importance could be in the policy of continuous improvement where worker's participation and commitment is vital. The order contribution could be to facilitate detection of errors and enhance suggestions for improvements in production. It seems reasonable think that an ordered workplace allows people to better organize their work and continuous improvement. Any study has been developed to know the quantitative effect of well organized working environment in the quality of products.

Integration of Order in Working Environment for improving Human Reliability and Quality

In this article, a new way in the relationship between working environment and human reliability is analyzed. From a conceptual point of view, the coherence between workplace, personality facets and working environment might be relevant. Order has been used to improve workplace from the management field. Many important companies organize their workplaces with 5S tool where order is one of its main concepts. In addition, order as a personality facet can explain worker performance. As already mentioned from the psychology field, order in conscientiousness trait of character is one facet that contributes to explain better performance. Therefore, order applied to working environment could be relevant to a better understanding of human reliability and quality. An integration of both perspectives in a well organized working environment could help us to understand how to avoid more mistakes and defects

caused by human behavior. Figure 3 shows the relation of WOVE and quality and human reliability.

Figure 3: Relation of WOVE for improving Human Reliability and Quality.



This research addresses the question of whether well organized working environment could reduce, or not, human errors. Organizations and technologies have become more complex, and errors, incidents or accidents in many of them have serious consequences and their causes remain unknown. There are many organizations such as hospitals, nuclear power plants and airports where the management of reliability is extremely important. The traditional way to handle these issues by using methods related to trial and error is inconceivable to those organizations which manage their reliability. For this reason, prevention of accidents, errors and incidents is the best way to address the problem. This article explores a non-conventional means taken from the system approach, based upon the impact of a well-organized working environment (WOVE) in order to prevent human errors.

Human Reliability Assessment (HRA) was the first tool for predicting and preventing the impact of human error in organizations. It manages three areas to control and reduce human errors. First, describe and register errors in order to know the events that occurred. Second, count errors and analyze the statistics and frequencies. Third, reduce the frequency of errors and their impact. The whole evaluation process of this tool begins with thorough knowledge of the sources of error. The study is based mainly on analyzing those activities that the worker should undertake and those that have been performed in reality. Little is known about the indirect effects that a working environment can have upon worker reliability such as the relationship with environmental events, in a logical and quantifiable framework. For this reason, it is

important to know if some of the worker mistakes could have originated as a consequence of a disorganized environment.

The tenet of reliability has been attacked for not knowing the causes and how they could best be avoided. However, in many cases organizations can not discover the true causes of human error. Reliability in most cases, becomes invisible, and it is not possible to know what happened and subsequently how to prevent future errors. In this situation, new avenues of research must be explored. There are unknown causes, hidden for organizations that may be enlightened upon.

Research methodology

Research Question

The problem studied in this paper is as follows; How does a well-organized working environment affect human reliability and quality?

Consequently, this paper aims to answer and discuss, by means of human experiments, the following question:

- RQ. Does a well-organized working environment significantly improve human reliability and quality versus a not well-organized working environment?

The possible responses to the research question are:

- H0. A well-organized working environment does not improve human reliability and quality in comparison with a not well-organized working environment.
- H1. A well-organized working environment improves human reliability and quality in comparison with a not well-organized working environment.

Data Collection

A human experiment with people was undertaken for testing the hypotheses. Subjects performed a simple task in a highly controlled work environment with two different treatments as independent variable. Working Environments are those things that do not directly affect the workplace or the work itself. Working environments are those things that workers can see but never directly affects a worker's productivity or quality. For collecting the data two experiments were done, T1 treatment 1 and T2 treatment 2.

- T1. A Not Well-Organized Working Environment.
Working Environment with disorder where many things are not located in right places.
- T2. A Well-Organized Working Environment.
Working Environment with order where all things are located in the right places.

It is important to stand out that the Work Environment doesn't affect the work itself.

Research Variables

The dependent variable is Worker Reliability named as $WR(i,j)$.

$WR(i,j)$ is worker reliability i measured as the number of mistakes divided by total output multiplied by 100 in the treatment j , for $j= 1,2$.

$$WR(i,j) = M(i,j) / T(i,j)$$

$M(i,j)$ is the number of mistakes of worker i in the treatment j , for $j= 1,2$.

$T(i,j)$ is the total output of worker i in the treatment j , for $j= 1,2$.

We considered as a correct output those answers made by participants that were the same as the standard.

Hypothesis to be tested:

$$H_0. \quad \mu_{WR(1)} = \mu_{WR(2)}$$

$\mu_{WR(1)}$: is the mean of worker reliability of individuals in the treatment 1.

$\mu_{WR(2)}$: is the mean of worker reliability of individuals in the treatment 2.

We test this hypothesis by a classical means tests. We consider three alternative tests:

- (1) Suppose that the variances of worker reliability are equal.
- (2) Suppose that the variances of worker reliability are not equal.
- (3) Suppose that the variances of worker reliability are not equal and use the Welch approximation.

Participants

All of our subjects were university undergraduate students who were recruited from different Faculties. Eighty one students participated in the experiment, thirty two males and forty nine females. Fifty one percent of the participants were students of the School of Economics and Business Administration. Students were hired for a short-term (2 hours) job requiring no previous knowledge. A total payment of fourteen Euros was paid to everyone.

Students applied for the jobs by e-mail. After receiving their applications, each participant was randomly assigned to one of the two treatments and was informed about of date and location where they were expected to carry out the job. Both treatments were performed in a computer lab of the University. The experiment took place in October 2010.

Experiment task and working environment

Students had to introduce the results of a survey in a computer. The survey simulated a market research about the firm preferences of graduate students to work. The survey style was a multiple choice questionnaire. The answers were chosen by mouse clicks.

Previously, all the answers of surveys in the online program were filled. The surveys given to the participants were printed results of the data that had been entered in advance in the online program. Thus, each participant received a package of 80 surveys that supposedly already had been filled out by 80 different subjects. Each survey had 44 answers (inputs) to enter in the online program. Each survey had an identification number and the 80 surveys were arranged in ascending order according to this number. The survey data, type and model of computer, identification numbers and order of the surveys were the same for all participants. Each participant worked for one hour entering surveys. Then, they filled out NEO PI-R personality test and finally they filled out a brief questionnaire about their feelings about work environment.

The working environment was simulated in terms of well-organized and not well-organized. In the case of not well-organized working environment there were some papers out of place in a messy environment.

Data analysis

First, a graphical analysis of the mistakes by treatment was carried out to detect outliers that might distort the results of the study. Once clear outliers were eliminated, a dispersion analysis of mistakes and worker reliability was performed (Figure 4 and Figure 5). The dispersion analysis was separate by treatments, from 1 to 41 cases, is treatment 1 and from 42 to 80, is treatment 2.

Figures 4 seem to show that well-organized working environment may have reduced the mistakes and improve worker reliability, which is aligned with the descriptive statistic shown in table I. Table I states that the worker reliability of a well-organized treatment has a mean of 14.1 human errors by thousand of the total number of answers with a standard deviation of 24.2%. On the other hand, worker reliability of a not well-organized treatment has a lower mean of 25.8 errors per thousand with a higher standard deviation of 34.8%. These differences between the treatments are also illustrated in the Box-plot shown in Figure 6 and 7.

However, a formal analysis was needed to test the hypothesis of the research question: Does a well-organized working environment significantly improve human reliability and quality versus a not well-organized working environment? Consequently, the research question may be formulated by classical mean test considering the mean of worker reliability.

A formal independent samples T test for two samples was carried out to establish whether the means of two treatments are statistically different from each other. This analytical approach was intended to establish whether the worker reliability (mistakes divided by total output) in both treatments belonged to the same population of samples or if they constituted two distinct populations of samples with different average levels and different variations. Before running this statistical test, necessary assumptions must be validated, especially the normal distribution of the samples. Three 2-t test was used to compare both Treatments (Table II, III, IV). Table II assumed that variances are equal. Table III assumed that the variances are unequal and table IV assumed that variances are unequal and use the *Welch approximation*. The significant p-values of 0.0413, 0.0430, 0.0429 respectively confirm that the means are not equal. Consequently, H0 can be rejected and consequently support H1: A well-organize

working environment improves human reliability and quality in comparison with a not well-organize working environment.

Results show an average reduction of almost 53 percent in total mistakes, which means that the introduction of well-organized working environment improved worker reliability in 45 percent, measured in terms of mistakes divided by total output. In addition, there were a reduction in the variability with decrease of almost 31 percent in standard deviation of total mistakes and a 47 percent in standard deviation of worker reliability.

Figure 4: Worker reliability by Treatment and Case Number

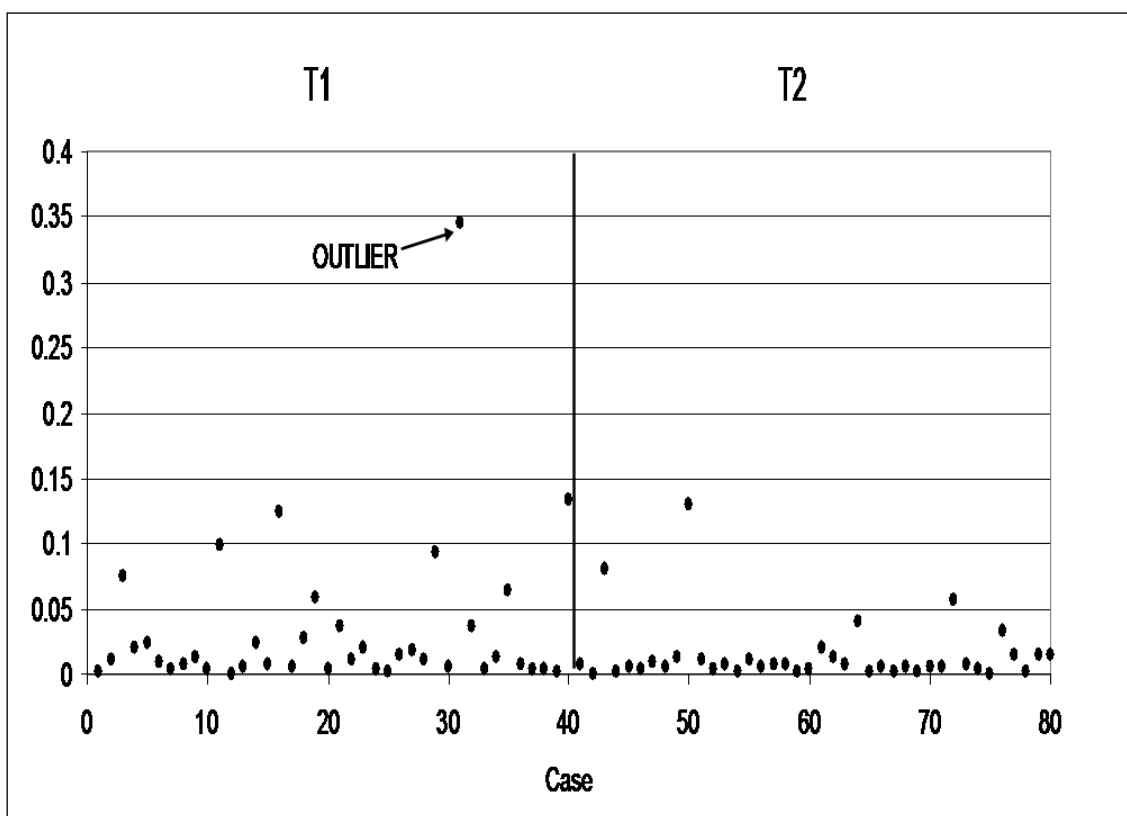


Table I: Descriptive statistics of the different treatments for $WR(i,j)$, $M(i,j)$, $R(I,j)$ and $T(i,j)$, including sample size, mean, standard deviation, minimum value, first quartile, median, third quartile, and the maximum value in the corresponding order

WR(i,j): Worker Reliability

	n	Mean	St.Dev.	Min	Q1	Media n	Q3	Max
1.0	39	.02579	.034823	.000	.00413	.01048	.02664	.13320
		85	2	00	91	03	97	71
2.0	41	.01406	.024162	.000	.00283	.00636	.01321	.13026
		33	2	76	69	36	37	82

M(i,j): Worker Mistakes

Treatment	n	Mean	StDev	Min	Q1	Median	Q3	Max
1.00	39	34.49	49.66	.00	6.00	11.00	34.00	211.00
2.00	41	16.22	26.23	1.00	4.00	7.00	15.00	136.00

T(i,j): Total Output

Treatment	n	Mean	St. Dev.	Min	Q1	Median	Q3	Max
1.00	39	1298.69	273.39	770.00	1121.00	1263.00	1541.00	1760.00
2.00	41	1225.17	285.98	484.00	1089.00	1169.00	1397.00	1952.00

Table II: Results of a Two-sample t test with equal variances

Group	Obs	Mean	Std. Err.	Std. Dev.	[95% Conf. Interval]	
1	39	.0257985	.0055762	.0348232	.0145101	.0370869
2	41	.0140633	.0037735	.0241622	.0064367	.0216898
combined	80	.0197842	.0033796	.0302282	.0130572	.0265112
diff		.0117352	.0066736		-.0015508	.0250212

Degrees of freedom: 78

$$H_0: \text{mean}(1) - \text{mean}(2) = \text{diff} = 0$$

Ha: diff < 0	Ha: diff != 0	Ha: diff > 0
t = 1.7585	t = 1.7585	t = 1.7585
P < t = 0.9587	P > t = 0.0826	P > t = 0.0413

Table III: Results of a Two-sample t test with unequal variances

Group	Obs	Mean	Std. Err.	Std. Dev.	[95% Conf. Interval]	
1	39	.0257985	.0055762	.0348232	.0145101	.0370869
2	41	.0140633	.0037735	.0241622	.0064367	.0216898
combined	80	.0197842	.0033796	.0302282	.0130572	.0265112
diff		.0117352	.006733		-.0017026	.025173

Satterthwaite's degrees of freedom: 67.3542

$$H_0: \text{mean}(1) - \text{mean}(2) = \text{diff} = 0$$

Ha: diff < 0	Ha: diff != 0	Ha: diff > 0
t = 1.7429	t = 1.7429	t = 1.7429
P < t = 0.9570	P > t = 0.0859	P > t = 0.0430

Table IV: Results of a Two-sample t test with unequal variance, Welch approximation

Group	Obs	Mean	Std. Err.	Std. Dev.	[95% Conf. Interval]	
1	39	.0257985	.0055762	.0348232	.0145101	.0370869
2	41	.0140633	.0037735	.0241622	.0064367	.0216898
combined	80	.0197842	.0033796	.0302282	.0130572	.0265112
diff		.0117352	.006733		-.0016972	.0251676

Welch's degrees of freedom: 68.8697

Ho: mean(1) - mean(2) = diff = 0

Ha: diff < 0	Ha: diff != 0	Ha: diff > 0
t = 1.7429	t = 1.7429	t = 1.7429
P < t = 0.9571	P > t = 0.0858	P > t = 0.0429

Discussion

Human error is one of the most important aspects for many organizations, especially for those where their consequences are fatal, such as happens in health organizations, energy infrastructures or means of transport. Human mistakes are always difficult to detect. A person works in a production, processing and system with interrelations amongst different resources, suppliers and workers. The difficulty is to knowing who is the responsible for a mistake; the solution is not easy. However, to know the actual causes of errors is a key issue of improvement. Therefore, it is necessary to have a better understanding of how people work and how a work environment affects them. How processes affect those persons in terms of quality and reliability has been well studied. But little is known about how working environment affects people. When workers enter into contact with working environment, different feelings are perceived for them. Whether or not a working environment is well organized could produce a reaction in people to respect and collaborate more with the norms and focus more on their activities. If workers think that a company cares about working environment then they could perceive that company is caring for them. In this research, empirical evidence about the relationship of a well organized working environment with quality and reliability has been found. An important reduction in the number of human mistakes was associated with this.

In this research, working environment refers to entities that do not things that do not affect directly to the work itself, in spite of workers perception of that working environment. Workers do their work in equal conditions of activities, tools and resources. Only changes in well-organized working environments were introduced. In

this research, questions about how participants perceived well organized working environment were asked. In treatment 1, all participants answered that working environment was not well-organized. In treatment 2, eighty six percent of participants perceived that working environment was well organized. Then, treatments reflex adequately the purpose of the experiments. In terms of the influence of environment in the person, in treatment 1 twenty six percent state that working environment affected them, with distractions and worst willing to effort. In treatment 2 fifty seven percent answered that working environment help them to work with more attention and with better willing to effort. Many participants were not affected by working environment but others perceived working environment as a help or a problem to do job. For this reasons, it is necessary to research in depth about the influence of working environment in each person. Personality tests could help us to understand better the effects and the relations. In any case, influence of well-organized working environment has been relevant for many participants and for the workers as a group. Working environment control variables were used in case of temperature, light, sound and smell. Same conditions for both treatments were used.

A well-organized working environment could mean more than is known in management theory. For many companies, order is a key in operations but not in working environment. Introduction of a well-organized working environment could significantly improve workers reliability, since workers can get better their job with less mistakes and more focus in their operations. This may be attributed primarily to the behavior of workers in an environment without distractions that increase the likelihood of willing to make more efforts.

Limitations of this research have to be considered. First of all, the sample is small with eighty participants. Second, the task was restricted to introduce data in a computer. There are several kinds of tasks where the response of workers to the well-organized working environment could be different. It is necessary develop new experiments with other tasks. In addition, the treatments were extremes without grades of well-organize. In the future, could be relevant introduce experiments with levels of well-organized control variable of working environment. Nevertheless, this is the first attempt to quantify the importance of well-organized working environment in terms of quality and human reliability and may justify 5S tool implementation in operation management of firms.

Conclusions

Since this research was based only on experiments, it would be useful to build into future research some case studies of several companies. In particular, it would be useful to analyze working environments of companies that have applied 5S in their operations. In addition, new experiments with different levels of order are needed.

Different worker's responses were observed in the analyses. Important effects from working environment upon a person were mentioned by some participants. Future research to correlate personality tests with the effects of a well-organized working environment may be introduced.

The fundamental conclusion of these experiments is that there is empirical evidence to support the idea that WOVE (well-organized working environment) has led largely to a reduction in worker's mistakes thus improving quality and worker reliability.

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Identification of semantic space of hedonomic and the most preferable road landscape

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Keywords: road landscape, hedonomics, semantic space, Kansei engineering, factor analysis, correlation analysis.

Category: Research paper

Introduction

According to literature review (Road ..., 1997; Roadscape ..., 1998) road landscape can be analyzed in three dimensions: visual, ecological and cultural heritage. Other resources inventory roadscape from visual and historical positions (The Roadscape ..., 2006). Various literature (Robinson etc, 2004; Smart ..., 2009) on sustainable development indicates requirements for sustainable road landscape to create: the requirements are based on social, environmental and ecological, economic and financial developments. Considering the literature review, we indicate such dimensions for a road landscape to analyze: visual, ecological, social, economic and cultural heritage. However, in this paper we will discuss and research road landscape just from visual point of view, which involves hedonomic approach. Other dimensions could be analyzed in further research.

Road landscape has never been analyzed from hedonomic point of view. Hedonomics is quite a new branch of science, which is closely related to ergonomics. Hedonomics analyses human-object interactions, saying that the usage of an object has to be pleasant and joyful for its user. A new approach to road landscape is proposed in the paper – road landscape is seen as a product, created by human action and nature, the product should provide pleasure to its main users: drivers and passengers. We use a concept of hedonomic road landscape, which means pleasant, delightful and providing a joy. Creation of hedonomic road landscape should be a necessary part of designing an aesthetic roadscape. Such countries as USA, Germany, Japan, Great Britain, Australia and New Zealand developed a number of design principles and planning guides for creation of an aesthetic road landscape. These countries also have a great experience in formation of an aesthetic roadscape. Lithuania's experience in roadscape planning and formation is not rich: one of positively valued road landscaping examples is the highway Vilnius-Kaunas project, which was implemented in 1970. After the restoration of independence, the aims of formation and maintenance of roadscape were forgotten. At the end of XXth century planning of a segment of an international highway Via Baltica in Lithuanian territory started. The highway had to fit the landscape in the best way. A project on planning and design parking and rest areas in Via Baltica roadscape was developed (Jakovlevas-Mateckis etc, 1997), but it was not implemented. In 2010, after the research on identification of hedonomic road landscape in Lithuania, A6 road Kaunas-Zarasai-Daugavpils landscape was identified as the most hedonomic among highways which are marked as European highways and as European road network

corridors, except for bypasses (Matijošaitienė, 2010). Later research-based guidelines for creating a hedonomic roadscape were proposed (Matijošaitienė, 2011). Though the factors which influence the hedonomics of a roadscape were revealed, still, it is not clear what kind of road landscape is the most preferable as a product to its users, and what factors determine its preference. Moreover, it is not clear how hedonomics of a roadscape is related to its preference.

The purpose of the research is to span the semantic space of hedonomic and the most preferable road landscape, and to identify relations between hedonomics and preference of a roadscape. The research will be a background for a further analysis of a roadscape: we propose to express the preference of a roadscape through its concrete properties, using Kansei Engineering. Road landscape is an object and a domain of the research.

Methodology

The research is based on the first step of Kansei Engineering - spanning the semantic space of a road landscape. Literature review uncovers, unfortunately, rather few examples of application of the method to land management and urban development. C. Llinares and A. F. Page (Llinares etc, 2008), with regard to Kansei Engineering method, analyzed the dependence of a choice of a living place in a city from perception of the respective urban landscape. T. Nakama and Y. Kinoshita (Nakama etc, 2010) used the method for the impression of Kyoto city streetscape to study. Kansei Engineering enables to measure perception of an object (or material good) and to link it to design, beauty and aesthetics criteria. The method is aimed at finding out and evaluating customers' opinion about a product, and establishing a quantitative interconnection between the customers' answers and features of the design (Desmet, 2000; Sogabe etc, 2010). The most researchers identify customers' emotion by using descriptive Kansei-words (Schütte etc, 2004; Axelsson etc, 2001; Koleini etc, 2010; Lu etc, 2010). Up to 600 Kansei-words can be used subject to research object/product. The more emotions are included in a study, the more accurate the results are (Schütte etc, 2004). M. Nagamachi (Nagamachi, 1995) collected 600 describing words, from which he defined 100 Kansei-words (he applied pilot survey and factor analysis for words' reduction). However, S. Schütte thinks that 100 Kansei-words are too many, because respondents will be soon wearied of a long questionnaire, and their answers can distort the results. He suggests to use about 20 Kansei-words (Schütte, 2002). For the reduction of collected words we use affinity analysis and factor analysis. The goal of the affinity analysis is to discover relationships between collected words and to group them in accordance with similarities between them. Factor analysis also lets us arrange defined Kansei-words into factors and interpret the factors. Correlation analysis educed relations between factors and variable *hedonomic*. A quantitative survey is used as a background for factor and correlation analysis. We use Semantic Differential (SD) to measure respondents' emotion and to create a questionnaire for the survey. Semantic Differential is a rating scale proposed by Charles E. Osgood (Osgood, 1964) and created to measure the [connotative meaning](#) of objects. The scale consists of two bipolar object's properties on its opposing ends, 5-point or 7-point scale is the most common. The more points, the more exact results on respondents' emotions are.

Research process

We used Kansei Engineering to span a semantic space of road landscape. With reference to the method, we collected 123 words and phrases related to road landscape or describing it. The words were collected from various articles, landscape design and planning guides, book chapters, internet. Collection of words was finished when no new words appeared in all the resources of information. A plenty of collected words impelled us to reduce the amount by application of affinity analysis. Every word was written on a separate card, participants were asked to arrange the cards into related groups in silence. A group of 10 students participated in the process of affinity analysis. The participants started to pick out cards with words, which, according to his/her opinion, were closely related, and put the cards into groups. The arrangement process lasted until everybody was satisfied with the formed groups. As a result, 34 groups were formed. Finally, the participants had to break the silence in order to name each group. The names of the groups are: *dynamic, complex, integral, attractive, emotional, mysterious, pleasant, noble, memorable, aesthetic, visually clean, representative, sophisticated, relaxing, natural, the road merges with the environment, active (aggressive), varied, luxuriant, peaceful, colorful, modern, visually comfort, overladen, visually safe, harmonious, interesting, beautiful, rare (distinctive), I would like to drive on this road, elements fit to the environment, positive impression, tidy, easily apprehensible*. Two groups were given double names in order not to miss any information: active (aggressive) and rare (distinctive). However, we got too many words and phrases to span the semantic space of a roadscape and to use them as Kansei words in further analysis. To reduce the data, we used factor analysis, which was based on a quantitative survey.

A quantitative survey is used for spanning the semantic space via identification of emotions on road landscape. A questionnaire for the survey consists of three parts: **a)** introductory part which presents the topic of the survey and its major goals, **b)** the main part including three pictures of Lithuanian highway landscape with 34 Kansei words represented in Semantic Differential scale, **c)** the concluding part dealing with the respondents' demographic characteristics, such as gender, age, education, frequency of their trips on roads etc. Three pictures with one of the most hedonomic, mid-hedonomic and non-hedonomic views of Lithuanian road landscape are included in the main part of the questionnaire (1). The Semantic Differential 7-point scale for each Kansei word (phrase) consists of two bipolars placed on the opposing sides of the scale – beginning with “very much” and ending with “not at all”. 206 respondents took part in the survey: 14 specialists of landscape and urban planning sciences, 103 respondents like to travel on roads and do it quite often in Lithuania and abroad, and 89 respondents, including students, which have different specialities and jobs. The gathered data was processed with a statistical software package PASW Statistics 17.0.

We used two data resources to perform correlation analysis: research results about the factors and research results about hedonomic road landscape. The latter results are taken from the research on identification of hedonomic road landscape, where variable “Hedonomic road landscape” was expressed by a formula. According to the formula (Matijošaitienė, 2011), hedonomics of each roadscape was calculated.



1. Pictures of one of the most hedonomic, mid-hedonomic and non-hedonomic Lithuanian roadscares were used for the quantitative survey

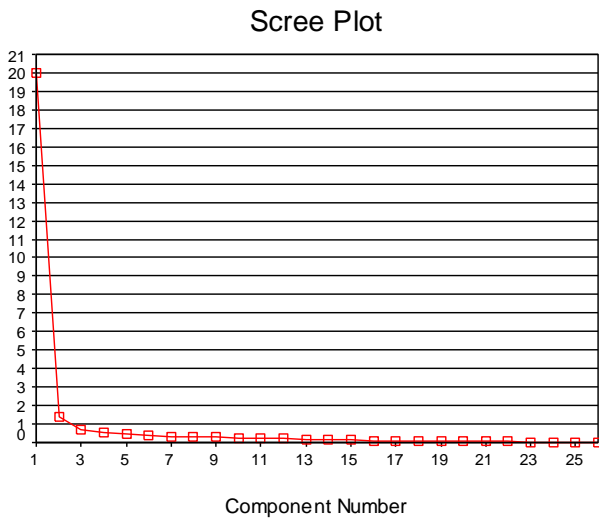
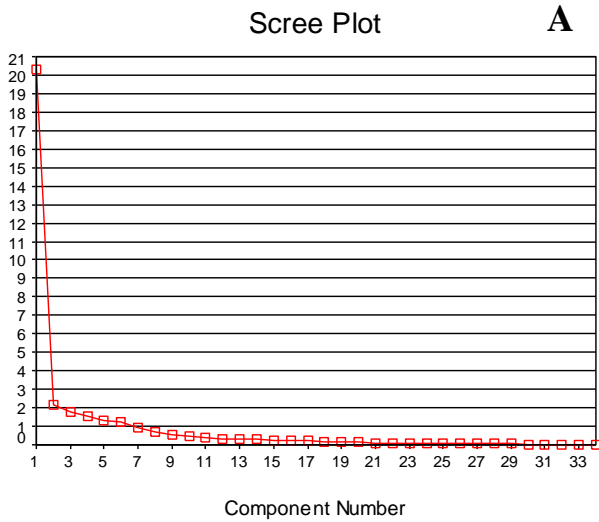
Results

After factor analysis had been performed with 34 variables (N=206), initial statistical loadings emerged (I). Principal component analysis was used as a method of extraction.

I. Initial output for principal components analysis: First analysis

Components	Initial Eigenvalues			Rotation Sums of Squared Loadings		
	Total	% of Variance	Cumulative %	Total	% of Variance	Cumulative %
1	20.299	59.704	59.704	19.819	58.292	58.292
2	2.136	6.283	65.988	1.811	5.328	63.619
3	1.760	5.177	71.165	1.803	5.303	68.923
4	1.550	4.558	75.722	1.718	5.054	73.977
5	1.304	3.834	79.556	1.696	4.987	78.964
6	1.203	3.537	83.093	1.404	4.129	83.093

Table I indicated that eigenvalues of six components were above 1.0, therefore six components were extracted for further analysis. Eigenvalues of 7-34 components ranged from 0.911 to 0.01075. Scree plot of the eigenvalues of the components confirmed the proper indication of the number of factors (2.A).



2. Eigenvalues of principal components: A - First analysis, B - Second analysis

In order to clearly distribute the variables into factors, Varimax with Kaiser normalization was used as a method of rotation. Table II shows factor loadings obtained after the rotation. The latter converged in 6 iterations. KMO and Bartlett’s test’s Kaiser-Meyer-Olkin Measure of Sampling Adequacy equaled 0.888 ($p = 0.000$) and meant that the sample was considered to be adequate for factor analysis.

II. Rotated Component Matrix: First Analysis

F No	Variables	Components					
		1	2	3	4	5	6
F1	Visually clean	,933	9,559E-02	-,108	-3,351E-02	1,733E-04	-4,397E-02
	Visually comfortable	,931	,113	-5,890E-02	-3,420E-02	-5,204E-03	-1,091E-02
	Aesthetic	,903	,138	-2,167E-02	-6,518E-02	-7,208E-02	-3,610E-02
	Maintained	,895	,137	-,110	-1,067E-02	2,025E-02	5,467E-02
	Modern	,887	6,965E-02	5,847E-02	-5,595E-02	-3,617E-02	-1,376E-02

		03	03	02	02	02
The road merges with the environment	-,887	-,224	7,621E-02	6,145E-02	4,750E-02	6,591E-03
Easily apprehensible	,886	,196	-6,644E-02	-4,898E-02	-5,845E-02	1,696E-02
Integral	,884	8,512E-02	-7,968E-02	6,813E-02	-4,161E-02	-5,591E-04
Emotional	,884	-,260	-8,237E-02	4,384E-02	-8,905E-02	-2,843E-02
Visually safe	,879	,240	-3,868E-02	4,296E-02	-6,835E-02	2,178E-02
Dynamic	-,878	,292	,106	8,992E-02	4,275E-02	7,966E-02
Elements fit to the environment	,867	2,003E-02	-1,858E-02	-7,113E-02	8,824E-02	7,961E-02
Natural	-,866	,131	,111	6,482E-02	9,174E-02	3,228E-02
Various	-,863	,294	5,235E-02	6,800E-02	,111	2,432E-02
I would like to drive on this road	-,861	,369	,100	,114	7,605E-02	4,723E-02
Colourful	,860	7,303E-02	-7,496E-02	-6,689E-03	2,400E-02	3,673E-02
Interesting	-,859	,321	6,971E-02	7,890E-02	5,055E-02	,102
Positive impression	-,854	,382	6,865E-02	8,593E-02	3,471E-02	-3,543E-03
Pleasurable	-,853	,381	,101	7,498E-02	3,627E-02	-1,872E-02
Attractive	-,849	,302	6,445E-02	9,609E-02	,111	5,434E-02
Peaceful	-,849	,151	2,498E-02	8,512E-02	5,852E-02	6,594E-02
Memorable	-,847	,141	,105	2,845E-02	,144	,133
Sophisticated	-,834	,236	,103	6,191E-02	-2,847E-03	-3,161E-02
Relaxing	-,833	8,151E-02	8,110E-02	3,466E-02	-1,148E-02	,348
Beautiful	,809	,208	2,002E-03	-3,740E-02	-,180	-,119
Harmonious	,806	-1,562E-02	-2,910E-02	-6,460E-02	-7,428E-02	,474
F2 Active (aggressive)	1,095E-02	,726	-4,201E-02	-,145	,139	1,594E-02
F3 Overladen	,142	-6,380E-04	-,908	5,931E-02	-2,046E-02	5,267E-02

	Luxuriant	-,131	-2,242E-02	,900	-8,461E-02	5,268E-02	6,401E-02
F4	Noble	-9,783E-02	,130	,105	-,921	2,103E-02	-5,399E-02
	Mysterious	-,370	-1,155E-02	-5,447E-02	,854	-5,153E-02	-7,889E-02
F5	Monotonuos	-6,164E-02	,145	-2,539E-03	-1,527E-02	,893	7,023E-02
	Rare (distinctive)	,122	-2,493E-02	-7,591E-02	4,601E-02	-,851	,156
F6	Representative	,144	-2,221E-02	-9,782E-03	4,083E-03	7,165E-02	-,96

The first factor accounted for 58.29% of the total variance and encompassed 26 components, where $L \geq 0.6$ in each case. The remaining five factors neither encompassed a satisfactory number of components nor accounted for a sufficient percentage of the total variance. However, Cronbach- α coefficient of the set of items within the first factor F1 appeared to be equal to 0.0139 and revealed that the items were not closely related as a group. Because this showed evidence that the items measured a latent construct and the whole scale was not unidimensional, the second factor analysis was performed with the components of the first factor F1.

After factor analysis had been performed with 26 variables (N=206), initial statistical loadings emerged (III). Again, principal component analysis was used as a method of extraction.

III. Initial output for principal components analysis: Second analysis

Components	Initial Eigenvalues			Rotation Sums of Squared Loadings		
	Total	% of Variance	Cumulative %	Total	% of Variance	Cumulative %
1	19,969	76,802	76,802	10,937	42,065	42,065
2	1,384	5,323	82,125	10,416	40,061	82,125

Table 1 indicated that eigenvalues of two components were above 1.0, therefore two components were extracted. Eigenvalues of 3-26 components ranged from 0.681 to 0.01162. Scree plot of the eigenvalues of the components confirmed the proper indication of the number of factors (2.B).

In order to clearly distribute the variables into factors, Varimax with Kaiser normalization was used as a method of rotation. Table IV demonstrates factor loadings obtained after the rotation. The latter converged in 3 iterations. KMO and Bartlett's test's Kaiser-Meyer-Olkin Measure of Sampling Adequacy equaled 0.936 ($p = 0.000$) and meant that the sample was considered to be adequate for factor analysis.

IV. Rotated Component Matrix: Second Analysis

F No	Variables	Components	
		1	2
F1	Visually safe	,849	-,353
	Easily apprehensible	,842	-,383

	Visually comfortable	,817	-,479
	Visually clean	,811	-,496
	Maintained	,806	-,435
	Aesthetic	,805	-,452
	Colourful	,774	-,420
	The road merges with the environment	-,762	,468
	Integral	,749	-,482
	Elements fit to the environment	,744	-,459
	Beautiful	,740	-,385
	Modern	,682	-,565
	Harmonious	,628	-,504
	Positive impression	-,392	,873
	I would like to drive on this road	-,414	,869
	Pleasurable	-,403	,863
	Interesting	-,433	,835
	Attractive	-,427	,830
	Various	-,449	,822
F2	Dynamic	-,481	,812
	Memorable	-,521	,715
	Sophisticated	-,507	,706
	Emotional	,606	-,677
	Peaceful	-,563	,661
	Natural	-,607	,649
	Relaxing	-,561	,636

The first factor accounted for 42.07% of the total variance and encompassed 13 components, where $|L| > 0.6$ in each case. The second factor included 13 components with all the factorial weights $|L| > 0.6$ as well, and it accounted for 40.06% of the total variance. Cronbach α coefficient of the scale of items included in the first factor equaled 0.9392, and Cronbach α coefficient of the scale of items comprising the second factor was 0.9371, suggesting that both sets of items have high internal consistency. The variable “The road merges with the environment” is presented in the first factor with minus – that means that in further analysis we should use its antonym “The road contrasts with the environment”. The first factor represents quite objective variables: if a road landscape is easy apprehensible, visually comfortable, clean and properly maintained, and if a road contrasts with the environment, it will look safe to its users; if a road landscape is colourful, integral, beautiful, modern, and elements fit to the environment, the roadscape will look aesthetic and harmonious to the users. The variable “Emotional” is presented in the second factor with minus – that means that in further analysis we should use its antonym “Impassive”. The second factor represents more subjective variables: a roadscape will leave positive impression, it will be memorable and a person would like to drive on a road if it is pleasurable, interesting, attractive, various, dynamic; a roadscape will be relaxing if it is natural, peaceful and sophisticated.

In order to indicate to what extent each set of variables reflects the respondents’ beliefs about the landscape’s hedonomics, correlation analysis was performed. Because all the variables are ordinal (rank), we use Spearman’s correlation coefficient. It describes

correlation between variables using a monotonic function, for instance, when X was increasing Y is monotonically increasing (not necessarily linearly) or decreasing. The correlation between F1 and *hedonomic* is $r_s=0.693$ at 0.01 significance level, and the correlation between F2 and *hedonomic* equals $r_s=0.672$ at 0.01 significance level. Consequently, both sets of variables comprising the factors are important to perception of hedonomics of a road's landscape.

However, an assumption could be made that lower rankings correlate with one factor, whereas higher rankings could correlate with the other one. Therefore, the rankings of the variable *hedonomic* were divided into intervals in accordance with quartiles (V).

V. Correlations between factors and *hedonomic* by quartiled intervals of *hedonomic*

Pct→		25	50	75	100
(x;y]: y		3.26	3.74	4.19	4.85
n		51	54	49	52
r_s	F1	0.976**	0.284*	0.517**	0.494**
	F2	0.048	0.664**	0.460**	0.662**

*correlation is statistically significant at 0.05 level

**correlation is statistically significant at 0.01 level

Table V indicated that F1 showed a bigger correlation with low rankings of *hedonomic*, whereas F2 showed a slightly bigger correlation with rankings from the intervals defined by the second and the third, and the fourth and up quartiles. However, a more detailed division into intervals could reveal more concrete results. In doing so, margins and median became subject to a bigger specification (shorter intervals) (VI).

VI. Correlations between factors and *hedonomic* by percentiled intervals of *hedonomic*

Pct→		5	10	15	20	25	35	45	50	55	65	75	80	85	90	95	100
(x;y]: y		2.48	2.79	2.92	3.16	3.26	3.50	3.71	3.74	3.83	4.05	4.19	4.26	4.39	4.44	4.59	4.85
n		10	11	9	11	10	23	17	14	5	26	18	11	10	11	10	10
r_s	F1	0.979**	0.998**	1.000**	0.782**	0.049	0.418*	0.083	0.533*	-0.205	0.439*	0.395	0.180	0.018	0.557	0.315	0.031
	F2	0.972**	0.961**	0.950**	-0.155	0.280	0.429*	0.889**	0.322	0.359	0.556**	0.364	0.637*	0.603	0.694*	0.574	0.909**

*correlation is statistically significant at 0.05 level

**correlation is statistically significant at 0.01 level

According to the data (VI), F2 correlates strongly with marginal rankings, which means that variables within the factor F2 are decisive to perception of a landscape's hedonomics. F1 correlates strongly with the lowest rankings, which means that variables within the factor F1 are decisive to negative perception of a landscape's hedonomics, or to the perception of its non-hedonomics.

Conclusions and discussion.

Application of the first step of Kansei Engineering via affinity analysis and factor analysis let us identify the semantic space of hedonomic and the most preferable road landscape. The semantic space is based on two factors and 26 variables, id est Kansei words, within them: *visually safe, easily apprehensible, visually comfortable, visually clean, maintained, aesthetic, colourful, the road merges with the environment, integral, elements fit to the environment, beautiful, modern, harmonious, positive impression, I would like to drive on this road, pleasurable, interesting, attractive, various, dynamic, memorable, sophisticated, emotional, peaceful, natural, relaxing*. The both factors explain 82.13% of the total variance. We intend to use identified semantic space for further research on the most preferable road landscape, though we find that 26 Kansei words are too many for implementation of the purpose. Further, we plan to reduce the amount of the words through employment of the second step of Water Logic – a method which enables to interconnect words/meanings on a highly associative level (de Bono, 1991).

Correlation analysis revealed, that both factors and sets of variables within them were important to perception of hedonomics of a road's landscape (for F1 $r_s=0.693$ and for F2 $r_s=0.672$). Though the variables *visually safe, easily apprehensible, visually comfortable, visually clean, maintained, aesthetic, colourful, the road merges with the environment, integral, elements fit to the environment, beautiful, modern, harmonious* are decisive to the perception of its non-hedonomics, and the variables *positive impression, I would like to drive on this road, pleasurable, interesting, attractive, various, dynamic, memorable, sophisticated, emotional, peaceful, natural, relaxing* are decisive to perception of a road landscape's hedonomics. We should use just the latter variables (from F2) for the further analysis of hedonomic road landscape and for design guidelines for hedonomic roadscape to create.

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A comprehensive survey on Italian SA8000 certified firms

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Key words: SA8000, corporate social responsibility, survey, Italy

Category: Research paper

Introduction

The scandals that have recently hit the corporate world and produced global consequences (e.g., the financial crisis or the environmental disaster of the Deepwater Horizon offshore oilrig) have once more driven public attention towards issues relating to Corporate Social Responsibility (CSR).

Organizations have a well-stocked toolbox at their disposal with various instruments that provide support in the management of CSR issues. Among these, however, SA8000 is the only certifiable standard available to address the highly sensitive relationship between employer and employee; hence, not only a tool that allows managers to deal with this aspect of CSR from a systemic perspective but, thanks to third party assessment and certification, also indicates that the information provided is reliable.

Theoretical background and previous research

SA8000 is an auditable certification standard focusing on the protection of the basic human rights of workers. The first version of the standard, proposed by Social Accountability International, dates back to 1997. Updated versions followed in 2001 and, most recently, in 2008 (SA8000:2008).

The standard is adopted on a voluntary basis and certification is not required but usually sought to maximise the positive signalling effects of the implementation of SA8000.

The legislative references include several International Labour Organisation (ILO) Conventions, the Universal Declaration of Human Rights and the UN Convention on the Rights of the Child.

SA8000 can be applied to all types of organizations regardless of size, geographic location or industry sector. Although the standard seeks to guarantee a minimum level of protection for workers, continuous improvement of working conditions is an important part of SA8000 and can also be used as a benchmarking tool.

Stakeholders play a significant role within the standard both as controllers of the standard's implementation effectiveness and as recipients of a constant flow of information from the company.

Finally, it is important to stress that SA8000 implementation does not only affect the company that chooses to comply with it but also takes into account other firms in the

same supply chain given that globalised enterprises outsource relevant parts of their production processes to contractors in third world countries where workers usually enjoy lower legislative protection.

The standard contains prescriptions for employers concerning nine areas of human resource management:

1. Child labour;
2. Forced labour;
3. Health and Safety;
4. Freedom of association and right to collective bargaining;
5. Discrimination;
6. Discipline;
7. Working hours;
8. Compensation;
9. Management systems.

Although the structure of the standard is quite similar in many respects to ISO9000 standards for the implementation of quality systems, profound differences can be found when considering the motivations on which these norms rest. In fact, SA8000 was not designed as a technical norm but to define voluntary, non-binding reference standards that enable organizations to obtain significant results in the field of human rights and the general working conditions through management criteria.

Despite the fact that ample literature exists on CSR and, more specifically, on the drivers and consequences of the shift towards a management system that integrates social concerns, rarely does this literature have the same focus as this present survey; studies either lack focus on issues such as the country and CSR tool examined – with many contributions analysing a wide range of different countries and CSR tools together – or too specific, considering only organizations of a particular size or sector, or using only certain CSR tools other than SA8000. As a result, the literature reviewed, summarized in **Error! Reference source not found.** in chronological order, is rather heterogeneous since the aims of the studies differ.

Table 18 – Papers included in the literature review comparing different parameters with the present survey

Paper	Country	CSR tool	Size	Sector	Focus
La Rosa & Lo Franco 2005	Italy	SA8000	All	All	Reasons, effects
Salomone 2008	Italy	Various	All	All	Motivations, obstacles
Ciliberti et al. 2009	Italy	SA8000	SMEs	All	Supply chain management
Stigzelius & Mark-Herbert 2009	India	SA8000	All	Garment	Drivers, obstacles, opportunities
Casadei & Amadei 2010	Italy	Various	SMEs	All	Corporate Disclosure Social
<i>This survey</i>	<i>Italy</i>	<i>SA8000</i>	<i>All</i>	<i>All</i>	<i>Drivers, difficulties, benefits</i>

It comes as no surprise that Italy and India are the only countries considered since it is well known that Italy leads the ranking of SA8000-certified organizations, followed by India.

The La Rosa and Lo Franco (2005) survey will be examined last as it is the most similar to this work.

We first turn to Salomone's (2008) paper, which also examines SA8000 implementation by Italian organizations, but only incidentally. The main aim of this survey is the implementation of an Integrated Management System (IMS) and the author focuses more on the interaction of different tools such as ISO 9000 and ISO 14001 certification. However, some interesting results on implementation motivation and the obstacles encountered during the process are to be found. 12% of the responding organizations had an SA8000-complying management system, while 3% were still in the implementation phase. These organizations were mainly large or medium sized (73%) manufacturing firms (60%) from Northern Italy (73%). The most important implementation drivers reported relate to continuous improvement, corporate image and competitiveness while some major issues affecting organizations negatively were organizational difficulties, poor information on SA8000 and lack of skilled human resources.

The work of Ciliberti et al. (2009) differs from our research in various respects, concentrating only on SMEs and focusing mainly on supply chain management issues related to SA8000, but some interesting results related to the usefulness of SA8000 emerged. In fact, the study found that despite the costs of certification, SA8000 can reduce information asymmetry and thus transaction costs.

Stigzelius and Mark-Herbert (2009) surveyed seven certified Indian clothing factories between November 2005 and January 2006, conducting semi-structured interviews with factory managers, employees, NGOs and trade union representatives as well as buyers. The fact that this survey has such a narrow scope as far as industry and sample size are concerned, while simultaneously widening it in terms of subjects interviewed, makes it the least interesting in this review.

In fact, the main reason for implementing SA8000 is a result of buyer requests - companies from developed countries that want to ensure they do not procure from factories run in a socially unsustainable way. The main difficulty that SA8000 implementation implies is the increase of labour costs in terms of both higher wages and limited use of overtime work. Managers of SA8000-complying factories do however expect certification to attract new buyers and increase sales as a result of improved corporate image and guaranteed labour law enforcement, thus making it a profitable investment in the long term.

The paper by Casadei and Amadei (2010) focuses on Corporate Social Disclosure (CSD) and competitive drivers related to CSR tools, including SA8000. The most interesting finding from this survey on Italian SMEs is the usefulness of CSD, and hence of SA8000 certification, amongst others, with respect to improved competitiveness.

The most important contribution in the field is the survey by La Rosa and Lo Franco (2005), which is very similar in scope to this paper as it analyses the reasons and effects of the implementation of SA8000 by Italian organizations. However, some important differences can be identified.

First, the survey was conducted in 2003-2004, which implies that the results are affected by the fact that organizations had implemented the second version of the SA8000 standard (dating back to 2001); in addition, the population for the study was much smaller than in our analysis.

Moreover, the discussion lacks any cross-sector or size related considerations, which would have been interesting since the study included organizations from different sectors and of different sizes.

Considering the obtained results, the responding organizations are mainly SMEs in the service or manufacturing industry. Over half of respondents also have ISO 9001 certification, while around one third have both ISO 9001 and ISO 14001 certification. As far as certification timescales are concerned, almost two out of three companies required between six months to a year for certification.

The key motivations for SA8000 adoption are mainly related to potential economic benefits in terms of production value increase and improvement of the firm's corporate image. The most commonly reported effects are higher costs, higher investments, human resource upgrading and improved image. Unfortunately, the distinction between costs and investments is rather unclear, as essentially all costs that SA8000 compliance implies should be perceived as investments.

From the examined contributions with respect to SA8000 implementation by Italian organizations, some issues that should be examined in more detail emerged:

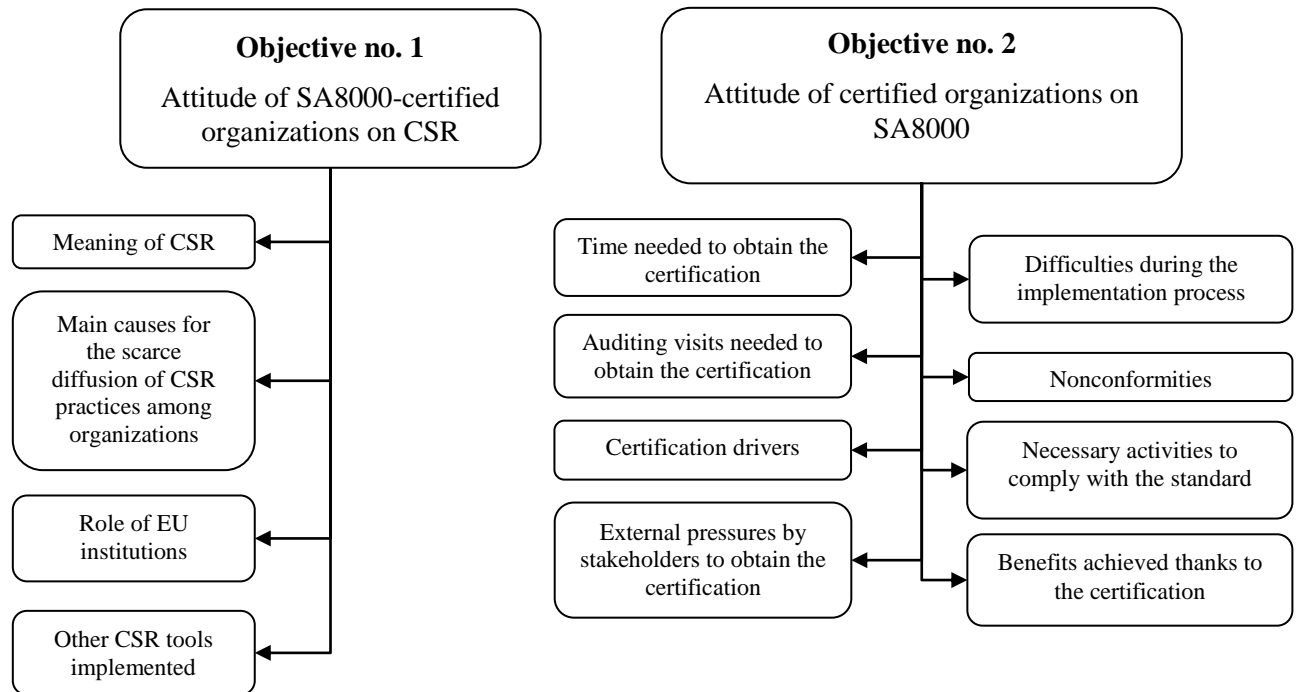
- Cross-sector analysis of the results;
- Difficulties encountered by organizations;
- Other CSR tools (other than certification) used by the organizations;
- Improvement initiatives implemented necessary to comply with the standard;
- Effectiveness evaluation and possible improvements.

Methodology

The objective of this survey was to investigate how Italian SA8000-certified organizations experience CSR and especially the SA8000 standard with particular reference to the drivers for implementation, the difficulties encountered and the benefits achieved.

The main tools used to carry out our study are a tree graph (Figure 1), making the structure of the survey explicit, and a specifically designed questionnaire to collect data on the organizations' perception of their certification.

Figure 46– The structure of the survey



The questionnaire was kept as short and clear as possible, with particular attention paid to the wording to ensure maximum ease of response. The final questionnaire was divided into three sections:

1. General aspects of CSR;
2. SA8000 certification;
3. General information on the responding organization.

The last section is very important to allow a more in-depth analysis of the answers collected.

For most questions, we chose categorical scaling, with possible responses generally ranging from 1 to 5, with 1 usually associated with “Not important” and 5 with “Very important”.

Organizations were contacted by phone first and then, if willing to participate in the survey, the questionnaire was sent to the appropriate person by email, fax or regular mail.

A Microsoft Excel spreadsheet was used to perform some simple statistical analyses (frequency distributions, mean values, etc.).

The survey was carried out in two distinct periods, the first from December 2008 to May 2009, the second from January to April 2010. We did not use a sample but instead chose to analyze the entire population of Italian SA8000-certified organizations.

Results

Overall, 960 organizations were considered but 42 of these had given up their certification when we contacted them, while 59 certifications were duplicates as some organizations had more than one certification.

We therefore considered only 859 organizations, of which 60 could not be contacted. 490 organizations answered our questionnaire, with a 57% response rate that enables us to draw statistically significant conclusions on SA8000 in Italian organizations.

The significance of our results can be demonstrated by using the following formula to determine minimum sample size, which, as shown below, equals 266, a considerably lower value than the 490 answers we received.

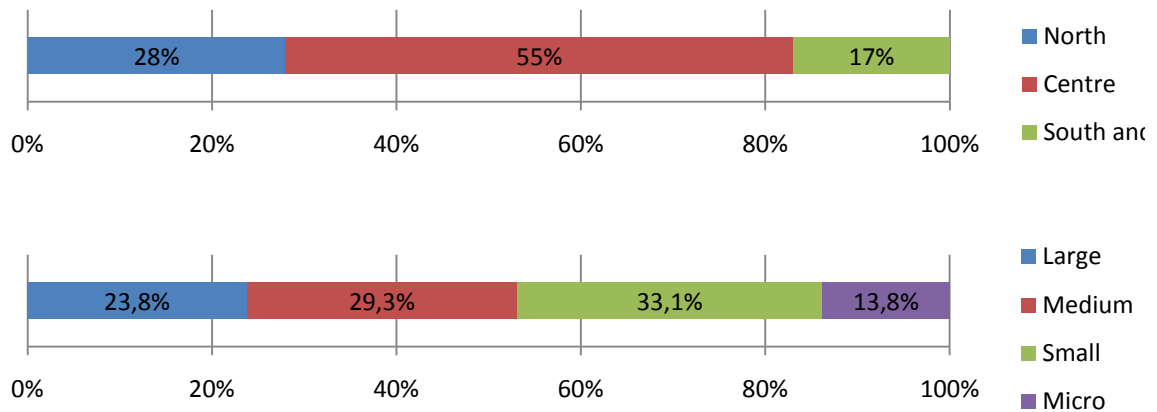
$$n = \frac{Z_{\alpha/2}^2 N p (1 - p)}{e^2 (N - 1) + Z_{\alpha/2}^2 p (1 - p)}$$

$$Z_{\alpha/2} = 1.96 \quad N = 859 \quad p = 0.5 \quad e = 0.05 \Rightarrow n = 266$$

We chose to use a few profiling-oriented questions in our questionnaire to allow a better understanding of the answers provided. These showed that the responding organizations are mainly (55%) located in central Italy. The regions of Tuscany and Umbria are particularly important in this respect since about 42% (205 out of 490) of the responding organizations are located here. This is most likely the result of the supportive administrative setting in these two regions. In fact, in Tuscany, to partially cover the costs to obtain SA8000 certification public subsidies are awarded to the best organizations in a public competition, while in Umbria SA8000-certified organizations enjoy simplified administrative procedures to obtain certain authorizations and more favourable conditions in public tenders.

Another important parameter that was taken into account is the size of the organizations. In this respect, the European standard definition of size classes, based on headcount, turnover and balance sheet total, was used (European Commission 2003). Overall, SMEs prevail among our respondents, as shown in **Error! Reference source not found.** It would appear that the share of large organizations is higher in our case than at the national level where micro organizations have a higher share. This is an indicator of the fact that SA8000-certified organizations tend to be larger than average because the choice to implement the standard is usually the result of an advanced position in the CSR awareness path. Furthermore, it was observed that very small organizations are usually more concerned about the costs that SA8000 implementation and certification implies than larger organizations.

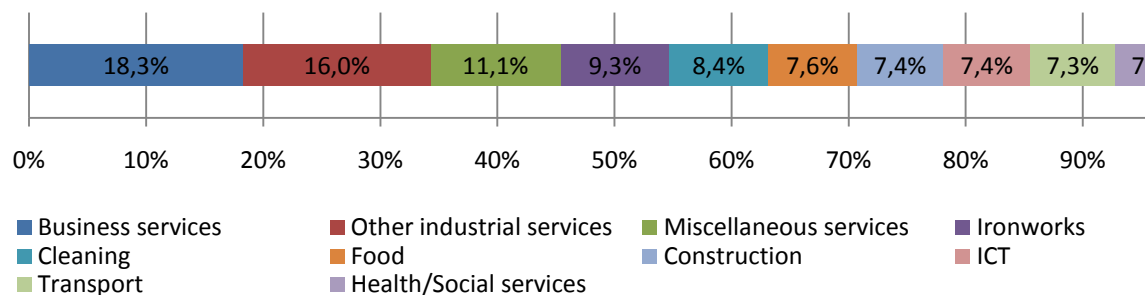
Figure 47 – Location and size of the responding organizations

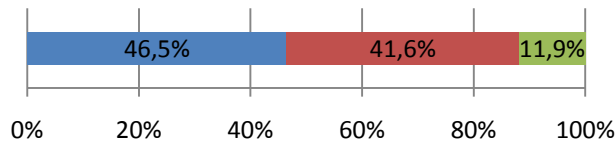


The responding organizations operate in 29 different industries but some of these were aggregated for the sake of simplicity, resulting in only 10 sectors. In fact, the “Other manufacturing sectors” and “Other services sectors” categories contain 10 smaller sectors each. A surprisingly low share of responding organizations operate in the construction sector, while the share of ICT firms is curiously large. These data are somewhat perplexing; we would have expected more construction firms among our respondents since SA8000 related issues are likely to be more relevant in this sector. Conversely, these same issues should not be particularly noteworthy in the ICT sector.

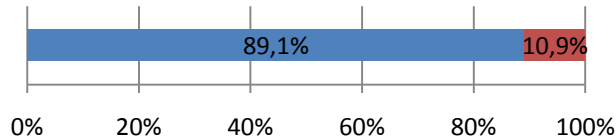
The importance of supply chains in the SA8000 standard has already been mentioned and sustainable supply chain management is an even more relevant issue for those companies that outsource some parts of their production process or buy materials from foreign countries, particularly if these countries have less rigorous legal requirements on workplace safety, salary and other issues related to SA8000. For this reason, responding organizations were asked about their internationalization level, which was assessed by analysing the prevailing end market and the number of foreign subsidiaries. The results show that local/regional markets prevail and that only about 10% of respondents have one or more foreign subsidiaries. This circumstance can be explained by the relatively small size of the organizations participating in our survey. In fact, it emerged that foreign markets are more important for medium and large organizations.

Figure 48 – Sector and internationalization level of the responding organizations





■ Local/Regional ■ National ■ International



■ None ■ At least one

The attitude of respondents to CSR

After having presented the main characteristics of the organizations that took part in our survey, we will now examine the responses we received with reference to the general aspects of CSR.

First of all, respondents were asked to indicate what CSR meant to them. A list of several issues commonly associated with CSR was proposed and each item of the list required an evaluation of its significance on a scale ranging from 1 to 5.

The items that received the higher average scores are related to the well-being of the workforce while image improvement, philanthropy and production of good quality products at an affordable price are among the least important items. This result is not surprising since SA8000 focuses specifically on the rights of the organization's employees. The fact that philanthropic and charity initiatives score lowest among these issues exemplifies the evolution of CSR towards a more modern vision, a change that is even more evident in this survey as respondents necessarily have higher awareness in this field.

Furthermore, the moderate importance of the production of good quality products at an affordable price clearly contrasts with Milton Friedman's view of CSR as the maximization of profits within loyal and open competition.

The importance that the choice of suppliers was given can also be related with SA8000's commitment to improve working conditions across the entire supply chain.

Table 19 – The meaning of CSR to responding organizations

Item	Mean importance*
Equal treatment of employees	4.77
Not using child labour	4.69
Protect human rights	4.62
Guarantee employees' welfare and safety	4.52
Respect ethical principles	4.44
Ensure just compensation to employees	4.40
Contribute to the improvement of social standards	4.16
Choose suppliers carefully	3.97
Adopt codes of conduct	3.87
Ensure that products and processes don't damage the environment	3.74
Respond to a moral obligation	3.52
Having a mean to improve corporate image and reputation	3.52
Make sustainable investments	3.37
Commit to initiatives in favour of the local community	3.35
Take a market chance	2.85
Make good quality products at reasonable prices	2.83
Commit to philanthropic/charity initiatives	2.82

**1 = Not important; 2 = Not very important; 3 = Rather important; 4 = Important; 5 = Very important*

When answering our question on the main causes for the scarce diffusion of CSR practices among organizations, the respondents did not indicate some issues being much more important than others. In fact, all items scored in a 0.6-point range. However, the top three items relate to awareness, involvement and information issues, not regulatory framework or financial resources.

Table 20 – Main reasons for the scars diffusion of CSR

Reason	Mean importance
Lack of training and awareness	3.96
Lacking stakeholder involvement	3.91
Scarce information	3.82
Lack of public intervention and incentives	3.52
Inefficiency of EU initiatives	3.48
Lack of financial resources	3.48
Lack of stakeholder dialogue	3.41
Lack of expertise	3.40
Lacking cooperation between enterprise and suppliers	3.37

The profound understanding of SA8000-certified organizations with reference to CSR also emerged when they were asked to indicate what kind of role EU institutions should have in this respect. In fact, a coercive stand is regarded as inappropriate while the promotion of best practices, ethical investments and public awareness are seen positively.

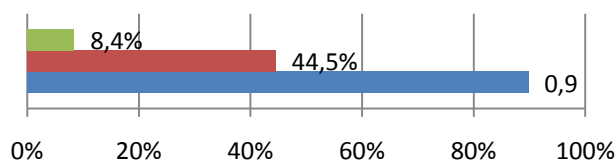
Table 21 – The role EU institutions should play

Role	Mean importance
Cultural development and best practices diffusion	4.27
Support to ethical investments	4.26
Information and education campaigns	4.20
Control of the implementation and of the declared results	4.05
Elaboration of a European reference frame	4.00
Promotion of stakeholder dialogue	3.91
Promotion of a product label	3.50
Coercive	2.77

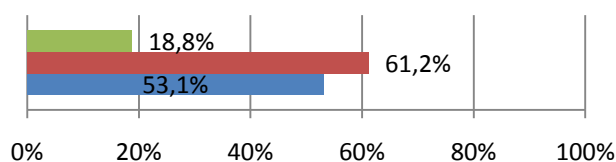
SA8000 is only one of many CSR tools that organizations can make use of. Therefore, we asked respondents whether they also had ISO9001 or ISO14001 certification, or EMAS registration. As expected, ISO9001 certification (which is not primarily a CSR tool but still testifies a certain concern for the consumer) is quite widespread, followed by ISO14001 (the ISO standard that addresses environmental management systems), while EMAS-registered organizations are quite few, which is also the case when not only considering SA8000-certified organizations.

Other frequently implemented CSR tools include codes of ethics, social balance sheets and environmental balance sheets. When considering the size of organizations, it appears that large and medium firms tend to have higher adoption rates for codes of ethics and environmental balance sheets.

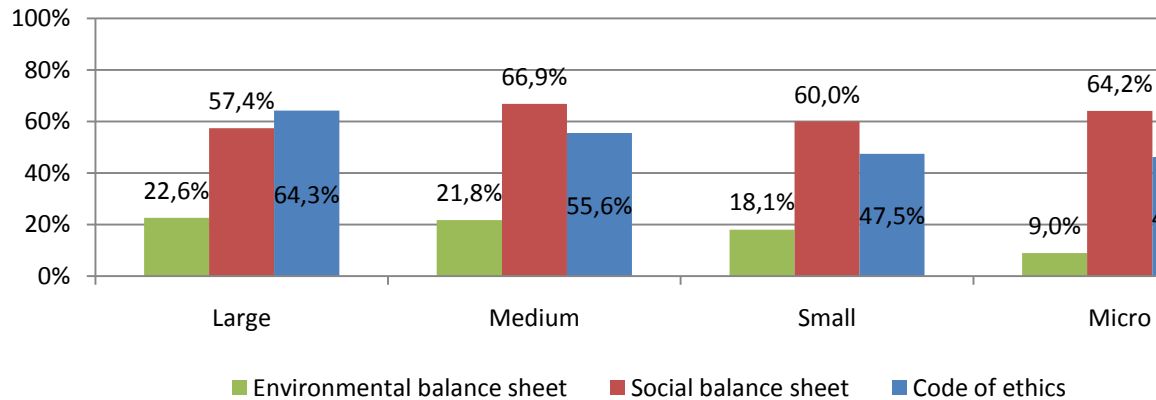
Figure 49 – Other certifications and CSR tools



■ EMAS ■ ISO14001 ■ ISO9001



■ Environmental balance sheet
■ Social balance sheet
■ Code of ethics



Overall, the results on the general aspects of CSR can be summarized as follows.

The organizations' conception of CSR is quite advanced on a theoretical level. In fact, respondents see CSR as a tool to improve their relationship with their human resources rather than to improve their image or market possibilities. However, on this issue we could probably have provided more diversified response options to better understand if CSR has other possible meanings for organizations. The answers we received on the role that EU institutions should have in CSR also led us to believe that SA8000-certified organizations affirm the importance of the voluntariness of CSR initiatives, with policy makers only providing a minimum regulatory framework and promoting public awareness on the theme. This also emerges from the responses on the reasons for the scarce diffusion of CSR, where respondents appear to focus on training and information rather than on financial resources and public support.

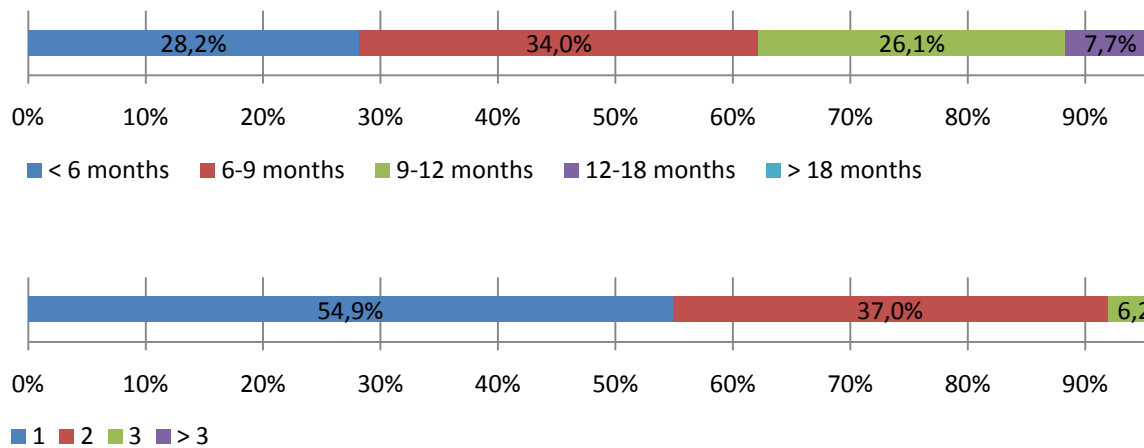
On a practical level, the responding organizations demonstrate considerable commitment to sustainability by addressing both broad and specific issues through dedicated tools.

How organizations experience SA8000 certification

The most important results of our survey are those relating to how organizations experience their certification. The questions in this area focus on the time needed to obtain the certification, the drivers for certification, the difficulties encountered during the process and the benefits obtained from certification.

As concerns the time needed to obtain the SA8000 certification, it emerged (Figure 5) that around 25% of the organizations needed less than 6 months, around 30% needed between 6 and 9 months, another 25% needed between 9 and 12 months while only around 10% needed more than a year. These data can be compared with those relating to the number of certification visits that were required for the certification to be obtained. Moreover, with reference to this aspect of the certification process, it is clear that only very few organizations needed to be inspected more than twice.

Figure 50 – Time and certification visits necessary to obtain SA8000 registration



Certification drivers are a major area of interest in our survey and were thus carefully analysed, also considering the stakeholders that influenced the management’s decision to apply for SA8000 certification.

Error! Reference source not found.5 shows the mean importance of a number of proposed drivers. Market related drivers such as the improvement of corporate image and reputation but also the improvement of employee satisfaction are in the top rankings. Conversely, financial drivers such as fiscal advantages and improvement of financial resource attraction capacity score poorly.

When considering the size of respondents, no substantial differences emerge with the exception of micro organizations, which are less influenced by the possibility to improve their competitive position and regulatory compliance as drivers for certification. These results are not surprising, since the majority of organizations that participated in our survey are private firms that have to make a profit from their activities. Therefore, certification is seen as a strategic tool that can positively affect economic returns by improving corporate image, making employees more satisfied and thus enabling the acquisition of a competitive advantage.

Table 22 – Certification drivers

Driver	All	Large	Medium	Small	Micro
Improvement of the corporate image and reputation	4.14	4.23	4.04	4.23	3.99
Improvement of employee satisfaction	4.05	4.17	3.99	4.04	4.04
Acquisition of a competitive advantage	3.61	3.82	3.6	3.62	3.21
Capability to attract new customers	3.35	3.54	3.22	3.35	3.28
Impact on the public opinion	3.21	3.27	3.3	3.21	3.00
Improvement of regulatory compliance	3.08	3.13	3.19	3.2	2.57
Brand protection	3.06	3.02	3.00	3.21	2.85
Ability to attract skilled personnel	2.66	2.66	2.55	2.76	2.6
Possibility to obtain public incentives	2.29	2.08	2.35	2.38	2.21

Ability to attract financial resources	2.29	2.19	2.32	2.34	2.24
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In this respect, SA8000 becomes a differentiation tool that many organizations, especially smaller firms from manufacturing sectors, can use to signal to consumers that their products are made in a sustainable way, without outsourcing production from developing countries where workers enjoy less protection.

On the other hand, SA8000 is not perceived as very useful to attract financial resources or to obtain fiscal incentives. As concerns public incentives, as previously mentioned, only two regions provide some form of facilitation for SA8000-certified organizations and these are the regions where a considerable share of the organizations are located, while no tax relief or administrative simplifications are present at the national level.

Within this frame of reference, external pressure on management is not a significant factor in applying for certification. In fact, the decision to implement SA8000 is mainly taken by management to ensure the survival and possibly the expansion of the firm.

Table 23 – Pressures by stakeholders to obtain SA8000 certification

Stakeholder category	Mean importance
Customers	2.64
Employees	2.16
Investors	2.01
Public authorities	1.91
Consumers	1.64
Local community	1.63
Suppliers	1.51
NGOs	1.35

Once organizations decide to apply for certification they have to comply with all the requirements of SA8000. Organizations were hence asked to indicate the importance of various difficulties on a scale ranging from 1 to 5.

Overall respondents do not appear to be significantly affected by the proposed difficulties, with all items, except for the top 6, having average scores lower than 3. Cost-related difficulties do not seem to be very significant, with the average importance being 2.62 and the most important item being certification costs. General difficulties are somewhat more important, with an average score of 2.97. Involving suppliers is the most difficult aspect, followed by employee training and employee involvement. This is in agreement with previous findings relating to the lack of external pressures to apply for certification. In fact, since suppliers and employees do not push for SA8000, it is not surprising that they are not generally involved in the implementation process.

Smaller organizations appear to have more significant economic difficulties with their certification than larger firms.

Table 24 – Difficulties during the SA8000 implementation process

Difficulty	All	Large	Medium	Small	Micro
Suppliers involvement	4.00	3.02	2.61	2.81	2.93
Employees training and awareness	3.20	2.79	2.48	2.63	2.60
Employees involvement and motivation	3.15	3.39	3.17	3.07	2.85
Operative controls	3.09	4.00	4.00	4.03	3.93
Planning and implementation of the system	3.04	3.50	3.13	3.11	3.00
Documentation management	2.95	3.05	2.97	3.05	3.09
Internal audits	2.82	2.91	2.92	2.94	3.09
Costs-benefits assessment	2.81	3.20	3.08	3.06	2.97
Nonconformities management	2.72	2.94	2.80	2.80	2.75
Lack of specific expertise	2.63	2.88	2.63	2.67	2.79
Relationship with the certifying body	2.27	2.35	2.18	2.25	2.40
Certification costs	3.02	2.55	2.65	2.95	3.19
Consulting costs	2.80	2.78	2.93	3.12	3.36
Personnel training costs	2.76	2.70	2.77	2.80	2.73
Suppliers assessment costs	2.76	2.64	2.76	2.81	2.82
Costs due to higher loans and improved services for employees	2.20	2.12	1.99	2.25	2.51
Control equipment costs	2.18	2.05	2.02	2.27	2.64

Another important part of SA8000 implementation concerns possible nonconformities that external auditors may detect when examining the organization. In our questionnaire, we considered serious nonconformities, minor nonconformities and observations together with all those cases where no nonconformities or observations were made. This allowed us to draw some important indications on this topic. Specifically, we found that while, as expected, there are many organizations where no nonconformities were detected on forced labour, freedom of association and child labour, a considerable number of organizations were confronted with the insufficiency of their control on important issues such as first and second tier suppliers, workplace health and safety.

This situation can be explained as the result of different factors and circumstances that characterize the Italian corporate world. The small number of nonconformities related to forced labour, freedom of association and child labour are due to the very restrictive laws that are effectively enforced in Italy as in other developed countries. The lack of controls on suppliers can be attributed to the fact that applying organizations are only beginning to understand the importance of supply chain management. Lack of involvement on the supplier side does not help in this respect. The insufficient levels of workplace health and safety on the other hand, are a much debated problem in Italy, where sadly, for a developed country, a surprisingly high number of workplace accidents take place. Nevertheless, this is not the main topic of our survey and will not be discussed further but it should be noted that while laws exist, their lack of enforcement is probably the primary cause of this situation as is lack of employee training.

Table 25 – Nonconformities and observations

Issue	Major nonconformities	Minor nonconformities	Observations	All nonconformities and observations	No nonconformities
Control of 1st and 2nd tier suppliers	12	198	180	390	171
Healthiness and safety of the workplace	8	195	244	447	221
External communication	5	76	139	220	290
Working hours	8	78	80	166	342
Registrations	5	41	90	136	368
Loan criteria	5	53	84	142	373
Management Review	2	44	72	118	380
Corrective Actions	2	47	78	127	382
Planning and implementation	3	42	92	137	387
Organization representatives	3	42	54	99	396
Policy	2	22	41	65	428
Disciplinary procedures	1	21	37	59	432
Discrimination	3	25	34	62	442
Access to audits	2	18	22	42	451
Management system	1	19	22	42	453
Child labour	3	8	24	35	457
Freedom of association	1	7	22	30	461
Forced labour	2	4	7	13	477
Total	68	940	1322	2330	-

We finally examine the benefits of SA8000-certification, both at a general level and more specifically with reference to the workforce.

Overall, the most important benefit is the improvement of the organization's image, which is also the most important certification driver, thus enabling us to conclude that from this point of view, SA8000 is an effective tool. In fact, the standard and its certification allow organizations to signal to the public (customers, public authorities, trade unions, etc.) that they are acting in a sustainable way.

Similar considerations on the standard's effectiveness are applicable to the workforce relationship, which is also an important driver and benefit. Conversely, it would appear that SA8000 is not very effective in ensuring easier access to financing, better insurance conditions or facilitation in administrative authorizations. This circumstance cannot however be attributed to the standard but is a consequence of the scarce evolution of the Italian financial and insurance market as well as a lack of knowledge of public authorities of the standard and its implications in terms of workplace conditions.

When considering respondent size, slightly lower benefits were found in micro organizations. Indeed, the average scores for all benefits are 3.07, 3.01 and 3.03 for

large, medium and small organizations respectively while for micro organizations this figure is only 2.79.

Table 26 – Benefits gained thanks to the certification

Benefit	Tutti	Grande	Media	Piccola	Micro
Improvement of the corporate image and reputation	3.86	3.97	3.81	3.94	3.59
Improvement of the relationship to employees	3.64	3.68	3.64	3.65	3.53
Improvement of employee satisfaction	3.59	3.65	3.58	3.62	3.45
Impact on the public opinion	3.26	3.30	3.33	3.28	3.02
Acquisition of a competitive advantage	3.19	3.49	3.17	3.14	2.91
Improvement of the relationship to suppliers	2.83	3.02	2.78	2.88	2.50
Acquisition of new customers	2.67	2.84	2.68	2.63	2.48
Improvement of financial and insurance conditions	1.98	1.85	2.12	2.04	1.77
Easier authorizations from public authorities	1.95	1.88	1.96	2.06	1.82

At first glance, the benefits relating to the relationship with employees are surprisingly low but we should consider that the questionnaire was compiled by the management, not by employees; therefore, more positive feedback is likely to be associated with the workforce in many of the response options proposed, whereas managers also consider the costs that are associated with the benefits.

Table 27 – Benefits gained thanks to the certification for employees

Benefit	Mean importance
Improved satisfaction for services offered by the organization	2.84
Reduction of injuries	2.32
Increased number of permanent contracts	2.30
Reduction of extra hours	2.23
Reduction of sanctions and fines	1.94
Reduction of turnover	1.91
Reduction of illness absences	1.88
Reduction of strike hours	1.71
Increase of trade union applications	1.70
Reduction of night hours	1.48

Discussion and conclusion

Our survey offers a previously lacking insight into SA8000 implementation in the world's most significant country as far as this tool is concerned.

The features of the Italian business world that have influenced the diffusion of the standard mainly concern the size of organizations, the legislative framework on employment, the scarcity of public incentives, a strong culture of certification and growing external pressure on firms to reduce labour costs, especially in the

manufacturing sectors. These features can have a positive or negative effect on the decision to apply for, and maintain, SA8000 certification.

Small size can certainly have a negative effect, since smaller organizations tend to have priorities other than CSR, also because certification tools tend to be costly, which represents a barrier for SMEs.

Furthermore, the regulatory framework is already very stringent in Italy – especially where employees are concerned – and hence not justifying the efforts that SA8000 certification implies.

Public incentives such as subsidies or favourable tax and administrative regimes are also very rare but in those regions that use them to stimulate SA8000 adoption, they have proved to be very effective.

Another factor that can positively affect the widespread diffusion of the standard is Italy's strong certification culture. This has also emerged from our survey given that many organizations have more than just SA8000 certification.

Finally, Italian firms, especially those that operate in manufacturing sectors, are constantly under pressure to reduce costs to be able to compete on a global scale. Many organizations have chosen to deal with this challenging situation by outsourcing their production to countries with cheaper labour costs, albeit not always in a sustainable way, exploiting underpaid third World country workers. Some organizations instead choose to turn their sustainability into a competitive advantage thanks to the signalling effect of certification.

Having explained the Italian situation, we can now comment on the results of our survey.

We found that responding organizations are mainly small and medium sized and mostly located in those regions that offer public incentives for SA8000 certification. As expected, the average size of respondent firms is slightly larger than Italian firms overall, as CSR costs discourage microenterprises.

CSR awareness and understanding among responding organizations is reasonably good as they focus on the well-being of the workforce when defining CSR while image improvement, philanthropy and production of good quality products at an affordable price are not as important.

The role that EU institutions should have with reference to CSR, according to respondents, also indicates they are aware that voluntariness is a key feature of CSR.

SA8000 certification drivers are both strategy- and sustainability-related while financial drivers score poorly. The fact that external pressures to apply for certification are not significant can be linked to the fact that the responding organizations' management have much more awareness than other stakeholders (the most important in this context being suppliers and employees).

Respondents did not particularly encounter many relevant difficulties during the certification process; however, supplier and employee involvement once again emerged as a key issue.

Finally, the effectiveness of SA8000 certification is demonstrated by the benefits that it grants, especially with reference to corporate image and the relationship with employees.

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University Students' Perception of Service Quality offered by Travel Agencies

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Introduction

Today's highly competitive environment forces all companies to be more customer-oriented (Kotler and Keller, 2009). It is obvious that the level of customer satisfaction determines repeat sales, word-of-mouth recommendations, and customer loyalty (Bearden and Teel, 1983). Superior service quality has become a major differentiator in producing customer satisfaction, and successful quality management is recognized as the most powerful competitive weapon that many leading service organizations possess (Kandampully, 1998; Berry et al., 1988).

Tourism is a key industry in the economy and it is expected to play a key role in the service industry sector (Aaron, 2006). Undoubtedly, the travel agent represents an important intermediary within the travel industry. The services of travel agent include a sales outlet of air carriers, hotels, car rental firms, major attractions, event organizers and other travel suppliers; in addition, providing travel information, organizing tour packages, serving as middlemen for hotel bookings, issuing air tickets, and arranging car rental services (Lam and Zhang, 1999). Travel agencies also play a fundamental role in the development of the tourism sector, and facing intense change in the competitive environment in many countries (Lam and Zhang, 1999; Millan and Esteban, 2004; Aaron, 2006). Recent changes within the travel industry have resulted in the travel agency business becoming increasingly competitive. Due to the fact that the shift is toward information technology, the travel agent's traditional roles as an intermediary has come under severe pressure and is currently challenged to its existence. In addition, travel agents have faced difficult time in recent years due to the increasing customer demands and internal competitions.

As tourism remains a key industry in most country's economy incorporating the services of travel agents, tour operators, airline flight operators, and hotel operators, it therefore becomes imperative that these agents exert much effort and energy into upping and maintaining standard services to leave positive impressions in the mind of their customers to be competitive. Juran and Gryna, (1993) points out that the most important factor influencing business performance is the quality of goods and services offered by an organization, compared to those offered by its competitors. In the tourism sector, service quality plays a key role in differentiating service products and building a competitive advantage as in most service firms (Hudson and Miller, 2004). Its growing importance in the entire service industry as well as the substantial revenue generated explains why notable researches have been conducted toward possible avenues for improving service quality in the sector especially as it is a people oriented sector and an image view of a country or people.

Service quality has become an increasingly important factor for success and survival in the tourism industry. Provision of high quality service aids in meeting several requirements such as customer satisfaction and its consequent loyalty and market share, soliciting new customers, financial performance and profitability (Cui et al. 2003). Besides service quality promotes customer satisfaction, it also stimulates intention to return, and encourages recommendations. Therefore, customer satisfaction greatly increases profitability, market share, and return on investment (Hackl and Westlund, 2000; Barsky and Labagh, 1992; LeBlanc, 1992; Stevens et al. 1995; Legohérel, 1998; Fornell, 1992; Halstead and Page, 1992). Thus, “quality” is a magic word for customer satisfaction. In all service sectors, businesses with good service quality will therefore improve their market share and profitability (Oh and Parks, 1997). In a highly competitive travel agencies and tour operators sector, individual agencies must find ways to make their products and services stand out among the others. To achieve this, managers must understand their customers’ needs—and then set out to meet (or exceed) these needs. As Faché (2000) has observed, one of the most important developments in the tourism industry is the growing attention to service quality from the customer’s perspective.

If service quality is to be improved, it must be reliably assessed and measured. According to the SERVQUAL model (Parasuraman et al. 1988), service quality can be measured by identifying the gaps between customers’ expectations of the service to be rendered and their perceptions of the actual performance of the service. SERVQUAL is based on five dimensions of service (Parasuraman et al. 1988): *tangibles*—the physical surroundings represented by objects (for example, interior design) and subjects (for example, the appearance of employees); *reliability*—the service provider’s ability to provide accurate and dependable services; *responsiveness*—a firm’s willingness to assist its customers by providing fast and efficient service performance; *assurance*—diverse features that provide confidence to customers (such as the firm’s specific service knowledge, polite and trustworthy behavior of employees); and *empathy*—the service firm’s readiness to provide each customer personal service.

Several researchers have sought to define and measure the concept of service quality (Carman 1990; Cronin and Taylor 1992; Parasuraman et al. 1985; 1988; 1991; Teas 1994). It has also been argued that the number of dimensions and the nature of SERVQUAL construct may be industry specific. The fit of five-dimensions of SERVQUAL carried out in different service activities has always been an important question in several studies that these dimensions proposed by SERVQUAL do not replicate. Many times the SERVQUAL scale has been found uni-dimensional (Angur, et al. 1999; Babakus and Mangold, 1992; Babakus and Boller, 1992) and sometimes with even ten dimensions (Carman, 1990). It has also been argued that performance-only (SERVPERF) measure explains more of the variance in an overall measure of service quality than SERVQUAL instrument (Cronin and Taylor, 1994). Therefore, the present study sets out to diagnose how university students perceive the service quality of travel agencies’ services through SERVPERF scale option of the SERVQUAL.

The aims of the study are: (i) to assess the applicability of the original five dimensions of the SERVPERF in a different cultural setting; (ii) to analyze how customers perceive service quality in this setting; and (iii) to ascertain whether perceptions of travel

agencies service quality influence consumers' overall service quality perception and level of satisfaction.

The study plan to organize as follows; following the introduction, the next section presents a review of the relevant literature, then describes the methodology of the empirical study. The analysis and results are then described. The paper concludes with a summary of the major findings, managerial implications, and suggestions for future research.

Literature Review

Quality is generally viewed as attribute performance of product or service (Namkung and Jang, 2007, p. 388). As Kandampully (1997) proposes "quality in retailing is a package, consisting of goods quality and service quality in combination". Since the product quality is at the same level in many industries, service quality has become a key factor to evaluate customer satisfaction. Parasuraman, Zeithaml, and Berry (1985, p. 47) maintain that "perceived service quality is the result of customer's comparison of expected service with perceived service". Although there are many external and internal factors affecting service quality perception, these factors can not be generalized to all customers since service quality perception is subjective and depends on customers' individual experiences with the service they encounter.

Delivering consistently good service quality is difficult but profitable for service organizations, as many organizations have already discovered (Zeithaml, Berry and Parasuman, 1988). Zeithaml, Parasuman and Berry (1985) approached that problems and strategies in services marketing arise from four unique characteristics of services: intangibility, inseparability, heterogeneity, and perishability. When a service firm has many customers, there is tendency to view them as statistics. This tendency results in that companies ignore the basic rule that services are performed for individuals (Berry, Zeithaml and Parasuman, 1985).

Customer satisfaction, furthermore, plays an important role in achieving customer loyalty and profitability (Barsky and Nash, 2003). Therefore, it is crucial to know exactly how such satisfaction is measured. Many have been trying to measure customer satisfaction and have gathered plenty of data as a result. The problem is that measuring customer satisfaction does not provide any clues for achieving it. Customer satisfaction is essentially the culmination of a series of customer experiences or, one could say, the net result of the good ones minus the bad ones. It occurs when the gap between customers' expectations and their subsequent experiences is closed (Meyer and Schwager, 2007).

Service quality and customer satisfaction are thus the two core concepts of contemporary marketing theory and practice in service industries (Spreng and Mackoy, 1996). As Shemwell et al. (1998) have observed, the key to sustainable competitive advantage lies in delivering high-quality service that result in satisfied customers. The link between service quality and customer satisfaction is now firmly established (Bolton and Drew, 1991; Boulding et al., 1993), and it has been shown that this link subsequently produces higher revenues, increased cross-sell ratios, higher customer retention (Bennett and Higgins, 1988), repeat purchasing behaviour (Taylor and Cronin, 1994), and expanded market share (Bowen and Hedges, 1993).

Quality goes beyond mere customer satisfaction and relates to attitudes formed on the basis of a comparison between expectations and perceived performance (e.g.: Parasuraman et al. 1988). This is inevitably linked with concepts of customer care (Lewis, 1995) and consequent attempts to minimize any disparity between customers' expectations and the service delivered. 'Expectations', in the service quality context, are viewed as desires/wants - which are formed on the basis of previous experience and ideas of what organizations *should* provide. This is distinct from 'expectations' within a consumer behavioral context - which are essentially "predictors" (probabilities) made by a consumer about what is really liable to take place during a transaction (Lewis 1993). Customer expectations are very important with regard to measurement of service quality, since their comparison with actual service performance results in the appraisal of quality a customer will have for a specific services provider. The *disconfirmation* between expectations and perceptions of quality forms the basis for models of service quality which have predominated within the literature since the early 1980's. This approach forms the conceptual framework for SERVQUAL, the measure used in the study (Parasuraman et al. 1985).

Starting from this conceptual basis, Parasuraman et al. (1985; 1988; 1991) have attempted to identify and measure service quality. They describe five types of disconfirmatory 'Gaps'—relating to disparity between expectations and perceptions of customers and management in service specification and delivery. Analysis of these has resulted in the development of the SERVQUAL model. Focus groups were used to identify key categories, which they labeled "service quality determinants" and which formed a basis for the subsequent development of the dimensions of SERVQUAL: *tangibles*—the physical surroundings represented by objects (for example, interior design) and subjects (for example, the appearance of employees); *reliability*—the service provider's ability to provide accurate and dependable services; *responsiveness*—a firm's willingness to assist its customers by providing fast and efficient service performances; *assurance*—diverse features that provide confidence to customers (such as the firm's specific service knowledge polite and trustworthy behavior from employees); and *empathy*—the service firm's readiness to provide each customer with personal service.

According to Parasuraman et al. (1985; 1991) the concept of expectation has been emphasized as a key variable in the evaluation of service quality. However, Teas (1994) points out that some validity problems arise when customer expectation is used as a comparison standard. For example, expectation is dynamic in nature and may change according to customers' experiences and consumption situations. Boulding et al. (1993) reject the use of expectation as a comparison standard for the measurement of service quality and recommend performance-only measurement.

The negative empirical findings concerning the measurement of expectations led to some doubt about its value. Some scholars maintain that measurement of expectations does not provide unique information for estimating service quality; they argue that performance-only assessment has already taken into account much of this information (Cronin and Taylor, 1992; Babakus and Boller, 1992). In general, previous studies would recommend that performance-only measurement is sufficient. Thus SERVQUAL, however, has not been without criticisms. Particular research efforts by Cronin and Taylor (1992) cast doubts about the validity of the disconfirmation

paradigm advocated by Parasuraman et al. (1985, 1988). These authors questioned whether or not customers routinely assess service quality in terms of expectations and perceptions. They advance the notion that service quality is directly influenced only by perceptions of service performance. Accordingly, they developed an instrument of service performance (SERVPERF) that seems to produce better results than SERVQUAL (Asubonteng et al. 1996).

Apart from the debate among the above researchers for the merits of SERVQUAL over SERVPERF and vice versa, it seems, however, that on balance the emerging literature support the performance-based paradigm over the disconfirmation-based paradigm (Cronin and Taylor, 1994). This research bears on these conclusions and adapts the performance-based SERVPERF paradigm.

Methodology

The present study focuses the university students as young customers. Young customers are regarded as a prospective target for current marketing activity and are potentially a lucrative segment to form longer term marketing relationships with (Jenkinson, 2000). During their years in higher education, students will develop many of their opinions and preferences which they will keep throughout their lives (Jenkinson, 2000) and may be considered potential future customers (Arnold, 1998). North Cyprus, which the study was carried out, has six international universities where there are students from around seventy different countries, mainly from Far East Asia, the Middle East, Europe and Africa. Hence, the youth market can be considered to have some representation of the international setting that the North Cyprus travel agencies are exposed to. Within such an international atmosphere, students present marketers with the opportunity to reach consumers at a critical point in their life cycle that may result in long-term marketing relationships.

The sample of the study consisted of university students studying in the six universities; namely Eastern Mediterranean University, Near East University, Cyprus International University, Girne American University, Middle East Technical University and Lefke European University located in the Gazimağusa, Lefkoşa, Girne, Güzelyurt and Lefke regions of North Cyprus respectively. A pilot test study was conducted with 30 customers. As a result of the pilot study, the instrument was reworded for measuring perceived service quality for travel agencies. There were 26 items in total—22 items for measuring service perception of perceived service quality (adapted from Parasuraman et al. 1991), and 1 item for measuring overall service quality and 3 items for customer satisfaction. The survey instrument was applied to both in Turkish and English languages. So, the survey was prepared according to the back-translation method (McGorry, 2000) for Turkish respondents. The questionnaire also included questions regarding certain demographic characteristics of the respondents (gender, age, occupation, educational level and average monthly income). A seven-point Likert scale was used for data collection. The data was collected in April and May 2010. The sample was selected on the basis of a non-probability convenience sampling technique (Aaker et al., 1995). A total of 465 questionnaires were distributed to university students. Of these, 433 questionnaires were returned. In all, 400 questionnaires were found to be useful, which represents 86% response rate from the original sample of 465. The questionnaire was based on only service perceptions. SPSS 16.0 for windows was employed in order to access the particular results required for the scale measurement.

Descriptive analysis such as means, standard deviation and frequencies are calculated. Reliability and validity of the scale is tested, dimensionality of the scale is confirmed through an exploratory factor analysis and regression analysis produced causal results.

Findings

The Sample

A demographic breakdown of the sample shows that 60,8% of the respondents were males and 39.2% were females. As for the age distribution, 8 % respondents have age “under 18”, 52% were between “18-22”, 37,5% were between “23-30”, and 2,5 % have age 31 and above. In terms of nationality, 22,8% of respondents were Turkish Cypriots, 67,2% were Turkish and 10% were from other nationalities. Almost 37% of respondents have monthly family income less than 2501 USD, 43,5% have monthly family income between 2,501 – 6,000 USD and 19,5% have monthly family income more than 6,000 USD.

Reliability and Dimensionality of the Scale

Table I demonstrate that the overall reliability of the scale had an alpha coefficient of 0.96—which is deemed acceptable (Nunnally, 1978). Each dimension (tangibles, reliability, responsiveness, assurance and empathy) of perceived service quality (SERVPERF) had reliabilities greater than minimum standard 0.70, described by Nunnally (1978).

Factor analysis using varimax rotation was employed to explore the dimensionality in the data. The results of factor analysis demonstrated that SERVPERF instrument failed to form its five assumed dimensions—tangibles, reliability, responsiveness, assurance, and empathy. The results were found to be one-dimensional. The single factor—had variance percentage 63.78%, cumulative variance 63.78%, and all the factor loadings were found to be greater than 0.50 (Hair et al. 1979)—which demonstrates SERVPERF to be uni-dimensional in this study.

Table I: Reliability and Explanatory Factor Analysis

Items	Eigenvalue	% of Variance	Factor Loadings
	14.03	63.78	
Employees are never too busy to respond to requests.			0.89
Employees are always willing to help.			0.87
Employees behavior instill confidence in customers.			0.86
Employees understand customers' specific needs.			0.86
Employees give personal attention.			0.84
Agency has best interest at heart.			0.84
Employees inform customers when services will be performed.			0.83
Employees give prompt attention.			0.83
Performs service right the first time.			0.83
Provides service at promised time.			0.82
Sincere interest in solving problem.			0.82
Provides services as promised.			0.82
Insist on error-free records.			0.82
Convenient operating hours.			0.81
Visually appealing work materials.			0.79
Employees are knowledgeable to answer questions.			0.79
Employees are consistently courteous.			0.76
Employees give individual attention.			0.75
Modern looking equipments.			0.68
Visually appealing physical facilities.			0.68
Customers feel safe in their transaction.			0.67
Employees have neat appearance.			0.63

Notes:

Kaiser Meyer - Olkin Measures of Sampling Adequacy: 0.962

Bartlett's Test of Sphericity: 7368,720; $p < 0.000$

Principal component analyses with a varimax rotation.

Overall reliability: 0.97

Reliability of respective dimensions: Tangibles (0.84), Reliability (0.93), Responsiveness (0.93), Assurance (0.87), Empathy (0.94)

Evaluation of SERVPERF Values of Travel Agency Customers

Table II demonstrates that customers had relatively high perception scores (mean ≥ 4.70) related to travel agencies' "employees have neat appearance", "employees understand customers' specific needs", "employees are consistently courteous", and "employees are knowledgeable to answer questions".

However, relatively low perception scores were (mean ≤ 4.55) for travel agencies' "modern looking equipments", "visually appealing work materials", "performs service right the first time", "sincere interest in solving problem", and "provides services as promised".

Table II: Evaluation of SERVPERF Values, Overall Service Quality and Customer Satisfaction Values of Travel Agency Customers

	Perceptions Means (SD)
Tangibles	
Modern looking equipments. 4.55(1.64)	
Visually appealing physical facilities.	4.68(1.68)
Employees have neat appearance.	4.81(1.81)
Visually appealing work materials.	4.55(1.91)
Reliability	
Provides service at promised time.	4.58(1.83)
Sincere interest in solving problem.	4.52(1.82)
Performs service right the first time.	4.54(1.81)
Provides services as promised.	4.52(1.95)
Insist on error-free records.	4.62(1.88)
Responsiveness	
Employees inform customers when services will be performed.	4.62(1.84)
Employees give prompt attention.	4.65(1.81)
Employees are always willing to help.	4.65(1.90)
Employees are never too busy to respond to requests.	4.58(1.87)
Assurance	
Employees behavior instill confidence in customers. 4.67(1.95)	
Customers feel safe in their transaction.	4.68(1.66)
Employees are consistently courteous.	4.70(1.76)
Employees are knowledgeable to answer questions.	4.72(1.82)
Empathy	
Employees give individual attention.	4.65(1.85)
Convenient operating hours.	4.63(1.89)
Employees give personal attention.	4.66(1.86)
Agency has best interest at heart.	4.60(1.88)
Employees understand customers' specific needs.	4.76(1.88)
Overall Service Quality	4.76(1.80)
Customer Satisfaction	
I am satisfied with my decision to get some service from this agency	4.69(1.88)
Taking everything into consideration, how do you feel about this agency?	4.60(1.84)
Taking everything into consideration, how do you feel about this agency?	4.55(1.90)

Note: SD: Standard Deviation

The results in table II show just a reasonable score for overall service quality (mean = 4.76) and customer satisfaction (mean = 4.61) in regards to travel agency services. Results means that North Cyprus travel agencies lack to maintain their reliability facilities and also employees of the travel agencies need to be well trained to provide minimum satisfactory services.

Regression Analysis

Multiple-regression analysis was employed with the overall service quality as the dependent variable and tangible, reliability, responsiveness, assurance and empathy as the independent variables. Since regression analysis is “the technique used to derive an equation that relates the criterion variables to one or more predictor variables; it considers the frequency distribution of the criterion variable, when one or more predictor variables are held fixed at various levels” (Churchill, 1995, p. 887). The regression analysis was first confirmed by testing the assumptions of normality, linearity, homoscedasticity, and independence of residuals, revealing that “the residuals are normally distributed about the predictor dependent variable scores, residuals have straight line relationship with the predicted dependent variable scores, the variance of residuals about predicted dependent variable scores is the same for all predicted scores” and “errors of prediction are independent of one another” (Tabachnick and Fidell, 1996, p. 136-139). The variables were also checked for multicollinearity. The VIF scores reported in the table show that the VIFs are well below 10 indicating that there is no cause for concern about the multicollinearity. Therefore multicollinearity was not a threat to substantive conclusion of this study. The results in table III demonstrate that there was a positive correlation with a $R = 0.881$ and a “F” value of 223.510, at a significance level of $p=0,000$. In terms of the relationship between the five dimensions of travel agencies service quality and overall service quality, the adjusted R^2 (0.773) was statistically significant. The travel agency service quality dimensions thus explained approximately 77% of the variance in the respondents’ overall perceptions of service quality. Of the individual dimensions, only “tangibles”, “assurance” and “empathy” were shown to be statistically significant in their effect on overall service quality (with “empathy” ($\beta = 0,563$) being stronger than “tangible” and “assurance”). In terms of the relationship between the five dimensions of service quality and customer satisfaction, there was a positive correlation with $R = 0.890$; $F = 1569,394$, $p=0,000$, Adjusted $R^2 = 0.789$ a $R = 0.890$ and a “F” value of 1569.394, at a significance level of $p=0,000$. The adjusted R^2 (0.789) was statistically significant. The travel agency service quality dimensions thus explained approximately 79% of the variance in the respondents’ level of satisfaction. In terms of individual dimensions, all of them were shown to be statistically significant in their effect on customer satisfaction (with “empathy” ($\beta = 0,424$) and “responsiveness” ($\beta = 0,204$) being stronger than others).

Simple regression analysis was conducted to test the effect of overall perceptions of service quality on customers’ satisfaction. The results are presented in table III. The results show that overall perceptions of service quality had a positive effect on customers’ satisfaction. Correlation analysis indicated that there was a very strong correlation of 0.879 between the two variables (Hair et al., 2000). Thus, overall perception of service quality of customers in fast food restaurants has a positive effect on their level of satisfaction.

Table III: Regression Analyses

Independent Variable: Tangibles, Reliability, Responsiveness, Assurance and Empathy				
Dependent Variable: Overall Service Quality				
Variables	β^a	t-value	P	VIF
Tangibles	0.104	2.424	0.016*	2.629
Reliability	0.076	1.282	0.201	5.044
Responsiveness	0.098	1.578	0.115	5.585
Assurance	0.108	2.044	0.042*	4.002
Empathy	0.563	10.693	0.000*	3.991
R = 0.881; F = 223,510; p=0,000; Adjusted R ² = 0.773				

Independent Variable: Tangibles, Reliability, Responsiveness, Assurance and Empathy				
Dependent Variable: Customer Satisfaction				
Tangibles	0.088	2.131	0.034*	2.629
Reliability	0.113	1.990	0.047*	5.044
Responsiveness	0.209	3.478	0.001*	5.585
Assurance	0.134	2.637	0.009*	4.002
Empathy	0.424	8.368	0.000*	3.991
R = 0.890; F = 1569,394, p=0,000, Adjusted R ² = 0.789				

Independent Variable: Overall Service Quality				
Dependent Variable: Customer Satisfaction				
Overall Service Quality	0,872	35,468	0,000*	1,000
R = 0.872; F = 8769,717; p=0,000; Adjusted R ² = 0.759				

Note: ^aStandardized coefficient; *p<0.05

Conclusion

The travel industry is a unique service industry that heavily relies on the delivery of high quality service (Ap & Wong, 2001). Service quality is gradually seen as the key factor in raising service product differentiation and establishing competitive advantage (Hudson, Hudson & Miller, 2004). There is a growing acceptance among researchers that to achieve and maintain competitiveness and profitability, travel agencies should manage and aim to continuously improve the level of service quality offered to their customers. However, a basic principle of quality management is that to improve quality it must first be measured.

This study was aimed to assess the service quality of travel agency young customers and to determine the customer satisfaction level in North Cyprus travel agencies. The findings of this study reveal that the SERVPERF scale successfully maintains its reliability. Hence, travel agency customers' evaluation of perceived service quality in North Cyprus is found to be uni-dimensional. According to the regression analysis, beta and probability values, travel agencies' authorities should give priority to the tangible, assurance, and empathy elements of service quality to influence customer' overall

service quality perceptions, while authorities should concentrate on all service quality dimensions to influence young customers satisfaction in travel agencies' services.

The results of the present study have a number of practical implications for travel agency directors that customers are likely to become more demanding in terms of the level of travel agency services they consider to be satisfactory. It is obvious from the results that tangibles, reliability, responsiveness, assurance and empathy are the predictors of customer satisfaction. Travel agencies will have to implement strategies for human resources in short and long terms to recruit, train and develop qualified employees. Travel agency directors should ensure that employees are well trained and understand the level of service that the agency expects to provide for their customers. Employees should be able to show adequate attention to customers.

The generalization of outcomes and conclusions drawn from this study is limited by the representativeness of the sample where non-probabilistic sampling method and convenience sampling were used. Data used in this research were collected from travel agencies in North Cyprus. Consequently, it may be difficult to adopt the findings to whole, other industries and countries.

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KANSEI Product and Product Innovation on the Kyoto Long-Standing Companies

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Introduction

Kyoto, Japan, is known worldwide for having many long-established businesses, of which examples can be seen in every industry. The products and services provided by these “old” businesses offer a unique value that appeals to people’s sentiments.

In this study, we take the products and services of an old traditional inn, Tawaraya, an incense shop, Yamada Matsu and printed paper producer Karacho, as examples to offer analysis and observations on product innovation, based on hearings with managers and real-life experiences. We consider ways in which products and services of Kyoto’s old businesses, with their distinct character, change through innovation.

Previous Research

Previous research into old businesses has highlighted the importance of both tradition and reform to underpinning business continuity in wide-ranging fields, from the management concepts and products and services themselves though to managing people as business resources and working with the community. Customers themselves have also come to be involved in planning development to deliver the products and services they need, allowing them to add new value in ways other than through the consumption process.

However, whilst previous research has dealt with the continuity of old businesses, Kyoto’s regional environment etc., there has been no research from the perspective of innovation and sentimental value - addressing how specific products and services by old businesses have continued to reform whilst preserving tradition, how continuing reform has changed them, how those changes have led to changing consumer sentiment, etc. Moreover, these studies have taken “reform” to mean “major change”, and have not worked from principles of innovation theory.

This study seeks to provide a root cause analysis of traditions and reform in Kyoto’s old businesses and to analyze changes in “added value”, examining via product innovation methods how changes in added value produce change in the sentimental value of customers. Our study has drawn on hearings with the business managers and residential observational study to provide analysis and observations based on three old businesses

representative of Kyoto – old-fashioned inn Tawaraya, incense shop Yamada-Matsu, and paper makers Karacho.

Innovation of the old-fashioned inn “Tawaraya”

Tawaraya is an inn which passes on the traditions and culture of Japanese inns (Figure 1), and can be held to represent not only Kyoto but Japan as a whole. We provide



observations on innovation for this old-style inn (Figure 2).

Figure 1. The old-fashioned inn “Tawaraya” and their guest room

Sustaining Innovation

(1) Analysis on improving key characteristics

As a traditional inn, quality and service which closely integrate many aspects of daily life - from the buildings to gardens, furnishings, baths etc. - are an important characteristic of each room.

(2) Analysis of mainstream customers

The customers in question are individual consumers who place importance on the quality of accommodation facilities and reception services supported by tradition.

(3) Analysis for increasing and maintaining profit margins

The accommodation facilities consist of 18 rooms built in the purely Japanese Kyoto style, with every aspect of room design, scenery, gardens, baths, sliding screens etc. professionally made. This makes accommodation costs very high at several tens of thousands of Yen per person.

Disruptive Innovation

(1) Analysis on improvement via new characteristics

With the shop “Yukei”, tea house “Yukei Salon de Thé” and restaurant “Tenyu” having opened in succession, Tawaraya’s own meals, towels, soap and other sundry items, available only to guests, can now be bought individually.

(2) Analysis of non-staying customers

Some services (food and sundry goods) are now available to customers not staying at the inn. This has enabled targeting of customers not using Tawaraya’s accommodation services, those unlikely to stay for financial reasons, and other new targets.

(3) Analysis of business model

Whilst dining in the newly-opened “Tenyu” is somewhat above market prices, it draws on Tawaraya’s cooking with carefully-selected ingredients to offer a characteristic taste.

It can be therefore supposed to be a business model that continuously looks to combine high quality and function rather than emphasizing profit.

Capabilities for Disruptive Growth

Resource perspective

The Tawaraya inn has many resources closely linked to daily life, including buildings, gardens, furnishings and baths. Hence, they are not the result of a single profession. This encompasses various traditional methods, making Tawaraya the product of a combination of many highly-skilled techniques.

Process perspective

In caring for the traditions of Japanese inns, Tawaraya devotes skill to the welcome given to guests, the facilities, furnishings and other aspects that change over time, whilst preserving the traditional beauty and mood of the inn passed down from days gone by. In doing so, design of Tawaraya's facilities, furnishings, reception etc. is a unique process.

Value standards perspective

Various methods are focused on providing the utmost hospitality to guests. In particular, whilst co-ordination of everything including the buildings, furnishings, gardens is very simple, it is a pleasant design that provokes emotion.

Hence, whilst Tawaraya's traditions are subject to continuous innovation, destructive innovation can be understood to contribute to reform. This means that tradition and reform at Tawaraya can be explained in terms of product innovation. Hence, the succession of tradition can be seen to be the progress of continuing innovation, with reforms from temporary changes causing destructive innovation.

Innovation of the incense shop “Yamada-Matsu”

We offer observations on innovation in the old Kyoto incense makers Yamada Matsu



(Figure 2), which has seen continuing steady growth amid reduced sentiment in the industry.

Figure 2. The incense shop “Yamada-Matsu” and their products

Sustaining Innovation

Analysis on improving key characteristics

The incense maker is highly regarded by customers for the stable way in which they have worked steadily and inconspicuously, together with their reliability for providing high-end products made from high-quality woods stored over a long period.

Analysis of mainstream customers

Yamada Matsu is highly rated by customers who have long used its traditional and classic products made from high-quality materials.

Analysis for increasing and maintaining profit margins

The company's practice is not to seek increased efficiency and uniformity through mechanization, but to continue producing by hand through the work of professionals with devoted care, providing distinctive products made from rare fragrant woods.

Disruptive Innovation

Analysis on improvement via new characteristics

Besides high-end products focused on natural materials, there are also many innovative products. Besides incense from conventional natural materials they also have synthetic flavors produced through practical application of materials, a style of incense for daily use.

Analysis of non-staying customers

Visitors learn the history and culture including ways of making *monko* incense and production from raw wood, such that customers with no knowledge of incense and *Kodo* (the Japanese art of incense) are also targeted.

Analysis of business model

The innovative products mentioned have led to provision of incense as a convenience product. As a result, they are aiming to strengthen direct sales in pilot shops and online, making this a business model with greater efficiency in its distribution channels.

Capabilities for Disruptive Growth

Resource perspective

Yamada Matsu's resources are their in-house operation for hand production by traditional craftsmen; they are strongly dedicated to materials and the use of traditional techniques.

Process perspective

Hand production processes by traditional craftsmen come at the cost of efficiency. However, despite making innovative products, they choose not to pursue excessive efficiency from mechanization, in order to maintain the same high quality as in years gone by.

Value standards perspective

The use of non-traditional, innovative products, applications and materials is based on different values from those of products made with conventional natural materials. This includes types of incense using artificial flavorings, which give rise to products completely different from the ingredients in monko such as the traditional fragrant woods.

Hence, whilst Ymada-Matsu's traditions are subject to continuous innovation, destructive innovation can be understood to contribute to reform. This means that tradition and reform at Yamada-Matsu can be explained in terms of product innovation. Hence, the succession of tradition can be seen to be the progress of continuing innovation, with reforms from temporary changes causing destructive innovation.

Innovation of the paper makers “Karacho”

Boasting 400 years of history, the paper makers “Karacho” are Japan's only producer of *karakami* paper for sliding paper screens (Figure 3). We offer observations on the innovation that is driving its business continuity.



Figure 3. The paper makers “Karacho” and their products (Monyo)

Sustaining Innovation

Analysis on improving key characteristics

Traditional Kyoto *karakami* and small articles etc. with woodblock prints reproduced on Japanese paper other than for sliding screens are products unchanged from years gone by. From day-to-day discussions with customers who value Kyoto *karakami*, Karacho identify the best designs, color and Japanese paper to offer products “made together” with customers – the ultimate in counter sales.

Analysis of mainstream customers

Just as the former home (Buaiso) of author Masako Shirasu features “cherry blossom” Kyoto karakami, there is also demand by eminent cultural figures and companies with a traditional focus.

Analysis for increasing and maintaining profit margins

Through Karacho’s characteristic materials and techniques, the work continues to offer the ideal face-to-face sales through “making together” with the customer.

Disruptive Innovation

Analysis on improvement via new characteristics

Karacho also has block print designs on other media than Japanese paper, and products apart from Japanese paper made in collaboration with other companies and various small articles are now being sold.

Analysis of non-staying customers

Many of the customers for Karacho products use them for paper screens in rooms etc. as described, whilst the aforementioned collaboration with other companies and small article sales are making Karacho designs more easy to obtain.

In this way, Karacho’s values are being expressed to others apart from existing Karacho customers; through this sharing and new collaborative products, the sales channel is widening to include previously unaware and more financially restricted customers.

(3) Analysis of business model

Seeking profit from collaborative products and small article sales can be considered a novel attempt to share Karacho’s values.

Capabilities for Disruptive Growth

Resource perspective

Karacho’s resources as mentioned are their patterned block prints, made using the distinctive materials and tools of *dorae-no-gu* paints and old Japanese paper (*Echizen Hoshō*). In addition, there are the staff of around 12 in total, including the craftsmen passing on traditional techniques as well as salespeople etc.

Process perspective

As mentioned, Karacho’s method of transferring paint to the paper is a distinctive craft that differs from block printing. Japanese paper made in this way is used to adorn folding and sliding screens, walls etc., which are sometimes fitted by Karacho staff themselves.

Value standards perspective

As Karacho put it, they share understanding of the paper's value with their customers - sharing value with the customer, implying a greater awareness of the customers themselves being "selected". In addition, work in Europe and a workshop in Paris have been set up, giving innovative value.

Hence, whilst Karacho's traditions are subject to continuous innovation, destructive innovation can be understood to contribute to reform. This means that tradition and reform at Karacho can be explained in terms of product innovation. Hence, the succession of tradition can be seen to be the progress of continuing innovation, with reforms from temporary changes causing destructive innovation.

***Kansei* value and Innovation**

From our analysis of three representative old Kyoto businesses, we can understand how they have innovated while continuing their work over the long years and months. We have also gained an insight into the essence of tradition in old Kyoto businesses. This can be broken down in the form below.

- Through continuous innovation, values and styles born gradually over a long time develop, and by passing on distinctive techniques, key materials etc., traditions move on as history is made in these old businesses.

The traditions and history of old businesses provides depth to the products and services offered, and builds a sense of value that appeals to customer's sentiments. This suggests that the concept of tradition can be transmitted in the specific form of the products and services offered.

We can also gain an insight into the core of reform in old Kyoto businesses, can be interpreted as below.

- Through destructive innovation, values reflecting temporary fashions and trends give rise to styles in the short term, using materials with unique techniques and focus backed by the traditions and history of the old business (coexisting with and complimenting tradition), whilst reform happens by assessing their validity today.

Whilst coexisting and complementing the traditions and history of old businesses, products and services fitting modern trends build values fostering sentiment in customers different to those who attach importance to tradition. This suggests that the concept of tradition can be transmitted in the specific form of the products and services offered.

Based on these observations, we have built a diagram showing the relationship between sentimental value and innovation in Figure 4. This shows how products and services provided vary depending on the type of innovation, and the sentimental value created in customers also changes.

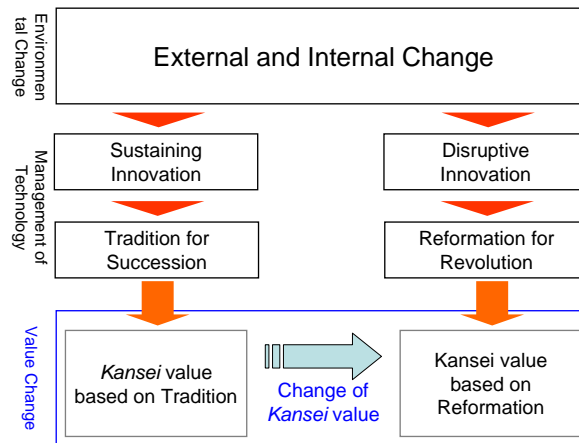


Figure 4. The relation between *Kansei* value and Innovation

Conclusion

Hence, from our analysis on the basis of innovation of tradition and reform at the heart of old Kyoto businesses, we have identified continuous innovation to be the backbone of tradition in old businesses, whilst adaptation to temporary changes is destructive innovation.

We have also shown how, according to the type of innovation, sentimental value embodied in products and services and imparted to customers changes. However, this cannot be said to apply to all old businesses in Kyoto; there remains scope for deeper objective study.

This shows how the core of traditions and reform in old Kyoto businesses is tightly linked to innovation, the various innovations creating products and services that inherit old business traditions and reforms, an inheritance which fosters customer sentiment. We can infer its importance in maintaining business continuity under tough operating conditions for many of these old businesses with their long history.

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Measurement of Customer Satisfaction in Business Networks

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Category: Research paper

An Introduction to Customer Satisfaction

Nowadays business become more and more „lean“. (Becker2007) Low availability of resources causes problems for businesses in developing and distributing complex performances and products on their own. Therefore networks are founded. Target-oriented cooperation and a focus on core competences shall achieve competitive advantages. (Becker2007)

Survival of businesses is more and more connected to the unique selling point of its network and a demarcation to business competitors. But this demarcation or outmatching of competitors is difficult, because products and services become more and more alike; only the contact to customers offers a high potential. (Winzer2004) But the offering of customer services by a complex network generates difficulties in measuring customer service performances. Parallel or even identical services of different businesses in a network have to be measured by the customer and connected to its initiator. It has to be figured out which service process and its performance creates the grades of customer satisfaction/dissatisfaction. But already existing methods and approaches are limited. There is a lack of methods for a systematical development of services and service processes that are economical and customer-friendly. (Meschner2010) Established methods like *Servqual* (Zeithaml1994) or *Kano* (Hölzing2008) – to mention just two of them – enable a practical approach for networks to measure and – in the context of continuous improvement – increase customer satisfaction in a systematical way, like it is required by the European Foundation for Quality Management (EFQM) or DIN ISO EN 9000. (Radowski2007)

In addition, networks have to handle the problem of trust, what is a main aspect of network-management. It is a predicament between provision of customer contacts for the survival of the network and the protection of in-house information and know-how in order to secure the survival of its own business outside of the network. (Ahlert2003, Knop2009) Accordingly every network partner has to decide how much information on customer contacts should be revealed to the network.

The aspect of revealing customer contacts and information influences the customer as well. The customer has to find out which network partner is the appropriate one for e.g. an order transaction or a customer complaint. Such information responsibilities are often not evident for a customer. Customer-relevant processes and their responsible

network-partners are confusing for both - the customer and the network-partners. This problem is also still unsolved. (Ahlert2003, Knop2009)

Therefore the aim of this approach is an enhancement of already existing methods for detection and measurement of customer-relevant service processes in businesses (Bruhn2004, Schlüter2010, Schulze-Bramley2009) or even to create a new design in order to provide a usability in business networks. By implementing this method, customer services should be connected to particular service processes. With the help of performance measurements, weaknesses in handling the customer services should be figured out.

It is also decisive that customer-relevant processes can be influenced by the structure of a network. Depending on whether there is an existing central network-management or not, customer-relevant processes can be applied more central with only one responsible network-partner than with several local network-partners involved. Structural differences like the example given above are increasing the problem of implementing a method by aspects like differing responsibilities, confidentiality of customer services information, liability due to reclamation or demarcation of a network-partner's customers to other partners because they are competitors in free-market economy. Thus the network-structure has to be considered during the design of a new method and in guidelines for implementing the method in a network.

Focus of the research presented in this paper is the advancement of already existing methods for analyzing customer-relevant processes in business for the use in networks. At first existing methods are pointed out. Afterwards their weaknesses and solutions are presented which are described by examples in the field of mass transportation systems. In the end results are summarized and further necessary steps on the way to an all-embracing approach are named.

Methods for measuring of customer-relevant processes

Marketing and Quality Management offer a multiplicity of methods for measuring customer satisfaction. Most popular methods in Quality Management e.g. are *Kano* (see (Hölzing2008)) – that subdivides demands in basic, performance and excitement demands – and *Servqual* (see (Zeithaml1994)) – which uses a process-oriented approach. While *Kano* is difficult to use because of its extensive survey method, and *Servqual*'s dimensions – reliability, assurance, tangibles, empathy and responsiveness - are adapted to banking, but used analysis is not always consistent (Zeithaml1994). There is still a lack of an all-embracing method for measuring customer satisfaction. Especially the gathering of the customer experienced performance is still a problem. (Bruhn2006)

In the field of Marketing, survey methods for gaining customer satisfaction data are divided into the two sub-classes “quantitative” and “qualitative”. They focus on capturing (qualitative methods) and measuring (quantitative methods) of demands. (Meffert2008) An overview offers Figure 1. Both kinds are not process-oriented like it is requested in EFQM and DIN ISO EN 9000 and do not record both: the objective performance of a service process and the caused, subjective customer satisfaction. (Schlüter2010b)

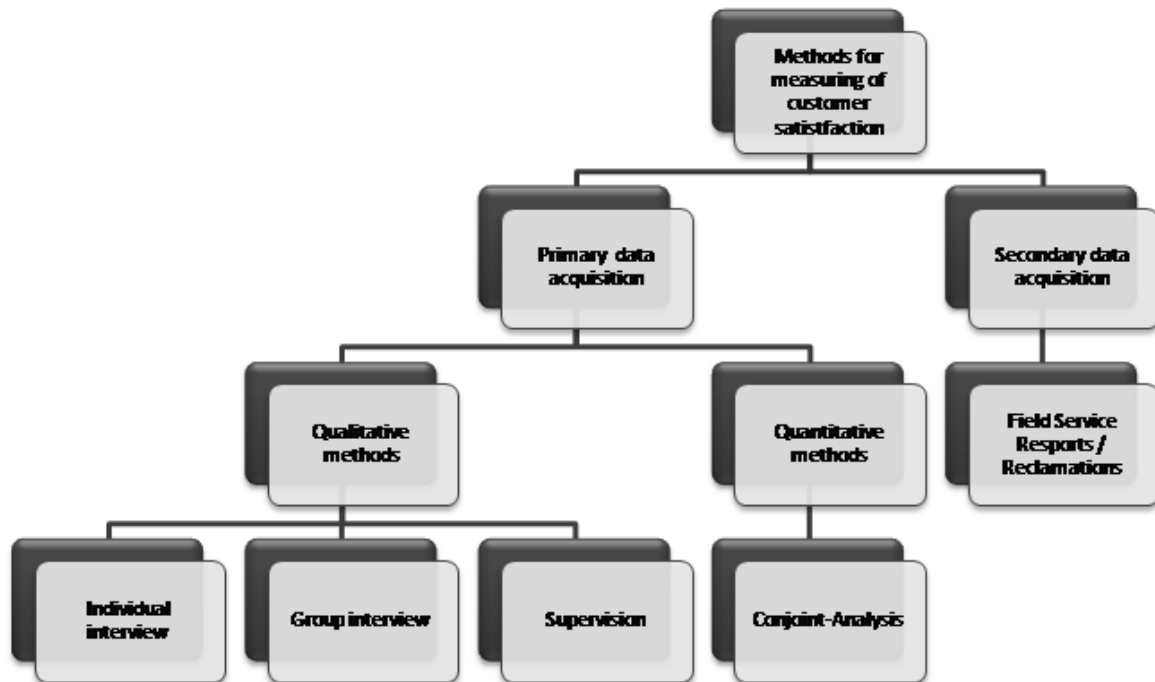


Figure 1: Methods for measuring Customer Satisfaction in the field of Marketing (Meffert2008)

Hence there is a need for a measuring method that is connected to the actual performance of service processes, so customer satisfaction can be connected to their occasion – the objective measured service processes of a company and the subjective customer satisfaction.

The so called KuWiss-method (**KundenWissen** = customer knowledge) developed by the Research Group "Product Safety and Quality Engineering" at the University of Wuppertal, Germany, focuses on process-orientation and customer contact points and therefore offers a solution that cannot be solved by mentioned methods above. It uses already existing process documentations (required by DIN EN ISO 9000) and connects them to correlating tools of a tool-box. The support of the Quality Management System (QMS) and Continuous Improvement (CI), required by QMS and EFQM, is consequently provided. So a business can use already existing information and data about processes, customer contact points, order transactions, reclamations and sales. The responsible parties are often known and therefore synergies concerning time and budget can be achieved. (Fiedrich2006, Schlüter2010b)

Illustrated in Figure 2, the KuWiss-method is based on customer-relevant processes that can be – if not already known – spotted by Service Blueprinting. (Bruhn2006) Service Blueprinting identifies customer contact points and verifies customer processes as well as business sub-processes that are connected to it. For each contact point performances and performance-indicators are identified and integrated into a performance-cluster that connects each performance-indicator with quality aspects of a service.

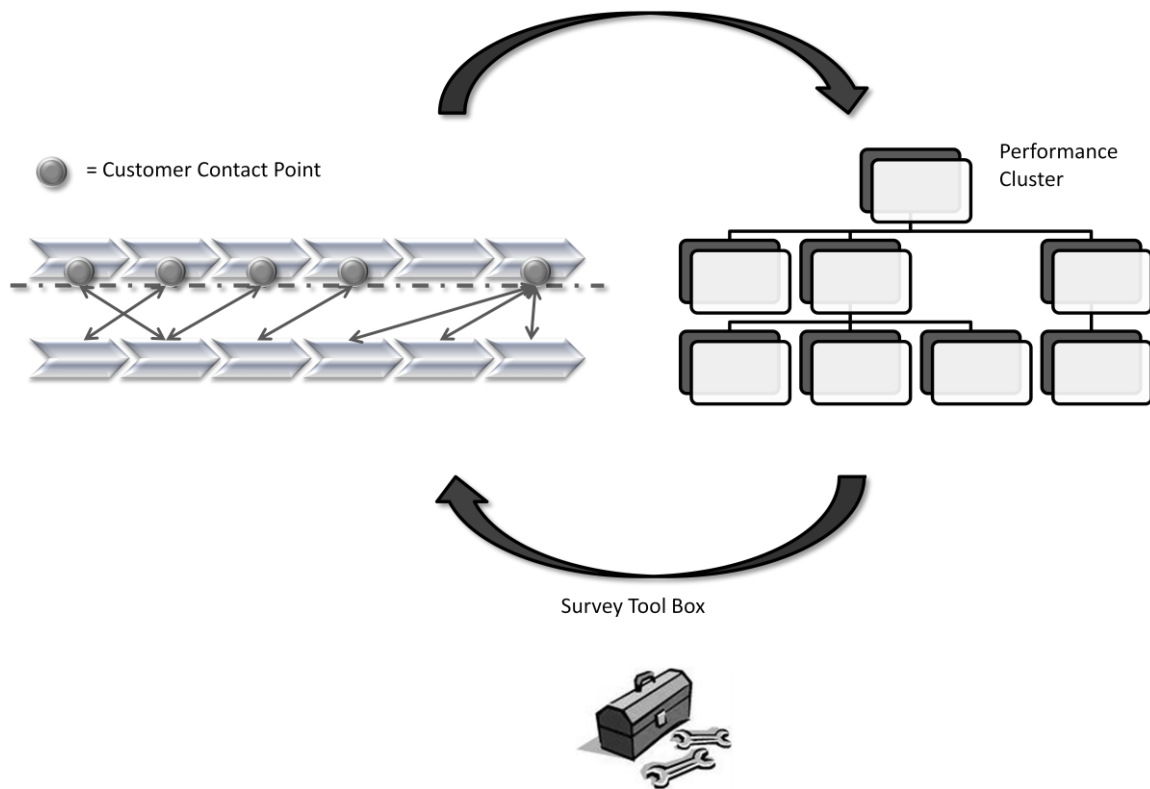


Figure 2: KuWiss Concept (Fiedrich2006, Schlüter2010a, Schlüter2010b)

In order to poll the customer satisfaction on each performance-indicator, permanent surveys with high return rates have to be implemented into the customer-process. Tools for this challenge can be “Cards & Lights” or “Poll Cards” methods, which offer questioning of a high number of customers in shortest time (only seconds) without interference. (Fiedrich2006, Schlüter2010b)

Concluding gained customer satisfaction data has to be imported into a data base tool and afterwards be analyzed in regard to problematical processes and customer trends. (Fiedrich2006, Schlüter2010b)

In summary the KuWiss-method is made up of seven steps shown in the following figure 3:



Figure 3: The seven steps of KuWiss (Schlüter2010b)

While KuWiss was tested in several domains like shops, manufacturers and mass transportation, the transfer for using the tool in business networks still has to be carried out. The advantages of KuWiss (synergies in time and budget, identification of parties responsible) are based on interconnection of process-oriented customer satisfaction measurement and QMS. Those advantages can also be gained in business networks, but the high complexity of networks have to be considered, e.g. each network-partner has knowledge of its own processes but an all-embracing process documentation of the network cannot be taken for granted. Each customer-relevant process has to be adjusted to the others and connected to a party responsible. Also parallel or identical processes generated by different network-partners and/or parties which are responsible have to be

related and overlaps handled. Concerning the results of a customer satisfaction survey also confidentiality has to be taken into consideration because networks-partners are business rivals at the free market.

Thus there are several aspects to be considered and problems to be solved by adapting KuWiss for business networks.

Development of a method for measuring customer-relevant processes in networks

Right in the beginning an extension of Service Blueprinting is necessary, because the structure of this method is based on only one business and not on business networks. There is no possibility of differentiation between the processes of network partners; a business network is equated with a business. Thus Service Blueprinting might be used for networks with a central network management but not for a peripheral network. In addition no responsibilities are documented in Service Blueprinting, so that relations of process responsibilities for the performance-clusters and the data base are still missing. This also includes agreements related to confidentiality, which is important for implementing a performance cluster and the data base. Furthermore parallel or identical processes of different network partners cannot be handled by KuWiss right now. Hence solutions for the Service Blueprinting, the implementation of performance-clusters and the data base have to be figured out.

In the following chapter those problems are examined and solutions are developed in reference to the steps of KuWiss. An overview of the steps and problems is given in Figure 4.

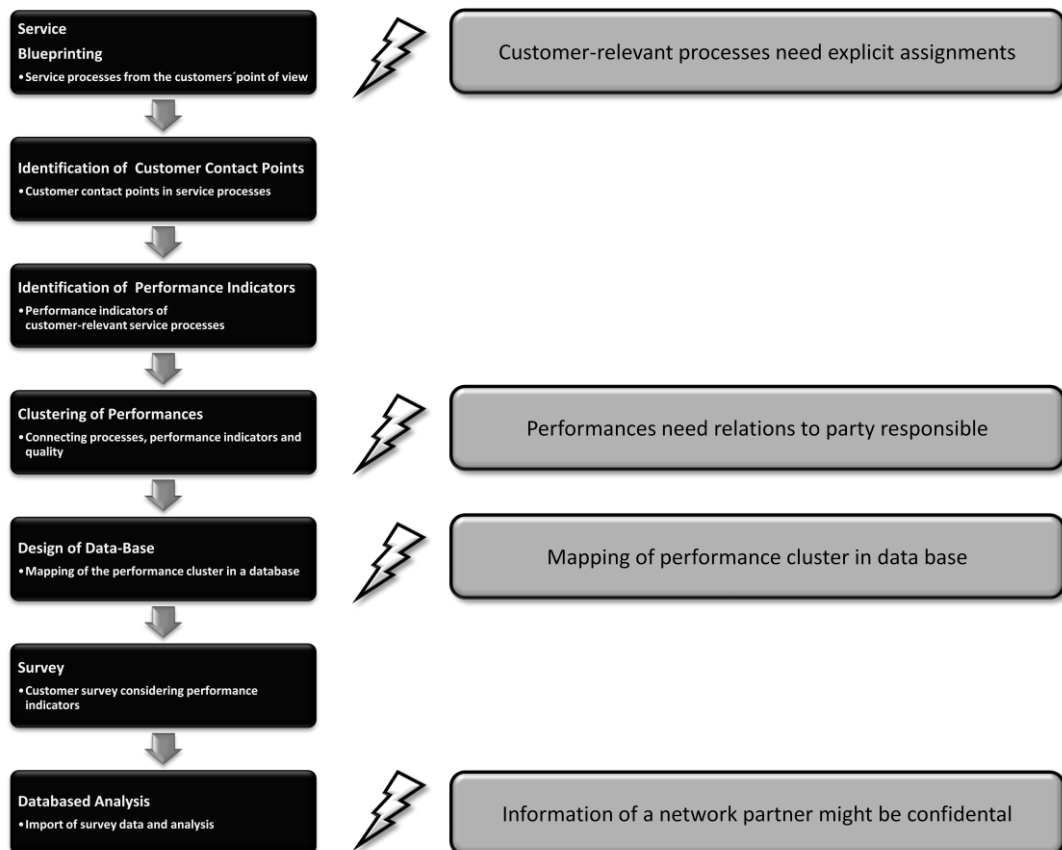


Figure 4: Problems to be solved in order to use KuWiss in Business Networks

Enhanced Service Blueprinting

In order to explain the adjustment of Service Blueprint, a short introduction of the method is given in the following sub-chapter.

Service Blueprinting in businesses

Structuring business processes is a basic idea of Service Blueprinting in terms of customer integration. Service Blueprinting is a structuring approach in order to analyze and design services. (Kleinalterkamp1999)

The accomplishment of Service Blueprinting is that all activities of a service process are related to according levels. The affiliation of an organizational unit does not matter. There are five levels, graphically divided by lines which show boundaries of each level from the customers' point of view. (Woratschek2000)

1. *Line of Interaction*
2. *Line of visibility*
3. *Line of internal interaction*
4. *Line of order penetration*
5. *Line of implementation* (Bruhn2004)

In addition to the levels visualized by the five lines, activities and their relations can be placed in levels like it is done by process modeling. In this case the process model of Service Blueprinting focuses on the result of a performance by visualizing the service processes in order of their activities and intersections between the customer and the company. (Kleinalterkamp1999, Kleinalterkamp2011)

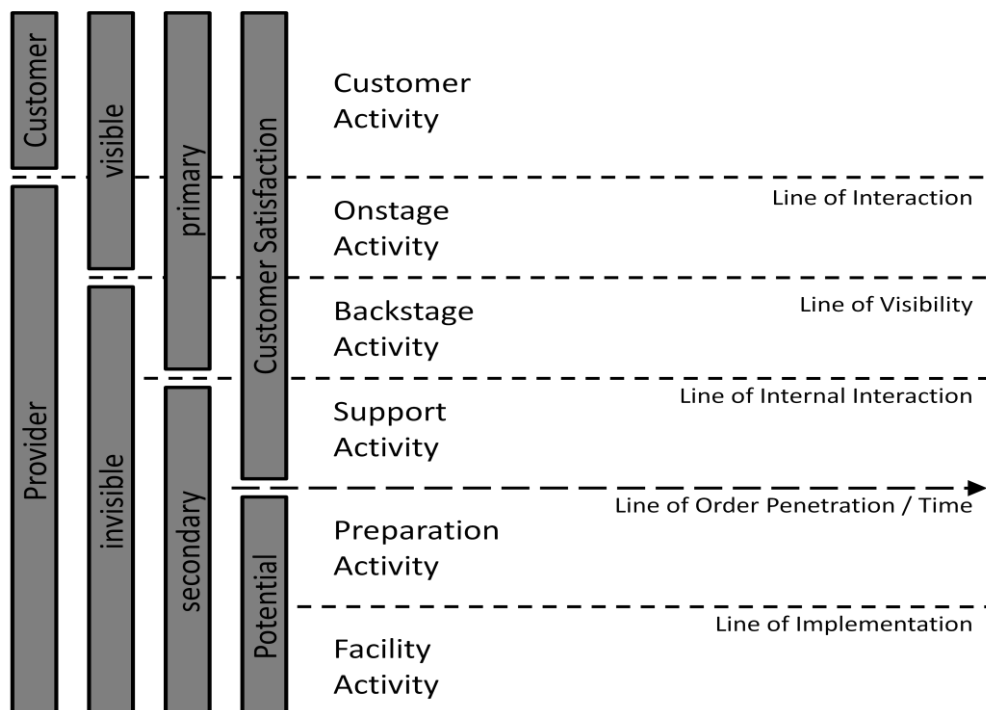


Figure 5: Service Blueprinting (Kleinalterkamp2011)

It is common to hold a workshop for creating a Service Blueprint where all customer affected units of a business are involved. This workshop should include following units:

1. Preparations including selection of processes (1-2 days)
2. Visualization of processes (1-2 days)
3. Postprocessing for documentation and graphical review (1 week)
4. Implementation and communication of results. (Kleinalterkamp1999, Kleinalterkamp2011)

Applying Service Blueprinting to Networks

In creating Service Blueprints in networks, an allocation problem is caused by the number of different businesses, partly parallel running or identical processes, e.g. the mass transportation network in Cologne.

It is carried out by several, autarkic businesses that are organized in a local network.

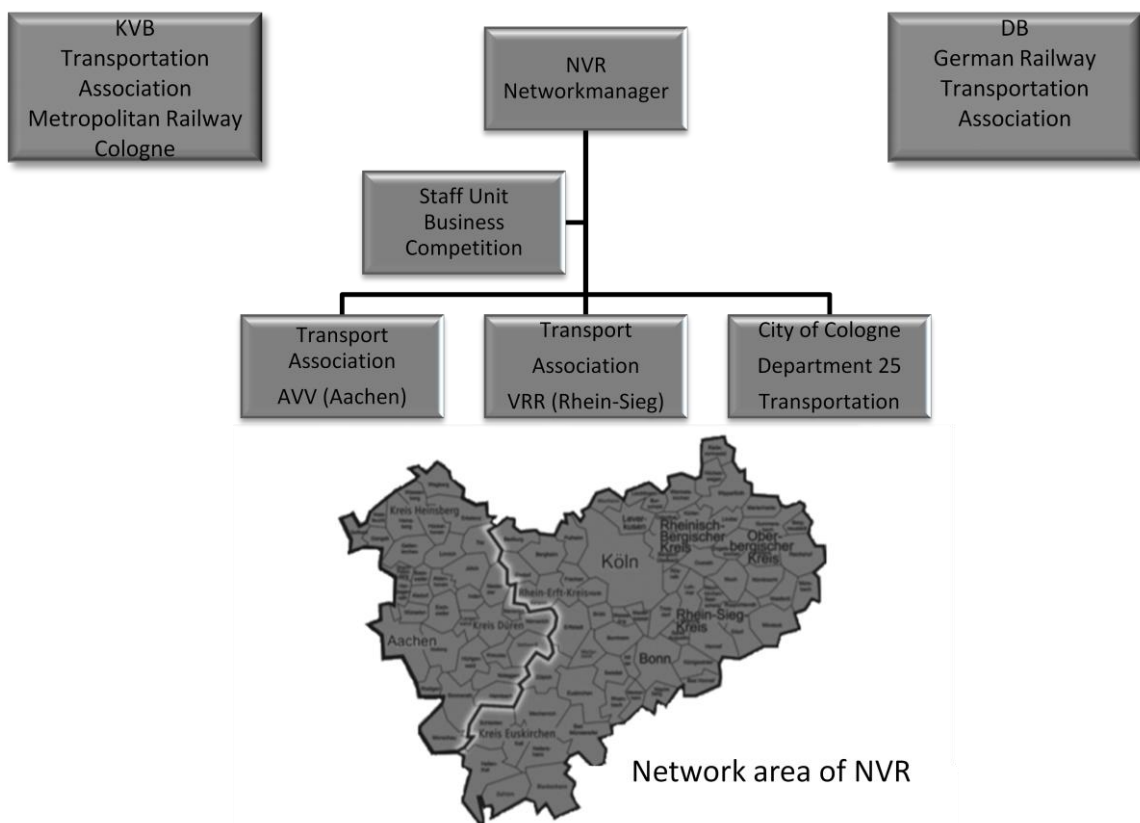


Figure 6: Mass Transportation in Cologne as an example for Networks (Reinkober2008)

Each network-partner provides performances for its customers. Interlocking of processes in the network causes the allocation of each process and its performance for customers, e.g. the performance of tidiness. The customer appreciates tidiness in busses, trains, at platforms and stations. On a ride in the inner city of Cologne, at least two facilities and their tidiness are experiences. This facilities can be owned by different network-partners. If a passenger starts in the western area of Cologne and takes a bus to Cologne central station, he has to use departments of the AVV (bus transportation), the German Railway (DB) and the KVB (Cologne city trains) to reach his destination.

Therefore AVV, DB and KVB are responsible for the performances. Responsibilities are changing in every single place. This has to be attended in Service Blueprinting.

Even more difficulties occur by combined performances of different network-partners in the same area respectively at the same customer touch point: at central station, the main infrastructure is operated by the German Railway (DB) and KVB (city trains), the bus platforms outside of the building are managed by the VRS (bus transportation). A segregation of responsibility is not detectable during the passenger's switching from bus to train, although there are three companies responsible for the tidiness.

Consequently, performances in Service Blueprintings have to be separated into different levels, relating each performance to the according performance-generator respectively network-partner.

The given example is visualized in the following Figure 7:

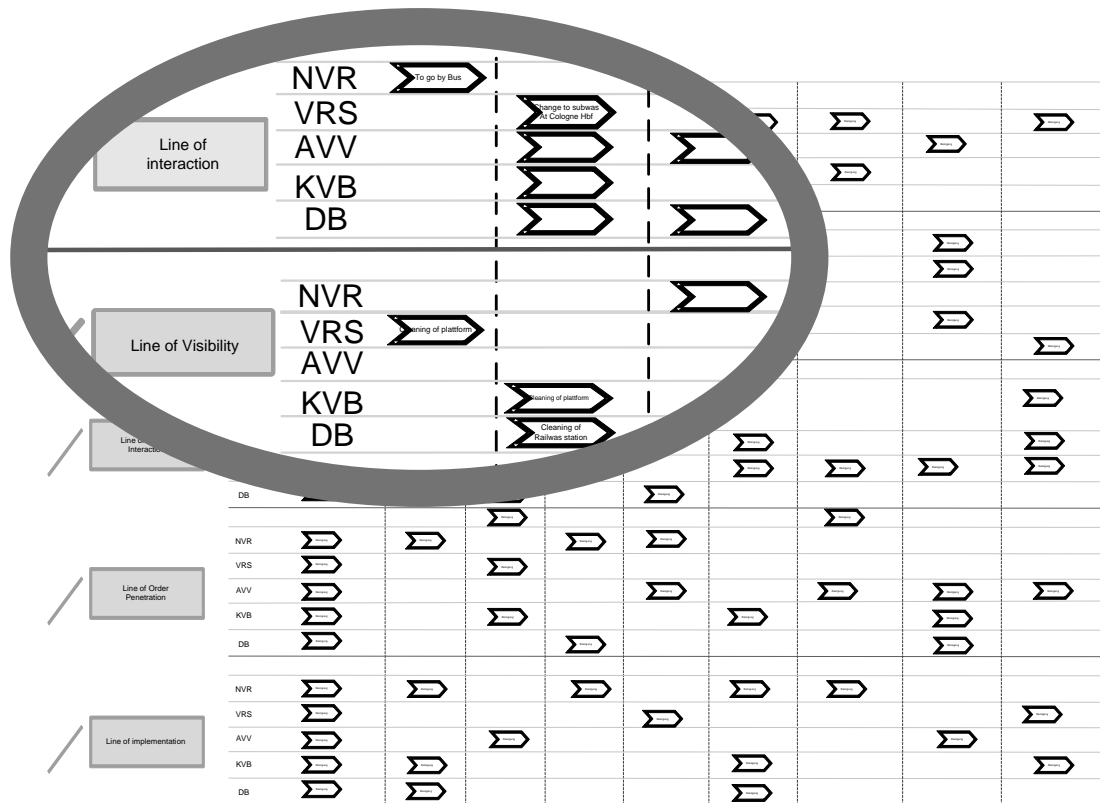


Figure 7: Extended Service Blueprinting

The integration of sub-levels for responsibilities in Service Blueprinting of each performance can be related to the network-partners.

Service Performance Clusters in Networks

The enhancement of Service Blueprinting is the first step towards a solution of the problems described above. The example of mass transportation in Cologne shows a clear relationship between performance and the party responsibility. Furthermore a territorial differentiation is important: The performance tidiness cannot be generalized,

it has to be related to the actual place, e.g. the bus stop with its dirty windows or the station where the litter is disposed every hour by the staff.

Several attributes have to be attended while measuring the performance. In detail, those attributes are: the party who is responsible, the processes and their performance indicators and the place respectively customer touch point. These attributes have to be kept in mind while creating the performance cluster which connects the performances with quality criteria. With regards to the example, performances of the mass transportation system in Cologne have to be connected with the quality criteria for safety and security.

	A	B	C	D	E	F	G	H	I	J	K	L	M	N		
1	Performance Cluster			Quality Criteria												
2				Infrastructure							Safety and Security Indicators				Environment	
3				Categories	Dimensions	Performances	Distance to Exit	Exits closed	Overcrowded place	Air-conditioned	Day/Night/Time	Weather conditions	Tidiness	Graffiti	Nontransparent windows	Smell
4																
5			Markers on platform floor			x										
6	Entrance/Exit															
7		Entrance/Exit	Stairs	x	x	x		x		x	x		x	x		
8			Hand rail at stairs		x	x				x				x		
9			Escalator	x	x	x				x			x	x		
10			Barriers		x	x										
11		Barrier-free travelling	Elevator				x			x	x	x	x	x		
12			Ramp		x	x				x	x					
13	Services															
14	Information/Communication	Time table information	Time table online		x	x		x	x	x	x					
15			Time table notice		x											
16			Traveller announcement							x	x					
17			Annunciator panel at platform													
18			Information on construction sites													
19			Route map notice		x	x		x	x	x	x					

Figure 8: Clipping of a Performance Cluster of Cologne Central Station (Schlüter2010a)

For appliance in a network it is necessary to create several performance clusters – one for each network partner. Summarized, those performance clusters are part of an all-embracing performance cluster which includes information about the relation to the responsible party.

To handle the amount of information, performance clusters have to be implemented into a data base. The data base is built from on several attributes, for example process ID, network partner, place, time, date, stakeholder, event, performance, performance indicator, etc..

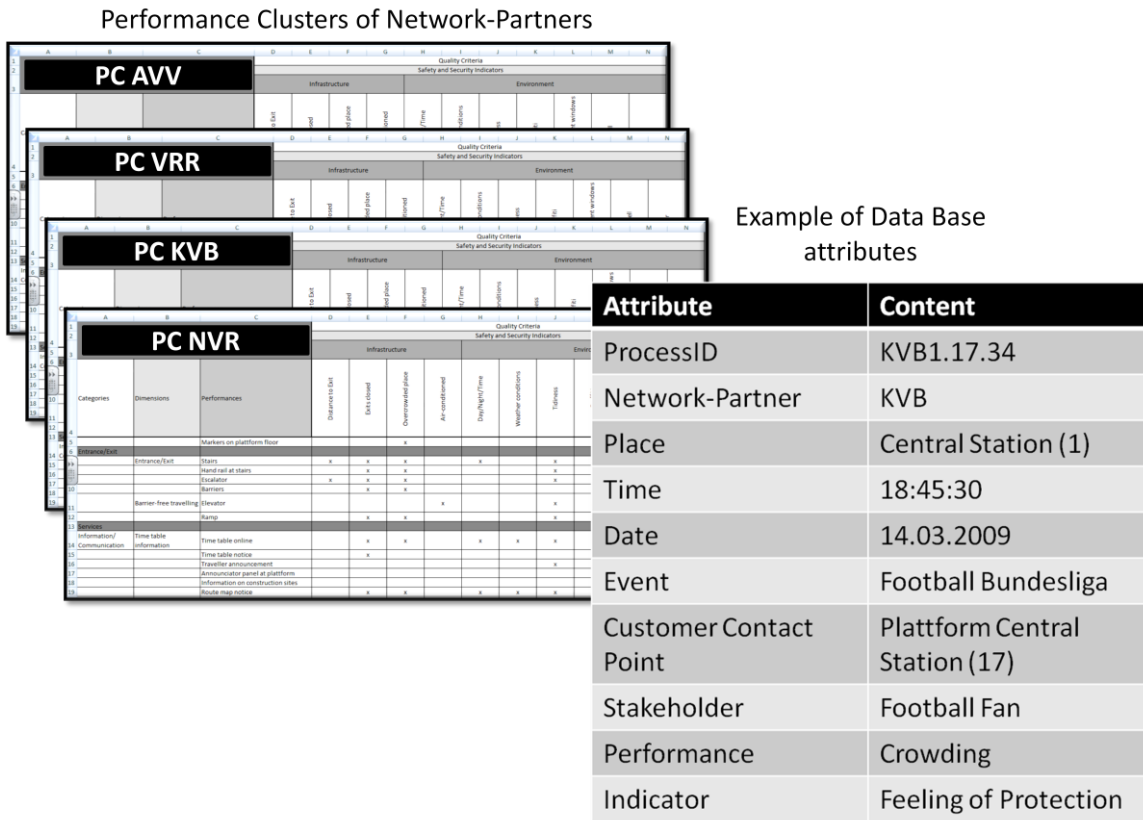


Figure 9: Example of a Performance Cluster of Network-Partners and Attributes of the Data Base

Design of a Database including Data Interpretation

As mentioned above, the number of performance clusters and the resulting amount of data, their implementation into a data base becomes necessary, as this data volume can only be handled within a data base . Furthermore a data base with according statistic tools like regression analysis (Schlüter2011) allows to analyze this data for measuring performances and thus to predict customer satisfaction, by analyzing performance indicators and their impact on customer satisfaction or the correlations between indicators. This information provides the basis for a continuous improvement in process performances and customer satisfaction.

In addition it is recommended to implement rights of access in the data base. Although trust is a basic demand in networks (Ahlert2003), the willingness to reveal intra-company data like performances, customer processes and customer information is limited. By designing performance clusters for each network partner and implementing the rights of access, this problem can be solved in an opportune way.

Field of Application

The approach of implementing performances measurements in mass transportation systems was one example to deploy the new method – KuWissNetz. In context of a project which deals with the customer satisfaction and the sense of protection in mass transportation systems during mass events, a performance cluster was designed and the

measurement of customers' feeling of protection concerning a throng of people was successfully carried out. (Schlüter2011)

In addition, a data base was implemented. Its statistical tools document the association of the sense of protection within a throng of people and also the type of event or stakeholder. The problem of several parties who are responsible and identical or parallel running service processes were solved by enhancing the Service Blueprint and the use of further attributes in the performance cluster. The applied method leads to the desired results.

Using the method in local organized networks also seems to enable its use in other branches. Right now, a research study proceeds in context of cutlery manufacturing in order to prove this hypothesis.

Using this method in production networks in addition to service networks is another field of research.

Conclusion

Within the scope of this research the usability of the new method KuWiss-Netz for measuring customer satisfaction in business networks was proved.

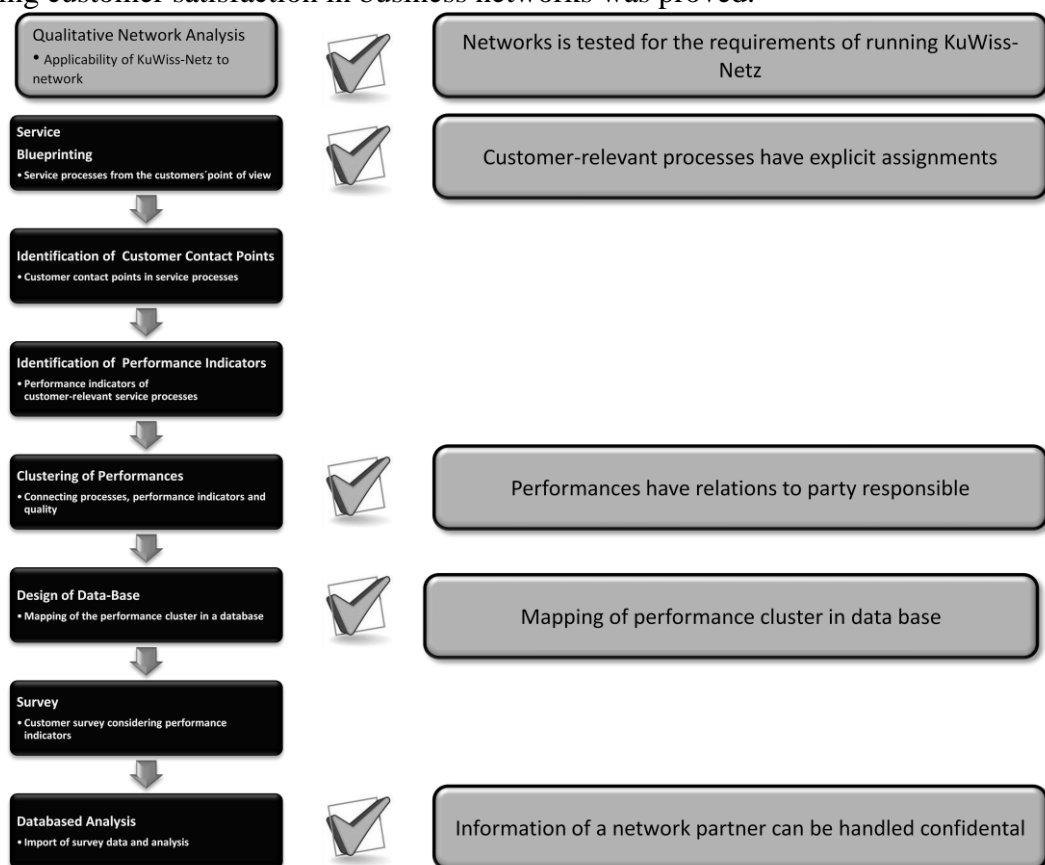


Figure 10: Steps of the new method “KuWiss-Netz” for measuring Customer Satisfaction in Business Networks

The new method includes an enhanced Service Blueprinting and the design of a data base with according attributes.

Nevertheless there are still problems to be solved. The correlation of network structures and the design of performance clusters has to be examined. A study on this problem is already running and it seems like the results can achieve synergies in generating performance clusters and the implementation into the new method. The study also develops a guideline for a qualitative network analysis in order to check the application of KuWiss-Netz in networks. This is necessary because networks need a particular level of maturity to be able to run the KuWiss-Netz method. A network which is still in configuration often does not have the needed resources and information.

The guideline on checking the network capability should be executed right in the beginning of KuWiss-Netz. It is may be a termination milestone for implementing KuWiss-Netz, but will otherwise build a basis of information for the further steps of KuWiss-Netz.

All in all the KuWiss-Netz method offers a possibility to measure the customer satisfaction. It is related to the customer and network processes and enables a permanent measurement. Therefore it fulfills the requirements demanded in ISO 9000 and by the EFQM model. A next step regarding the EFQM Excellence Model is the connection of basic quality indicators of KuWiss respectively KuWiss-Netz and the "Customer Result" of the EFQM Excellence Model and its criteria.

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Choice of primary care in Sweden: an explorative study of citizen statements based on discourse analysis

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Introduction

Since the beginning of the 1990s, Sweden's inhabitants have enjoyed the experience of choosing their care-giver in primary care. In 1993, a GP reform was introduced which entailed that every inhabitant had the legal right to choose his/her GP. Following a transfer of power in the Swedish parliament in 1994, the GP Act was repealed in 1996 (Ahgren 2010). Some county councils have retained the possibility of choosing a GP. Since 2010, the county councils have been obligated to allow their citizens to choose between different care-givers in primary care. The aim of this national reform is to enhance freedom of choice for the citizens and facilitate for new providers to establish themselves in publicly financed primary care (National Board of Health and Social Welfare 2010). Depending on the domicile of the citizen, they can choose either among comprehensive local health care arrangements, primary care centres or GP and other health professionals (Anell 2008).

The design of the choice of care models varies with regard to the primary care remit, e.g. whether this includes or excludes children's health care, pre- or ante-natal care, rehabilitation, home nursing, and medical chiropody (National Board of Health and Welfare 2010), as well as how reimbursement principles are designed (Anell 2008). A fundamental is that reimbursement accompanies the individual's choice of care-giver and that private and public providers are treated equally (Nordgren 2010 b). This is possible under the Act on System of Choice in the Public Sector (Swedish Code of Statutes 2008:763), which gives municipalities and county councils the opportunity to allow the end-user to choose a provider of support and care services.

The overarching aim of this article is to make a contribution towards increasing knowledge of the grounds on which inhabitants say they make their choices. Through a discourse analysis of the end-users' statements on their choice of primary care, there is a focus on how the end-users' themselves reason with regard to what governs these choices.

Knowledge about choice of health care

As regards patient choice in tax funded health care systems, several international studies conclude that patients have shown relatively little interest in choosing a care-giver, apart from when they are dissatisfied with their care, e.g. when waiting times are unacceptably long. Patients seem in general to be more interested in participating in the choice of treatment alternatives, while simultaneously taking part in that process to a lesser extent than they would wish (Fotaki *et al.* 2008; Goodwin 2006). Groups diverging from this include patients who are well educated, who seem to use information to a greater extent, and who seem to be more inclined to make choices in

their health care. Young and mobile patients seem to be more anxious to be able to choose their care-giver in comparison with many other patient groups who prefer to retain old contacts (Thomson, Dixon 2006; Fotaki *et al.* 2008). Results from Swedish primary care are in line with the conclusions of international research:

- Patient influence on the treatment undergone is valued highly by Swedish primary care patients (Hjelmgren, Anell 2007).
- A study within Stockholm County Council shows that only a small proportion of patients had utilized their possibility of changing their primary care unit; instead, choosing a care-giver locally (Berggren *et al.* 2009).
- According to Rosén *et al.* (2001), patients of young ages living in cities are more eager to be able to choose their care-giver in primary care in comparison with other patient groups. Berggren *et al.* (2009) draw a similar conclusion regarding *Vårdval Stockholm* (Choice of care in Stockholm).

Cautiousness around choosing one's health care also exists within county health care (Swedish Association of Local Authorities and Regions 2009(a)).

Availability of primary care

Mobile patients, e.g. those with access to transport of their own or who are not disabled, in many cases have an expanded frame of reference as regards availability linked to the distance between home and care-giver. These patients are thus able to choose between several care alternatives and still perceive these to be available from a transportation point of view (Ahgren 2010). Moreover, the number of care-givers in primary care has increased as a result of the choice of care systems gradually being implemented. This increase stems from private entrepreneurs who have been accredited for inclusion in the county councils' choice of care systems (Konkurrensverket, Swedish Competition Authority 2010). Through this increase, there is an improvement to mobile patients' possibilities of finding a care alternative that is available transport-wise. At the same time, county councils with a large proportion of sparsely populated areas have had a lower augmentation of new health care units (Vårdföretagarna, Association of Private Care Providers 2010).

Elderly patients, who are an important target group in primary care, are generally declining in terms of their mobility, on the other hand, in step with their increasing age. Thus, for these people, short distances are crucially important if primary care is to be perceived as geographically available. Accordingly, this reduces their real options (Ahgren 2010).

Furthermore, it seems as though the choice of care systems initially stimulate care-givers into shortening waiting times for clinic visits (Lövtrup 2009) and making primary care more available (Sveriges Kommuner och Landsting, Swedish Association of Local Authorities and Regions 2009(b)), which is appreciated by primary care patients (Hjelmgren, Anell 2007). When mobile patients choose primary care units that they perceive to have reasonable waiting times, they are actively realising the goal of making primary care available as regards time. Elderly and disabled patients of limited mobility do not have the corresponding possibility of minimising their waiting times, which can entail a non-equivalent range of primary care services in relation to the needs of the population (Nordgren 2009). Similar consequences can arise when patients are temporarily "unfaithful" to the health centre they have chosen if waiting times temporarily rise, which is possible for patients in most county councils (Anell 2008).

Continuity

Patients with a regular need to meet care-givers in primary care, e.g. elderly people with multiple illnesses and chronic invalids, prefer interpersonal continuity in order to make these visits easier and are thus unwilling to meet unfamiliar district medical officers at each new visit (Hjelmgren, Anell 2007; Rosén et al. 2001). This means that this group of patients will probably not change their choice of care-giver often, as that would hamper their ambition to maintain, for instance, a high level of patient-doctor continuity (Ahgren 2010).

Certain patients, however, see the advantage of frequently being able to reconsider their choice or to look for another care-giver than the one they are listed with. Incentives for some of these can include finding a doctor who is willing to prescribe a specific medicine or put them on sick leave. Choice of care systems that allow frequent re-selection, and the possibility of visiting other care-givers than the first one chosen, facilitate this type of discontinuity (Ahgren 2010).

Need for the coordination of health care

As some individuals find it difficult to make their own choices, different types of support functions are discussed in situations of choice, including information (which is often inadequate), as ways of supporting the end-user. Informal networks and contacts with relatives and friends also play an important supportive role. According to Glenngård, Anell (2010), the competence to coordinate the patient's care requirements is of significance in connection with choosing a care-giver (see also Nordgren 2010 c). The same applies to care of the elderly (Svensson, Edebalk 2010).

The concept of the customer

A prerequisite for customer choice is the existence of at least two producers to choose between, and making a choice. If no choices are made by the customer, no competitive situation will be created, and nor will any possibilities for new producers to establish themselves. The actions of the customer and the concept of the customer are thus key concepts in the realization of customer choice (Kastberg 2010; Nordgren 2003).

The concept of the customer turns one's thoughts to someone who actively chooses. There are expectations that more and more people will function as customers in society. There is, however, a tendency in the customer choice discourse to simplify the line of reasoning and emphasize the positive aspects of a customer role, while the problematic aspects are toned down (Nordgren, 2010a, Kastberg 2010). Suffering, dependency, and vulnerability are not linked to the concept of the customer; on the contrary, with patients needing welfare services.

Theory

Research into choice of health care has been dominated by a positivistic view of science, with an influence on economics, management, social policy, and anthropology. In the foreground, there has been a view of the human being as willing to calculate alternatives.

The human being as influenced by the affective, symbolic and by language, a view that is more occurrent in psychoanalytic theory and linguistic theory, has been unable to

play a major role in this research (Fotaki 2006). People in general, according to psychoanalytic theory, find it difficult, under their own steam, to make the choices and assume the responsibility (Rose 1999) that choice of care models presuppose. The ability to behave like an informed customer, participating and choosing, also varies from person to person (ibid.). On the other hand, people can be swayed by various discourses into making such choices.

A diversified use of theory, which is based on how people both influence and are influenced, should be able to contribute towards understanding the grounds on which people choose or refrain from choosing. Fotaki (2006), with the support of psychoanalytic theory, has shown that people's vulnerability and sense of unease and fear, in connection with being ill, affects their relationship with health care; for instance, what it means to make a choice or not. This primarily applies to more complicated choices, but maybe not to choosing hospitals or clinics. Fotaki (ibid.) argues that the relationships which people have with health care are complex and ambiguous and not as straightforward as a customer discourse makes out.

Methodologically this article draws on the concept of discursive formation (Foucault 1972). If a certain linguistic usage is legitimised by language users in certain societal positions and situations it will influence people's everyday spoken and written language as well as their way of acting as subjects (Foucault 1972). The discursive formation of such linguistic usage, including specific concepts, emanates from discourses that determine the meaning of the concept (Foucault 1972). Discourse signifies all statements within a certain discursive formation denotes the same concept and thus constitutes the concept as an object. The discourse has formative effects on the way in which new institutions develop within organisations, thus resulting in a more or less permanent transformation of the organisation (ibid.). It encompasses those who have the right to speak within that particular discourse and excludes those who do not (Foucault 1981). Some issues and statements may be raised within the discourse while others are excluded (ibid.). A discursive formation can be defined as the rules, which decide how statements are described to be dispersed to form a discourse (Foucault 1972, p. 41):

Whenever one can describe, between a number of statements, such a system of dispersion, whenever, between objects, types of statement, concepts, or thematic choices, one can define a regularity, we will say, for the sake of convenience, that we are dealing with a *discursive formation* (ibid.)

The conditions to which objects, mode of statement, concepts and thematic choices are subjected are called the *rules of formation* (ibid. p. 42). The fundamental element is the statement, which forms an authorized account of formulation and narration (ibid.). The statement is not the same kind of unit as the sentence, the proposition, or the speech acts (ibid., p. 97). Instead a statement "is a function of existence that properly belongs to signs and on the basis of which one may then decide, through analysis or intuition, whether or not they 'make sense', according to what rule they follow one another or are juxtaposed, of what they are the sign, and what sort of act is carried out by their formulation (oral or written) (ibid.).

Discourse analysis is about systematically analysing a selection of texts, characterized by a high grade of validity in relation to the purpose (Grant & Hardy 2004:6). In order to make the research transparent an accurate description is required of the selection

criteria for texts, their contextualization, the use of lengthy quotes, and the separation of voices that speak. A framework of analysis for analysing discursive formations on the basis of Foucault (1972) consists of:

1. Identifying statements. Do they contain stories? Are there any contradictions or associations in them which indicate that several discourses are active?
2. Which statements and concepts are circulating and being repeated?
3. Which themes can be identified among the statements?

Method

A group interview was administered in one location in southern Sweden. According to the framework based on knowledge, the group was designed to on the whole include individuals with following characteristics: age between 20-45 years, and 65 year or older, and also living in a small community. 6 individuals participated in the group interview, and, moreover, they were randomly selected with the assistance of local contact persons, and they also secured the interview fulfilled the selection criteria.

Guided by the described knowledge about choice of health care, the following question topics were drawn up. The experienced or perceived importance of:

- continuance of interpersonal contacts,
- care service convenience,
- patient empowerment,
- manners of practice,
- quality of care, and
- care provider image

The interviews reflected and commented on these topics. The interview was thus semi-structured, without any predetermined codes (Bowling 2009). The interview took about 1 hour to complete. The conversation was recorded digitally, and transcribed as verbatim reports. The analysis was based on discourse analysis following a certain analytical framework(see above).

Results

Discourse analysis studies which statements appear in the panel. In doing so, it is shown how the end-users themselves think and reason when it comes to choice of care. As the material from Kronoberg is suitable for making a discourse analysis, in respect of primary material, context, rich in statements, and with a reasonable selection of people, it is accounted for in detail. It is divided up into “Inhabitants with children” and “Old-age pensioners”. In the summary, there are dominating themes in the panel that are illustrated using example statements.

Inhabitants with children

Dominating themes were:

being able to make an active choice

“I went and made an active choice and moved, ‘cause when he moved from Markaryd to Knäred, I went with him kind of thing, but then when the accessibility and it got too bad, then I had to have a rethink and choose again. So.., absolutely come along if it...,” (Man)

“I won’t say too much, it was the case that, in the job I was doing, I’ve had that as my occupational health care and, as they know most of what there is to know about me, it’ll be just as well to continue. So it’s probably also been an active choice from the point of view that my children have wanted to come here” (Woman)

doctors and other staff must have clear professional knowledge, like listening carefully and making referrals to other specialists when necessary

“It’s like really important. Cause, in spite of everything, I’m the one who’s ill. And it’s my body, and I’d like to think that I know it better than anyone else, that’s kind of a little bit of that they ..., if we’re going to talk the other health centre down a bit, the fact that a load of times I went there and said I had a urinary tract infection. “Noooo, how do you know that?” “Well, I’ve had it 11 times before, so I know I have”. “Noooo, you haven’t got that, we’ll have to check that out first”. But here it feels as if they listen, “it’s great that you know the symptoms and what it is and ...”, they follow it up. So I think it’s..., they listen to my minor ailments too. And I don’t need to be mortally ill, I can have something else to offer them. (Woman)

it is very important to have service that is quick and available

“But there I can agree with [name], kind of that I don’t come here just for the doctor’s sake, I come here for quick service and then whoever it is that sees me, but now I’m going to tell you that I belong to the lucky crowd that the few things I’ve had to visit this place with, it hasn’t mattered. If I’d chosen some other health centre, I wouldn’t have been able to ask for that doctor to remain here, ‘cause I’m there maybe every 4 years or so. So I think it’s kind of the ... the availability.” (Woman)

the personal touch is valued highly

“No, but the positive stuff, it’s important to be received that way sort of, that you’re not any bother. You’re already at a disadvantage when you come in here, ‘cause there’s something wrong with you, if we put it like that. And if you’re received in a positive way, you feel more satisfied..., yeah, I’ll get help here. Instead of feeling that you’re a bother to them and feeling: ok, what are you doing here again, kind of thing.” (Man)

rumours about a health centre spread quickly in a small locality, strongly affecting the choices made

“It has the effect, of course, that when you lose patients, you have to change in some way and rumours say that things have got considerably better, at the other health centre as well. Those who use that one say that things are different. And that’s positive, of course. So if you keep on losing, then something must be wrong. So things are never wrong if you have a choice. It’ll probably be better for everyone in the end, I think.” (Man)

“That was what made me choose to come here. It was so incredibly good. But...And who said that it was so incredibly good? My mum and dad. Both of them come here and have really received the help they need. And then I felt that it was really good. That’s the way it should be, you go to a place and really get that kind of help. But..., no. ” (Woman)

it must be possible to show one’s dissatisfaction by actively rejecting a health centre

“I could probably think that the positive thing in all this is that now I can actively show that I’m dissatisfied, by leaving this place. Before, you could just..., there was nothing to choose between. If I got sick again, there was only one health centre to go to, and things would just turn out the way they did. But now I can show my dissatisfaction, if I feel that way, it doesn’t feel like much, that this..., no, now I’m going to choose a new one. That’s what I think is the positive side of choosing your care.” (Women)

you appreciate and take for granted that it is possible to make free choices across county boundaries

“But then I have to ask, don’t we have that possibility to choose today if we want specialist care somewhere? Or we don’t have that...?” (Woman)

“But then I’ve succeeded. So that’s why I kind of thought..., as I have .., we belong to Kronoberg County but I had to go to Lund ‘cause that’s where the care that I needed was.... And it was so easy that I was almost 100 percent sure that it was nothing..., you were able to do it without any misgivings.” (Woman)

Old-age pensioners

Dominating themes were;

all say that they have made an active choice

“Yes, we really have made, an active choice ourselves, my wife and me at another health centre where we were very dissatisfied with them for various reasons. There was no doctor even though an appointment had been made. So we came here directly and I toddled in here and asked if we could become patients here. And they said yes, so we did that and we really enjoy being here.” (Man)

choice of care is something positive in itself

“I was able to make a choice due to attending Halland, but I think that this..., I can tell you that I’ve been waiting to choose my care here. So you had the possibility of choosing the very one I wanted, right? Otherwise, I only had the possibility of choosing in Halland. I’d been waiting for that, I think it’s really good.” (Man)

it has to be possible to keep the same doctor that you trust

“Yes, totally agree with you. I’ll also say that, if you attend a small health centre, like this one, the same doctor will always be here, when we come. And that is very valuable. And above all, a doctor who I really trust and rely on to a 100 %. That for me is the law on freedom of choice, there are, of course, health centres that I might not want to visit and then I have the possibility of rejecting them.” (Man)

“Yes, the most important thing perhaps is probably which doctor it was. And then trying to keep him.” (Man)

it is important to be received well and with the personal touch

“Something that’s also very positive, we come here, both my wife and myself and I’m one of those association nerds who lives to attend meetings. And sometimes she’s been in before me and come out and been given an appointment, but when I come out and they want to give me the same time, I look in my diary and that particular day I really just don’t want to discuss, so there are never any problems. It

can be changed immediately so we both get an appointment on another day, when we are free, and I think that's brilliant." (Man)

"Yes, I agree. And I also think that all of the staff are agreeable and cheerful, and committed. I really appreciate that." (Man)

doctors and other staff have clear professional knowledge, such as listening carefully and making referrals to other specialists when necessary

"Yes, I can tell you that if you're able to choose, if you feel that you've got a sore back, I've had lumbago for 2 years, or a slipped disc in reality, I was supposed to have an MRI scan, but I didn't get one. I had a normal x-ray and they couldn't see anything in that. They saw that my back was worn out. With the result that I then sat for 3 weeks unable to do either one thing or another. So in the end, I had to ring and beg for an MRI scan. And it turned out that I had a slipped disc. And after that, I was able to visit the physio to get help. Well..., that's really what I wanted to do right from the start, go and have an MRI scan." (Woman)

rumours about a health centre spread quickly in a small locality, affecting the choices made

"Yes, I'd like to say that, as I've just moved into Markaryd, from Helsingborg, the first things is..., I'm nor going to put it like that, but ..., when I arrived here I was given some good advice, for instance to attend this health centre specifically. Because they had positive, very positive opinions about it and then I wanted to try it out, too. And I've done that, and I'm very satisfied." (Man)

"I might also say that I've heard loads and loads of good things, but of course not everything has been good." (Man)

it is possible to show your dissatisfaction by rejecting a health centre

"It can't get too big 'cause then maybe more doctors will work there and then you might not get the doctor you want. But when I made my choice, I was attending the other health centre and I'd made an appointment and when I got there, I didn't get to meet that doctor. Then it was those, what's it called, temps who just perhaps...relay race doctors? Yes, and that's something I wasn't satisfied with. No, so that's why I chose..." (Woman)

reasonable waiting times are important

"I say that it depends on what ailment you have, what you..., why you're visiting the doctor. If it's insignificant, or if you feel yourself that it's significant. But if it is kind of insignificant from the doctor's point of view, then you can wait. There don't need to be any knee-jerk reactions there. But if, on the other hand, it is something that's serious, then that's another matter." (Man)

"Yes, you can of course wait for a few days if it's not serious..." (Man)

Discussion

Discussion of method The selection of group members did not aim at forming interview groups which were representative for neither a local nor a national level. This is more or less impossible to do when forming this kind of group interviews. The results are thus not a mirror of views covering a whole population. The group interviews should instead be regarded as a contribution for increased understanding of, and knowledge about, factors and driving forces influencing citizens' choice of primary care. With a

qualitative method of this kind it is accordingly impossible to generalise the results, though, if these are unanimous with results of other studies their general importance increase (Kvale 1996). Furthermore, the results of this study could hopefully guide other studies in focusing relevant questions and also inspire the use of different methods, which in practice means establishing a so-called sequential method triangulation (Creswell 2009).

The interviewees answered semi structured questions, derived from relevant knowledge. Unstructured interviews with citizens would have had provided the study with more in depth information about the phenomenon studied (Bowling 2009), that is, choice of care.

Discussion regarding the discourse analysis

Choosing primary care entails being able to choose a care-giver. It also entails being able to reject the provider of the service. Most of the interviewees see freedom of choice as something positive, e.g. being able to follow the same doctor or having good accessibility to one's health centre. For some, the increased freedom of choice is linked to a change in attitude among staff, leading to patients being better received and to increased availability. Some are of the opinion that they feel they have been given increased responsibility for their own health through choosing their own care, responsibility that they wish to assume provided that there is someone (preferably a doctor) who can support them as patients. In order for choosing a doctor to be of value, this person should also assume a holistic responsibility in return, some of the interviewees say. In summary, it can be said that what choice of care claims to be is not always the equivalent of how the end-users see it.

Choice of care is perceived as a positive value per se since it is deemed to increase the flexibility of health care when faced with wishes and demands on the part of the patients. Even if this freedom of choice is not utilized by all, and the proportion choosing actively is sometimes low, freedom of choice is something that is perceived positively. Kastberg (2010) reaches the conclusion that freedom of choice is seen as something positive independently of the sector of society, or if freedom of choice is utilized or not, in education, the home help service, and in personal assistance. It is often about the belief that things could be "better than before", which chimes with the generally desirable trend of empowering patients and giving them a voice with which to choose, as well as terminate, a care relationship (Nordgren 2009, 2010a). Customer choice models are often introduced with the motivation that customer influence has to increase. The models per se do not necessarily mean, however, that the customer will be able to exert any real influence on the content. That will instead depend on how the shaping of the model occurs. Freedom of choice can be restricted to choosing a producer and the possibility of choosing and rejecting the provider of the service (Kastberg 2010). It can also, as the discourse analysis shows, be perceived as something broader, i.e. as a feeling of influence and confidence. Due to restrictions in the legislation and insufficient information concerning choice of care, however, choice of care has hardly entailed an empowering of the patient (Nordgren 2010a). Choice of care can thus give the illusion of exerting a greater influence than actually chimes with the real content.

Saying that one has actively chosen one's health centre or doctor is a discourse that stands out clearly in the end-user panel in Kronoberg. They say that they have waited for the choice of care reform and perceive it to be valuable.

Another discourse that stands out in the panel is that it has to be possible and straightforward to show one's dissatisfaction by rejecting a health centre: that is, to be able to re-select. Reasons for rejection can include insufficient continuity regarding which doctor you see or getting a poor reception. According to Ankarloo (2008), it is difficult to re-select in social services when the end-user is dissatisfied with the level of service, e.g. in the case of a bypass operation, when changing from one old people's home to another. The selection situation is characterised by great freedom to choose, but fewer possibilities of choosing again. End-users are, for practical and logical reasons, more or less tied ("the lock-up effect") to their first choice (ibid. p. 178). Ankarloo's line of reasoning seems logical. However, changing health centre would seem to be, according to the end-users on the panel, relatively simple to do, even though the lock-in effect is also represented in the link to a specific health centre and to a specific doctor, primarily for old-age pensioners and families.

Regularly recurring statements mention that "proximity to the health centre is important when choosing a health centre" and that, when changing health centre, "friends' and acquaintances' experiences" affect the choice of a new health centre (Gummesson 2004, 2007). When marketing the health centre, patients' and relatives' experiences of reception and communication can thus play an important role. This marketing can be done in direct contact with the end-user, on the recommendation of other end-users, within networks, and via websites and mail shots (Gummesson 2004, 2007).

Another regularly recurring statement mentions the importance of "a good and personal reception", perhaps even being known at the health centre. If there is no warm reception, it is not much of a leap to want to change health centre.

A consistent theme is that the interviewees' departure point is that "doctors and other staff should have clear, professional expertise, e.g. being good listeners and making referrals to other specialists when necessary". The latter can be interpreted in such a way that there is a need for a function that coordinates the efforts, patient information, and contacts of health care (Nordgren et al. 2010). This means that end-users see primary care as part of a larger undertaking of health care efforts and that it is desirable for primary care to assume a coordinating responsibility as regards referrals, responses etc. (ibid.). It can also be matter of giving advice about which health centre should be chosen.

The interviewees say that they normally feel confidence in and trust for the professional expertise of the staff, something which is characteristic of the discourse on professional service provision (Howden, Pressey 2008). This is natural as the professionals have a competence advantage (information asymmetry) in relation to their customers (ibid. p. 789). Some of the interviewees, however, express dissatisfaction with some of the expertise, which is said to be missing, and that referrals to a higher specialist level are not quick enough.

Old-age pensioners stress that it is important to be able to keep the same doctor at smaller units, which can also entail following a doctor if he/she moves to another health

centre. This is also stressed by parents of small children. This can be understood in terms of these groups preferring a “GP variant”. Professionals, on the other hand, say that they place a greater emphasis on quick and available service that is provided by competent staff, a variant that is reminiscent of a well-developed health centre.

Continuity and communication in the care process are generally seen as important. It is about the patient being able to obtain an initial contact and then an ongoing dialog enabling follow-up with the care-giver. It is also about the care-giver checking the patient’s state of health and ensuring contact with health care specialists.

Concluding remarks

According to the discursive analysis the following dominating themes concerning grounds for making choices emerged among *Inhabitants with children*: being able to make active choices; doctors and other staff have clear professional knowledge, such as listening carefully and making referrals to other specialists when necessary; it is very important to have service that is quick and available; the personal touch is valued highly; rumours about a health centre spread quickly in a small locality, strongly affecting the choices made; it must be possible to show one’s dissatisfaction by actively rejecting a health centre; you appreciate and take for granted that it is possible to make free choices across county boundaries.

The following dominating themes emerged among *Old-age pensioners*: all say that they have made an active choice; choice of care is something positive by itself; it has to be possible to keep the same doctor that you trust; it is important to be received well and with the personal touch; doctors and other staff have clear professional knowledge, such as listening carefully and making referrals to other specialists when necessary; rumours about a health centre spread quickly in a small locality, affecting the choices made; it is possible to show your dissatisfaction by rejecting a health centre; reasonable waiting times are important.

In summary it seems like choice of care has improved the possibilities of the citizens to choose preferred care provider, or drop one due to dissatisfaction. The study indicates an increased level of influence for the end-users. This may be connected with the choice of interviewees and that the panel situation per se may have influenced the participants in a positive way.

Comparing with some other public services, beginning with care of the elderly too, the preconditions for an increased level of influence on the selection and reselection of providers would seem to have been strengthened (Svensson and Edebalk 2010, p. 29). In the home help service, customer choice has created opportunities for end-users to change their provider and for assistance caseworkers to be able to offer several alternatives (Winblad et al. 2009). In education, freedom of choice is being utilized more actively than in health care, care of the elderly, and the home help service (Kastberg 2010).

The discourse analysis shows, furthermore, that there is a certain amount of confusion between how the phrases “choice of care in primary care” and “free choice of care” are used. The fundamental principle of the free choice of care was launched at the end of the 1980s and introduced by the county councils in 1991. The choice of care models are

based on the free choice of care, entailing that citizens have the right to freely choose their care-giver within their own county council, e.g. between different health centres in primary care. The term free choice of care in specialised healthcare means the right to choose a hospital within one's own county council or within another. This choice of care is conditional, i.e. it applies to certain diagnoses, there must be a referral, and, if the care guarantee is not honoured within the patient's own county council, then care must be offered within another.

According to the study, inhabitants also associate choice of care with values such as holistic responsibility and dialogue, professionalism and service, which are about more than choosing one's care-giver.

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Process Improvement: A TQM Approach

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Key words: TQM, BPR, Manufacturing

Today most organisations both in the private and public sector are facing immense challenges. These include the critical need to be more competitive by focusing on new organisational design, continuous measurement of performance, better management and co-ordination of intellectual capital, but most importantly, defining a strategic path for meeting and exceeding customer and market expectations.

Nevertheless, the underlying problem for organisations continues to be the failure of top management to find an all-encompassing strategy that would guarantee success. A number of process improvement strategies have been put forward over the last several years as the Holy Grail to all organisational problems. For example, Hammer & Champy (1993) advocated the adoption of BPR, which they suggested would enable corporations to fundamentally rethink and radically redesign their business processes to achieve dramatic improvements in critical, contemporary measures of performance such as cost, quality, service and speed.

The attainment of this lofty goal required that organisations eliminate old and archaic processes, policies, principles and structures that affect organisation performance; thus focusing on the removal of obstacles-systemic or human. Other authors, for example (Tinaiker et al, 1993) argues that process improvement through reengineering should encompass the restructuring of the entire organization to achieve dramatic improvements in its critical success factors of quality, productivity, customer satisfaction and time to market. However, an in-depth review of the literature by the author, found the absence of a systemic definition of process improvement that addresses the most important performance parameters used by the customer in evaluating the product or service provided by an organisation: quality, speed, reliability, cost, service, and flexibility. For Huff (1993) process improvement is the redesign and improvement of business processes both in-depth (roles and responsibilities, measurements and incentives, organisational structure, information technology, shared values and skills) and breadth (activities which lead to long term profits).The central message in the literature seems to suggest BPR as the main tool for process improvement, which is supported by the case.

In addition, there is an absence of a complete body of knowledge about the essential elements of any process improvement programme, particularly the need to change the underlying cultural problems of the organisation before embarking on process improvement (see table 1):

Table 1: Cultural problems in organisations

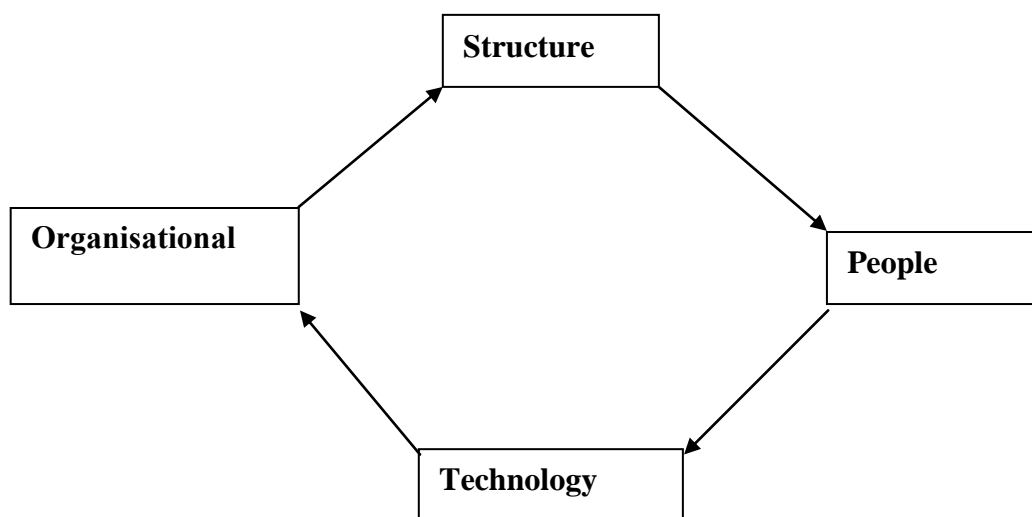
Management Systems and Processes	<i>Workforce</i>	Senior management	Management Practices and Work Methods
Too reactive	Low morale	Lacks process focus	Micro management

Too fragmented	Low emotional commitment	Speed and Agility not seen as a survival issue	Denounces critical or opposing views
Too short-term	Suspicious and sceptical of management	Create boundaries	Too little training
Product centric	Apathetic	Expert Mind	Conformity
Poor Process Visibility	Task oriented	Future Blind	Poor Communication

Requirements for Process Improvement

Leavitt (1964) suggested that improvement is attainable if an organization altered its structure, technology and people. Changing the organisations' structure involves rearranging internal systems- lines of communication, workflow, or managerial hierarchy. Changing the organisation's technology means leading-edge equipment, engineering processes, research techniques, or production methods and, changing the organisation's people would involve a focus on selection, training, building relationships, changing attitudes, and defining roles of organisation member. The central thesis of Leavitt's work is that organisations are made up of interacting, interdependent elements under the influence of common forces; that is, organisations are systems. The lesson for management is that operations improvement must focus on the interaction of all of all parts of the firm (see figure 1):

Figure 1: Key Organisational elements



From Figure 1 it can be delineated that structure, technology, and people are highly interdependent; a change in one is likely to affect the other elements as well. Thus, an effective improvement programme be it TQM, or BPR, is likely to be one that acknowledges the interaction of these three elements and attempts to change all three. Since the body literature on process improvement lacks a definitive approach for its implementation, the paper offers insight on how to effectively implement a process improvement reengineering program using MRP2.

The Case Study

There are only a few manufacturing companies that have achieved dramatic improvements in inventory levels, lead times, improved customer service, productivity and costs by adopting BPR. In places where this has occurred, it was always down to the implementation of Kaizen rather than BPR.

The attraction of this case is that it provides first hand knowledge of what is required to succeed with BPR. It demonstrates that the effective and cooperative management of people is critical to the success of any change programme. The company, due to a confidential agreement, would be referred to as Bournemouth Works.

Background

Bournemouth Works is an ethical pharmaceutical company employing over 450 people (of whom 120 are temporary staff). Its goal is to be at the leading edge of drug manufacturing, supplying 101 countries across the globe. It is one of the top 50 UK companies from an export perspective. Its manufacturing facilities are based both in the USA and Europe. For this company, its competitive advantage is neither price nor cost, but a fanatical dedication to meeting and exceeding its customers' needs by providing a first class responsive service. Prior to reengineering in 1993, the company had 8 layers of management, which impaired co-operation between management and the workforce.

The Journey

Bournemouth Works' motivation for adopting BPR was to become a world class manufacturing facility, unlike most companies, which only embark on BPR when faced with the risk of closure. The company began the BPR programme in 1993 by first undertaking an extensive self-analysis (internal audit) to determine how competitive it was in meeting the requirements of its customers. The importance of this analysis enabled it to avoid the common disease suffered by other companies implementing BPR; amputation before diagnosis, resulting in a crippled organisation. This exercise was highly rewarding because Bournemouth Works found its operating system not to be as efficient as many managers thought. The problems were:

- Late vendor deliveries that resulted in longer lead times, inaccurate inventory records, poor planning and scheduling of materials.
- Poor productivity due to incorrect machine layout, worker movement, transport and movement of materials. The use of specialised rather than multi-purpose machines.
- Low morale among the workforce. The management layers prevented interaction with employees. In addition, employees complained about lack of training and education and uncompetitive wages.
- The production processes were not built for speed. For example, changeover times were too long.
- Low service levels; continuously failed to meet customer due dates.

Without this diagnosis, Bournemouth Works' management would have felt everything was running smoothly. In fact, it had a mini crisis at hand: The factory had become a

headless chicken with highly de-motivated employees running around doing their best without any set direction or purpose.

Implementation of BRP at Bournemouth Works

In December 1993, a new manufacturing manager was hired to lead the reengineering programme. What he found was a team of employees willing to do a good job, but the policies, procedures, systems and processes within the company prevented them from doing so. He realised that the way forward was to refocus the plant as a low cost producer, not by cost cutting, but by reducing the length of time on all their processes, and getting production right first time. This required putting employees into product teams. People involved in making a product constituted a team; thereby ensuring ownership of product processes.

In an effort to improve morale, he set about redesigning the appraisal system. Each employee was to be evaluated by team members based on their overall contribution to the operating performance of the team. A share option scheme was introduced in which individual employees were entitled to 100 shares, which they could exercise whenever they chose.

What Bournemouth Works achieved is not rocket science but managerial commonsense; which incidentally, is not common practice in manufacturing.

A vision statement was drawn up:

'To become the most customer focused factory with the shortest lead times'

What is impressive about this vision statement is that it makes no mention of cost. The manufacturing manager believes that the reduction of operating costs as the key to competitive advantage is over-rated. What really provides competitive advantage in manufacturing is process efficiency – reducing the length of time in every process related activity.

Once the vision statement was determined, a strategy was put in place (figure 4) to achieve the vision. To gain employee buy in, the manufacturing manager made it known that no employee would lose his or her job unless an individual decided to take the option of early retirement. This unusual move assured employee co-operation. Furthermore, he communicated clearly to employees that the main goal of the project was to make Bournemouth Works a world-class manufacturer by the year 2000. This was to be achieved by an incremental rather than a dramatic approach to BPR (figure2).

Figure 2: BPR Strategy



One of the most important lessons in the implementation of BPR according to the manufacturing manager is, “do not reengineer in an unstable environment”. It is pointless to streamline or reengineer when operating activities are out of control. Therefore, it is a must to first standardize practices across the operating environment by getting work related issues under control, thus providing process visibility. However, most companies do not do this. They try to impose BPR on hostile processes and inevitably end in failure. Bournemouth Works first standardized its operating processes by implementing the principles of total quality management. One of the problems that underlined the chaotic nature of the operating process at Bournemouth Works was the fact that management wanted more output than the plant was capable. In addition, production planning was dictated by what management wanted and not what was demonstrably possible as determined by the Master Production Schedule (MPS). The introduction of TQM stabilised things by allowing all departments to work from a single, visible set of numbers. Equally important, was the fact that TQM enabled the company to integrate financial planning, marketing and purchasing with manufacturing. It enabled the company to better plan, load, schedule production and sequence customer orders (confirmed and expected) according to due dates. The implementation of TQM also brought about a 98% improvement in meeting due dates. Prior to the use of TQM as a coordinating manufacturing mechanism, Bournemouth Works met its delivery commitments only 40% of the time.

The second component of the strategy involved the streamlining of processes. The emphasis was placed on producing better quality products for the customer. A transformation map was developed encompassing critical operating elements, which had an immediate impact on the bottom line (figure 3)

Figure 3: Critical Processes

Quality	Customer	People Skill & Motivation	Cost & Efficiency	Environmental Health & Safety
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At a strategic level, a value proposition was determined – to focus on quality of product and delivery reliability. Therefore, operational emphasis was placed on streamlining processes to improve production methods, work design, work processes and shop floor performance. The order delivery process was streamlined to ensure the company was more responsive to its market. Managing plant capacity management focused on managing product throughput rather than 100% plant utilization. Shop floor performance standards were enhanced by elimination of bottlenecks. Suppliers were asked to deliver materials on a direct response basis. In addition, a cultural step change programme was introduced which led to a reduction of lead times from 12 to 2 weeks, and a drop in inventory levels by 70%. Management layers were reduced from 8 to 4 to improve vertical, lateral and cross-functional communication and co-operation between management and the workforce.

At the operational level - to achieve production efficiency, a 24-hour shift operation was instituted. This represented a move back to a functional structure rather than being process-led. The manufacturing manager found to his amazement that shift-based

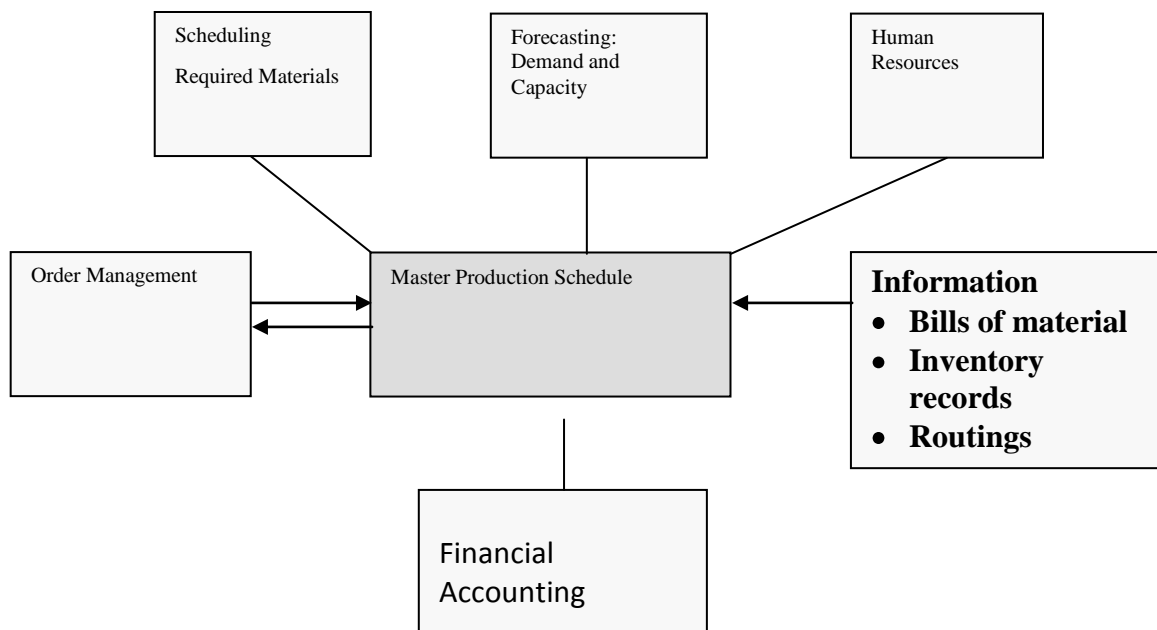
teams-that is product teams, were more productive than process teams. Employees were not happy working in process teams. They argued that people who work together during shifts should form the basis of a team. As a result of employee feedback, 4 teams were set up around four manufacturing shifts. This improved worker productivity by 46%.

At the organizational/process level a reengineering program was instituted, referred to as Project 2000 and started in June 1996. The focus was to redesign the work organisation. This would ensure operational transparency - allowing process standardization and work flow redesign in order to reduce inventory, shorten cycle times and lower operating costs. In addition, planning and budgeting, measurement, performance and reward systems were aligned to reinforce a process environment refocused to run on breakneck speed and agility. The overall objective for reengineering the work organisation was to ensure that Bournemouth Works through TQM:

- Eliminate errors in procurement and accounting
- Minimise delays in order fulfilment
- Maximise the use of assets
- Promote understanding and communication
- Improvement in plant management
- Focus on value added activities

The reengineering of the work organisation ensured that employees challenged the status quo; in particular the approach to customer service, speed and cost reduction: (figure 4).

Figure 4: The TQM – BPR Process



The reengineering of the work organisation ensured that the master scheduler assembled the resources for employees to meet production schedules. The company used shift teams to bring about improvements in the production process. Extensive training was used as a catalyst for change. This created employee ownership of the programme.

Structural changes as a result of re-engineering enabled the company to reduce headcount by 14%, increase output by 40%, and service levels from 76-99%. Cycle time dropped by 50%, customer lead times by 50%, purchasing costs by 30% and reduced inventory loss by 50%.

Conclusion

This case provides important lessons for organisations embarking on BPR:

To ensure success, re-engineering requires a strategy that addresses where we are?, Where we are going?, Why we need to change?, What's in it for employees?, How to do it?, How to get there? And where we go from there? BPR is a continuous journey, never a completed process. However, the key is that organisations must keep, keeping on. In addition, BPR requires that managers achieve operation and business stability before streamlining processes. The advice is, do not proceed if structures, processes and systems are out of control.

Finally, it should be noted that, Bournemouth Works did not employ technology. Employees were not re-engineered out of their jobs. What the company did was to use what it had available in terms of its intellectual property to bring about change. Another essential advice is never to use technology to drive improvement because employees will see themselves as redundant and they would resist change.

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Environmental management model and definition of the different maturity states.

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Introduction

Environmental Management is one of the aspects that a company needs to improve to be sustainable (Ludevid, 2004). In recent years, environmental issues are becoming very important in enterprises. Society is demanding to demand more environmental measures to companies due to the amount of waste they produce. For this reason, there is an increase in market demand for products and services that minimise environmental impact (Abarca, Sepúlveda, 2001). As a result, companies have decided to improve environmental management (Ludevid, 2004).

Currently, each company is using different tools to improve its environmental impacts. Nevertheless, companies should know what the factors that affect the environmental management are, so they can go a step further. Companies hold very different attitudes towards environmental management, ranging from seeing environmental improvements as a cost, to observing environmental aspects as a profitable and innovative opportunity. Nonetheless, the results of this study have shown that the evolution of environmental management within companies has gone through similar patterns of behaviour.

Purpose

Nowadays, there are different tools and models to improve environmental aspects. The main objective of this research is to detect how the environmental management of a company evolves over time. To achieve this goal, the first aspect that needs to be studied is the identification of the factors that affect the environmental management. The behaviour of a system arises from its structure (Forrester, 1961, Sterman, 2000). It is necessary to define the structure of the system to deeply understand its behaviour. Accordingly, the first thing that should be done is to identify the different factors that are involved in the structure.

All these factors determine the evolution of an environmental system. It is shown that this evolution is quite similar in every company as every enterprise goes through similar maturity states. In some enterprises it took longer to get some of the states as the factors affect differently to each company. So the evolution may vary in this aspect. Moreover, it is very important to define the different milestones or maturity states of environmental management so it could help companies to identify their state and know the steps that they have to follow to reach environmental excellence.

Methodology

The study has been carried out mainly through interviews to environmental managers from nineteen enterprises among different sectors in the Basque Country. The study includes firms from different sectors such as chemical, automotive, railway, turnover, and energetic devices, which differ in terms of environmental management. The interviews with environmental responsible have been face to face. Each interview has had as its main objective to understand how environmental management has been deployed in each enterprise.

In addition, there has been access to external sources such as press and web pages to compare and complete the information given by the environmental managers. Collecting information from multiple sources supports the events or facts by more than a single source of evidence (Yin, 2009). All the collected information has been gathered together and analysed.

Not only had the factors that affect an environmental management system been identified but also the interrelation among these factors has been defined. This interrelation is represented by causal loop diagrams (CLD), which is a tool used in System Dynamics (SD). SD is used to model all kinds of complex systems (Forrester, 1961, Sterman, 2000). CLD consists of variables connected by arrows denoting the causal influences among the variables. These arrows are called causal links. Each causal link is assigned a polarity, either positive (+) or negative (-) to indicate how the dependent variable changes when the independent variable changes. On the one hand, a positive link means that if the cause increases, the effect increases, and if the cause decreases, the effect decreases. On the other hand, a negative link means that if the cause increases, the effect decreases, and if the cause decreases, the effect increases. Regarding loops, the important ones are highlighted by a loop identifier that circulates in the same direction as the loop to which it corresponds. If the feedback effect reinforces the initial change, it is a reinforcing loop (+); if it opposes the original change, it is a balancing loop (-) (Sterman, 2000).

Not all these loops affect to all the different maturity states. Some of them appear in the first phase and others do not affect environmental management until the last stage. With the companies' information, the evolution of the environmental management has been analysed and classified according to the different maturity states that have also been identified. Maturity approaches have their roots in the field of quality management. One of the earliest approaches is Crosby's Quality Management Maturity Grid which describes five phases of quality management that companies were likely to evolve through (Crosby, 1979, Crosby, 1996). The maturity models are increasingly being applied to many different areas. The best known derivative of the quality management maturity concept is the Capability Maturity Model (CMM) for software which identified five levels that were labelled 'Initial', 'Repeatable', 'Defined', 'Managed' and 'Optimising' (Paulk et al., 1993, Hefley et al., 1995). The main purpose of defining maturity states for environmental management is to describe the typical behaviour exhibited by a firm at a number of levels of maturity (Fraser et al., 2002).

Results

All companies have agreed that each company is different from the rest. This is because they focus on particular aspects and not on general aspects. Through these results it is demonstrated that all companies have much in common. Consequently the structure of environmental management in every company is analysed.

Factors classification

There have been several and different reasons that have prompted companies to take into account environmental management in their daily activities. Moreover, there have been other factors that indirectly affect environmental management. The value of all these factors may change over time, since they gain importance while environmental management in the company improves (Fig. 1). Some of the main factors, which have been analysed among the companies, have been identified (Table XXVIII).

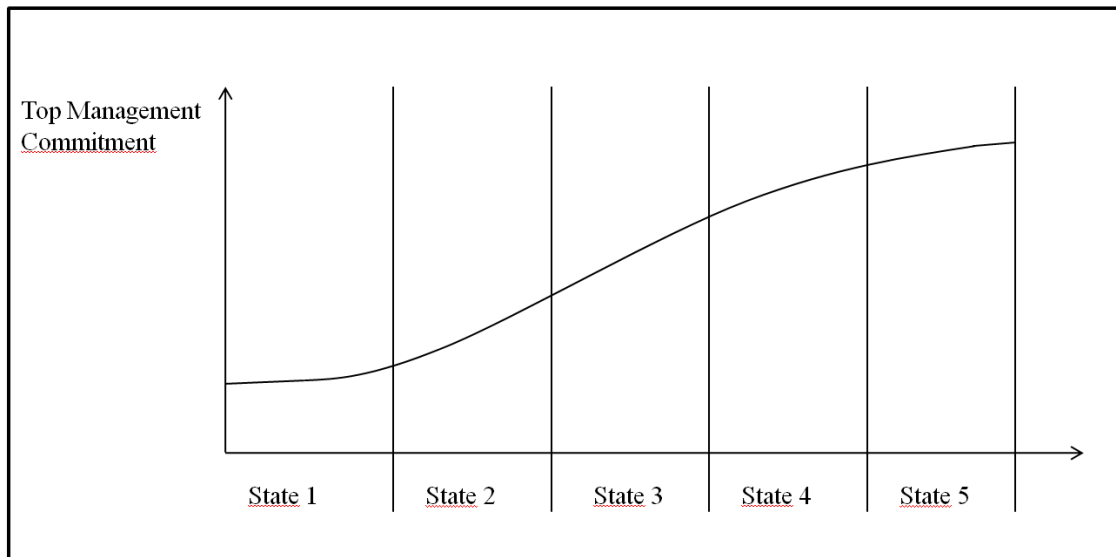


Fig. 1. Evolution of the Top Management Commitment

Table XXVIII. Factors that affect environmental management in a company

<i>FACTORS</i>	<i>DESCRIPTION</i>
<i>Environmental Legislation</i>	<p>It imposes certain norms that force companies to follow specific rules. All companies are trying to comply with current legislation and make great efforts to achieve the impacts that law considers acceptable. Otherwise companies would be penalised.</p> <p>This variable measures the evolution of law requirement in a company. Legislation is increasingly demanding. As Society is more aware of environmental legislation problems is demanding more environmental measures, so legislation may meet the desire of society.</p>
<i>Society Environmental Awareness</i>	<p>Nowadays customers and society are more conscious of environmental problems so they are requiring environmental practices. Moreover, there is a critical mass of people who is in favour of protecting the environment and tries to raise public awareness with its green activities.</p> <p>This variable measures people awareness regarding environmental issues. As society is more conscious, this variable is increasing.</p>
<i>Company Green image</i>	<p>Several enterprises have seen environmental management as an opportunity to surpass their competitors so they can increase their market share.</p> <p>This variable evaluates the green image of the company. Initially, companies do not have a green image. As their environmental management improves, they start to gain a green image.</p>
<i>Maturity Formalisation</i>	<p>This factor measures how the environmental management maturity changes over time. Companies start with a low environmental formalisation level and they go through different maturity states until they get to the environmental excellence.</p>
<i>Competitors Formalisation</i>	<p>This variable evaluates the competitors' environmental management maturity. In some enterprises, environmental management can be reinforced by competitors' pressure. In those market sectors where environmental practices are so widespread, it can not be considered as an opportunity but as a necessity.</p>
<i>Resources applied to Environmental Management</i>	<p>If a company wants to improve its environmental management, resources are needed. These resources could be different tools or certifications that may help the company to improve its environmental management.</p> <p>This variable measures the amount of resources that are applied to improve the environmental management of the company. At the beginning, companies do not apply many resources to environmental management. As their environmental management maturity grows they apply more resources as they consider that it is important to obtain better environmental results.</p>
<i>Used Natural/Energy</i>	<p>This variable measures the amount of natural or energy</p>

<i>Resources</i>	resources that are being used. Due to innovations that companies carry out, the use of natural or energy resources are gradually reduced, what will also mean costs savings.
<i>Top Management Commitment</i>	All enterprises agree on the importance of Top Management involvement. They consider that environmental improvements can only be carried out if the top management of the organization is committed to the environmental practices. This variable measures how the Top Management is committed to environmental issues. When a company starts to implement its environmental management, the Top Management is not usually committed. Nevertheless, once results are visible, they start to commit.
<i>Workers Commitment</i>	This factor assesses the extent to which workers are committed to the environmental management of the company. The environmental department cannot be the only responsible for environmental activities in the company. There has to be a commitment of all the different departments of the enterprise. For that reason there has to be communication between the top management and the rest of the workers, in such a way that everyone is conscious of the measures that are being taken so they may feel that it is part of their work.
<i>External Communication</i>	If environmental measures are being taken in the enterprise, it is very important to transmit them to suppliers and customers. This variable measures the evolution of external communication on environmental issues within the company.

All these factors are interrelated creating the structure of environmental management in a company. Consequently, from the structure of environmental management, it will be easier to understand the behaviour of the firms.

Maturity States

Nevertheless, not all these factors affect every maturity state that a company has to go through to reach the environmental excellence. For this reason, it is important to define the different maturity states and identify how the different factors may influence environmental management in the different maturity states. The interrelation among factors is represented by a causal loop diagram (CLD).

The structure of environmental management has been divided into two parts: inside the company and outside. The inside part is composed by internal factors of the company that affect the environmental management, whereas the outside part corresponds to external factors that may affect the environmental management of the company. The outside part is basically formed by the competitors, law and market.

State 1. Legislation fulfilment

The first step in a company's environmental management is to enforce the law. As the law imposes certain norms related to environmental impacts, companies try to meet the requirements. In this first phase what triggers the environmental management in a company is the Legislation (Fig. 2).

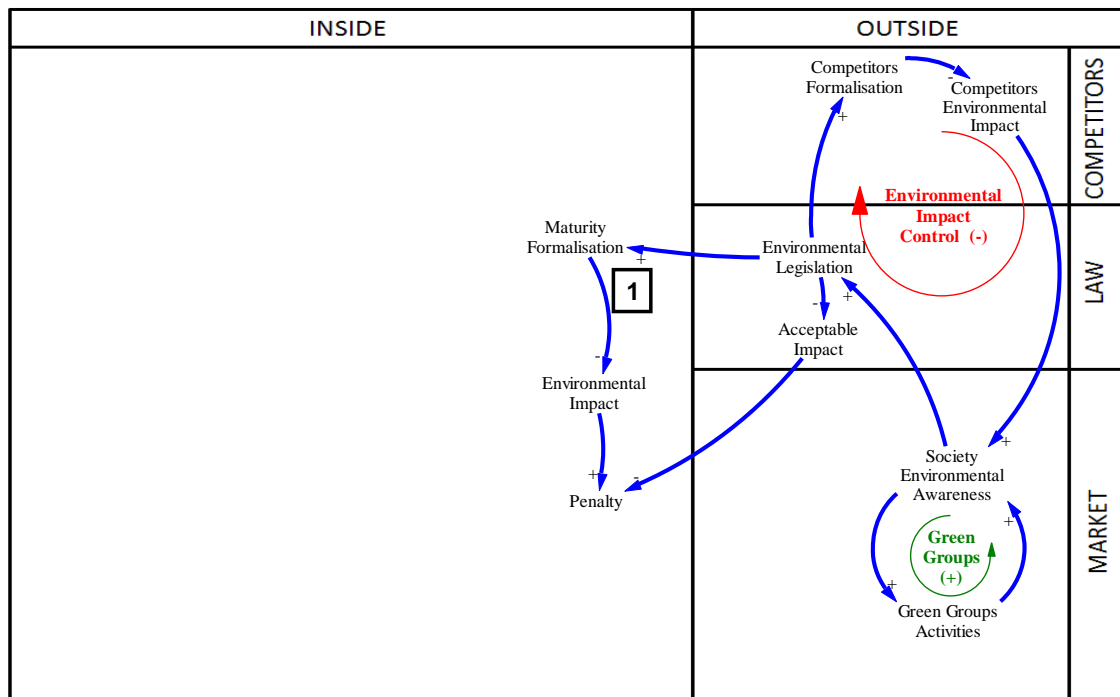


Fig. 2. Legislation state

This *Environmental Legislation* appears in response to *Society Environmental Awareness*. As *Society Environmental Awareness* increases, *Environmental Legislation* will be more demanding, so *Competitors Formalisation* will increase and this will lead to a decrease in the *Competitors Environmental Impact*. Consequently, *Society Environmental Awareness* will not grow due to this aspect. As a result, a balancing loop entitled *Environmental Impact Control* is created. At the same time, there are different groups that are aware of the importance of protecting the environment and try to raise public awareness. This could be seen in the reinforcing loop labelled *Green Groups*. If the *Green Groups Activities* increase, *Society Environmental Awareness* will increase, so more people will participate in these groups and *Green Groups Activities* will increase again.

When *Environmental Legislation* is more demanding, the *Acceptable Impact* will be lower, so if the environmental impact of the company does not change, the *Penalty* will increase. As *Environmental Legislation* imposes certain norms, companies start to improve their environmental management, so the *Maturity Formalisation* begins to improve. As a result, the *Environmental Impact* decreases, so the *Penalty* will also decrease.

State 2. Looking at the Savings

In the second maturity level, companies start to improve their environmental management from the economic point of view. They begin to motivate as they reduce consumption and this requires a reasonable investment (Fig. 3).

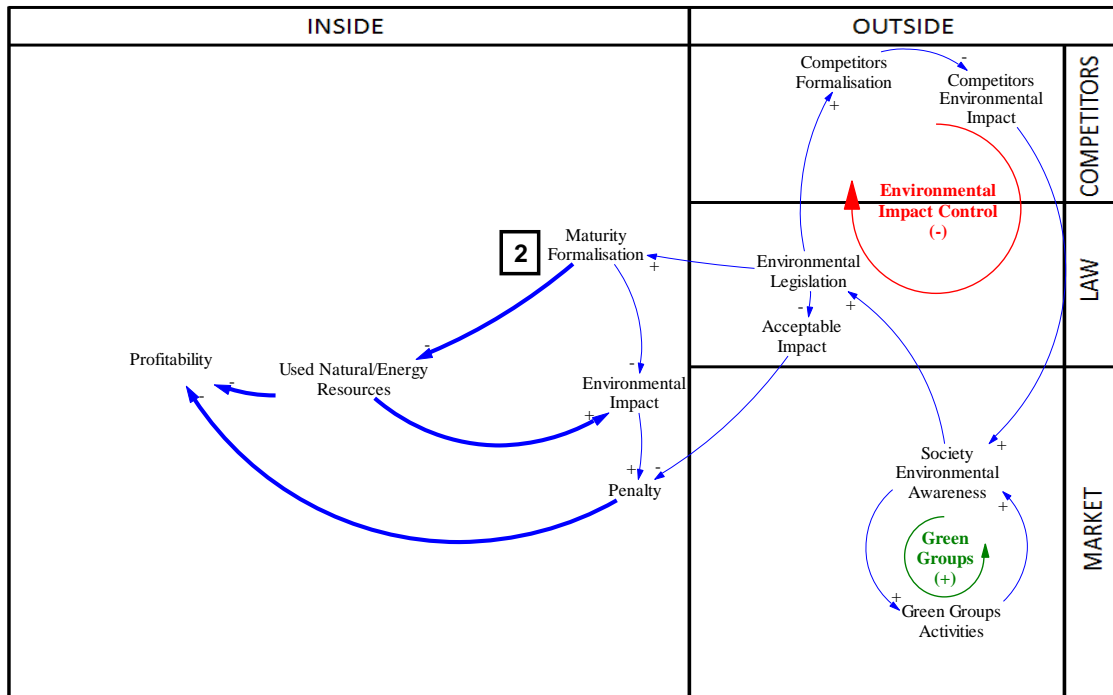


Fig. 3. Savings state

In this state, the trigger is the interrelation between *Maturity Formalisation* and *Used Natural/Energy Resources*. As *Maturity Formalisation* starts to grow, there is an interest in reducing the *Used Natural/Energy Resources* so *Profitability* may grow. At the same time, if *Used Natural/Energy Resources* are diminished, the *Environmental Impact* will be lower and hence the *Penalty* will decrease and this will lead to an increase in *Profitability*.

State 3. Systematisation

There is a point in the companies' environmental evolution in which companies start to systematise their good environmental practices. The trigger at this stage is that *Profitability* is becoming high and hence, the *Top Management Commitment* starts to grow (Fig. 4).

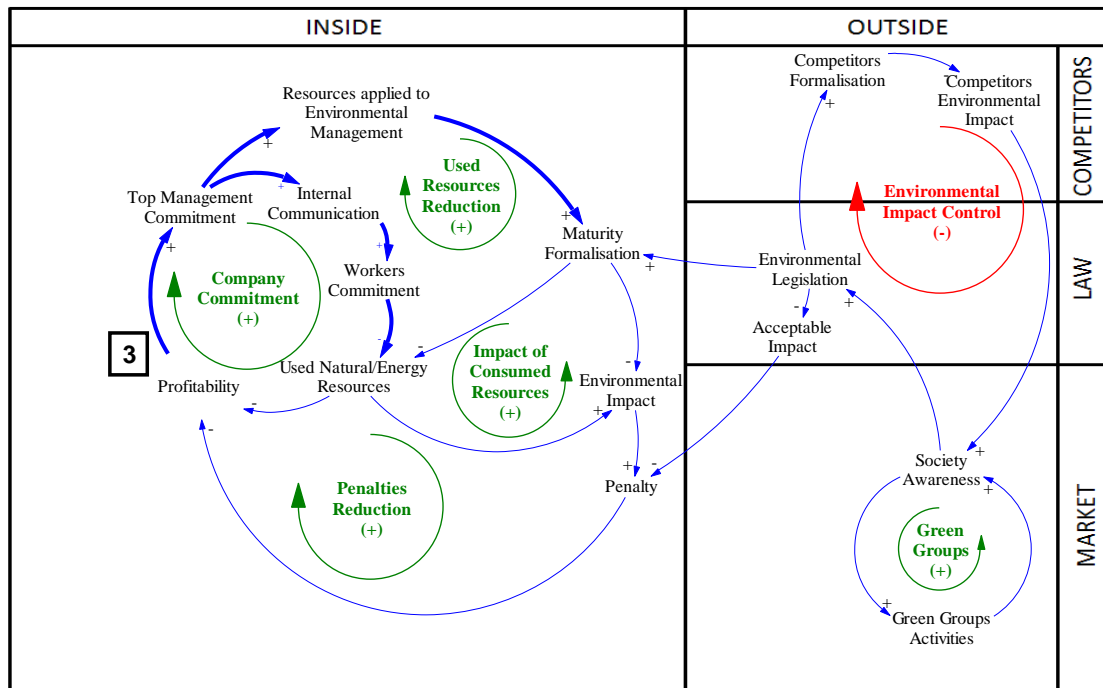


Fig. 4. Systematisation state

As *Profitability* increases, the *Top Management Commitment* becomes more consistent and it will increase the *Resources applied to environmental management*. Therefore, *Maturity Formalisation* will continue growing. This growth in the *Maturity Formalisation* will lead to the *Used Natural/Energy Resources* reduction. This decrease will improve *Profitability* and consequently the loop which is called *Used Resources Reduction*, will be closed. In the same way, two reinforcing loops are also created. One of them is the *Penalties Reduction*. If *Profitability* grows, the *Top Management Commitment* will increase. Hence, as it has previously been indicated, the *Resources applied to Environmental Management* will increase and this will lead to a greater *Maturity Formalisation*. Consequently, the *Environmental Impact* will decrease, so the *Penalty* will become lower and *Profitability* will continue growing.

The other reinforcing loop is the *Impact of Consumed Resources*. If the *Used Natural/Energy Resources* decreases, the *Environmental Impact* will decrease and the *Penalty* will go down. As a consequence, *Profitability* will grow; hence *Top Management Commitment* will increase. This will lead to an increase of *Resources applied to Environmental Management* and *Maturity Formalisation* will grow. This maturity will allow decreasing the *Used Natural/Energy Resources*.

Moreover, when the top management is committed to environmental issues, *Internal Communication* increases, so *Workers Commitment* starts to grow. Consequently, workers are more motivated and try to do their best, so the *Used Natural/Energy Resources* decreases and this leads to an increase in *Profitability* what means an increase in the *Top Management Commitment*. This loop is called *Company Commitment*, as both Top Management and workers are involved in improving the environmental management of the company.

State 4. Becoming a Green Company

Once the state of systematisation has been reached, the purpose is to become known as a green company. Companies begin to make public their environmental practices and they compete on environmental issues (Fig. 5).

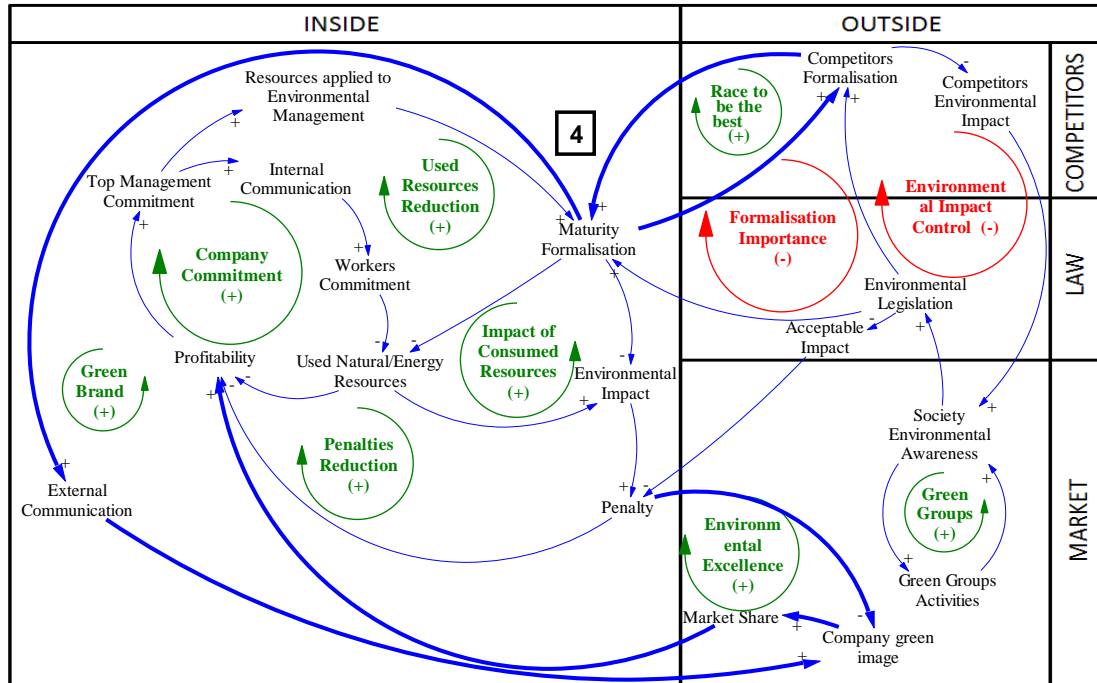


Fig. 5. Green Company

As *Maturity Formalisation* increases, the *External Communication* grows and this affects positively to the *Company green image*. As the image of the company increases, they will get more *Market Share* and this will lead to an increase in *Profitability*. This will increase the *Top Management Commitment*, therefore there will be more *Resources applied to Environmental Management* and hence *Maturity Formalisation* will continue growing, obtaining a new reinforcing loop called *Green Brand*. At this point, a decrease of *Penalty* may affect positively to the *Company Green Image* what will lead to an increase in the *Market Share*, improving *Profitability* and *Top Management Commitment* will increase. Consequently, there will be more *Resources applied to Environmental Management* what will increase the *Maturity Formalisation*. Due to this maturity, *Environmental Impact* will decrease, so *Penalty* will continue decreasing, creating another loop called *Environmental Excellence*.

On the other hand, as *Maturity Formalisation* grows there will be a competition against competitors; consequently a reinforcing loop called *Race to be the best* will appear. This loop represents the competition among companies of the same sector. If *Competitors Formalisation* increases, the company will have to increase its environmental measures if it wants to survive. For this reason, the *Company Maturity Formalisation* will also increase and in the same manner this will lead to a growth in *Competitors Formalisation*. Moreover, due to this interrelation among competitors, a balancing loop called *Formalisation Importance* is obtained.

State 5. Becoming Proactive

Once there is a systematisation and a green image development process, workers begin to be more committed to environmental problems and they become more proactive. Social aspects also take part. Internal communication between the Top Management and workers appears and this leads to an increase in the workers commitment (Fig. 6).

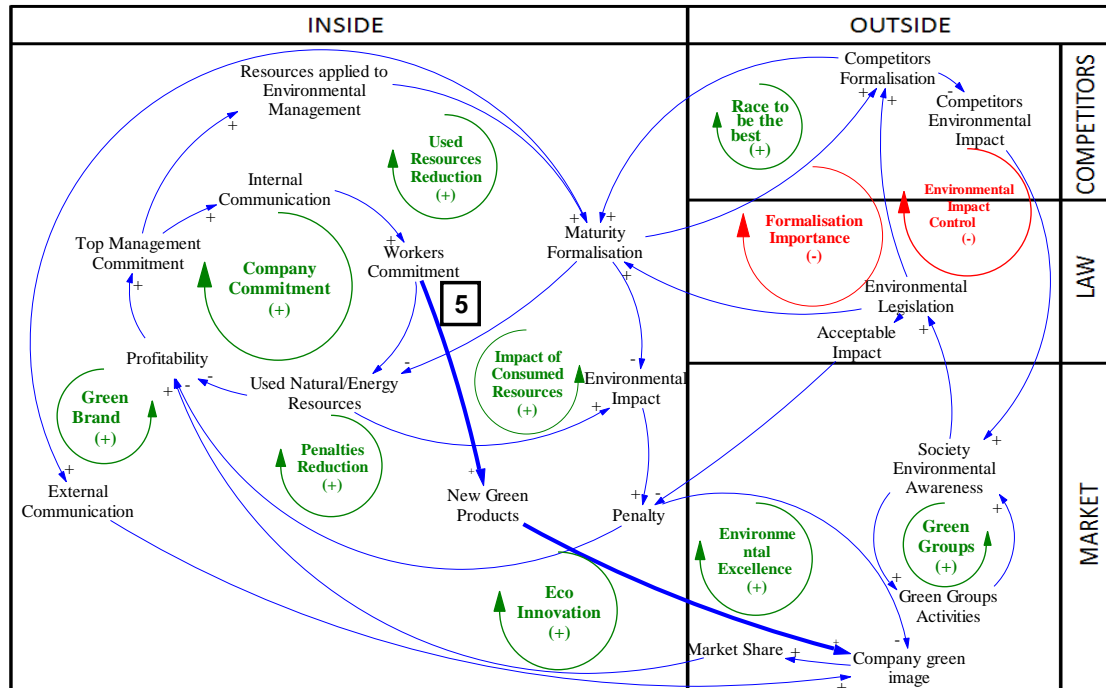


Fig. 6. Social Dimension

The trigger in this stage is *Workers Commitment*. As the *Workers Commitment* grows, they are no longer limited to reduce the used of resources, but they will begin to be proactive and they will try to innovate, creating *New Green Products* and consequently improving the *Company green image*. As a result, *Market Share* increases and consequently does *Profitability*. When *Profitability* grows, *Internal Communication* increases and hence *Workers Commitment* continues growing. This loop is called *Eco Innovation*.

Conclusion

At a first sight, it seems that environmental management is very different depending on every company. This research proposes that there are some factors that have an effect on every environmental management system. As a result, a generic model with the interrelation of the different factors has been built. As it has been explained not all the factors involved in all maturity states. Consequently, different maturity levels have been analysed so enterprises can check in what maturity state they are, and they can identify the steps that they have to follow to improve gradually their environmental management. Moreover, this classification helps companies to understand how an environmental management works efficiently. Not only are environmental practices important but also other factors, such as the Top Management commitment, are essential.

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Quality in higher education through strategic planning

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Key words: Strategic Planning, Meaningful Learning, Quality, Concept Maps, Knowledge Management

Introduction

Planning is the first stage of the administrative process by which a problem is identified or determined objectives, analyzed past experiences and develop plans and programs. Planning is a dynamic activity that gives sometimes very marked in any organization, since it is an exercise through which there will always be challenges and the objectives achieved followed by the establishment of others to achieve thus, a improvement constant. The SP is the process that begins with the establishment of organizational goals that define various strategies and policies, developing detailed plans to ensure implementation of optimal strategies and get the ends sought.

Drucker in 1993 gave the keys to the current knowledge society and especially the importance of sharing information. Meaningful Learning (ML) is the basic concept of the theory of Ausubel (1978, 2000) and Hanesian Novak, defined as rote learning in which new knowledge are the same casual way that is not incorporated in the structure cognitive or mental scheme now known as memory Long term of the individual, which if exploited with tools such as ML and Concept Maps (CM) starting with a good SP, could substantially increase the quality of foreground.

Methodology

The quality in higher education is imperative, however, despite the efforts of various international organizations have not achieved the objectives and implementation of standards such as the European Network for Quality Assurance. Knowing these rules we have to work to get the basics to create effective and efficient college students with technology tools, for this must have teachers trained in the specialties and current tools as well structured to long term.

Whereas a group of individuals in relationship more or less close, with awareness of similarity (in this case all teachers), willingness to make efforts to achieve common objectives and the acceptance of standards as mandatory for all members, that when entering a group will take a hit of habits and routines, type of authority, adherence to rules and regulations and character of each of the members, we must establish the right climate to attract your attention to the CM central theme and SP.

Concept maps created by Novak (1963) are graphical representations of various concepts and their interrelationships. Through the concept map, the students organized and prioritized with their concepts that visually representing them so they are tools to facilitate ML. They also help us identify, understand and organize the concepts that we plan to teach as mentioned by Gonzalez and Novak (1996). They also allow the integration of knowledge from various disciplines related to the area of Environmental Awareness (San Martin, Albisu, González, 2004) and adapt science content into the classroom.

Importantly, the opportunity to bring together a group with different characteristics in order to work together, the total covered by this study is 172 + 32 in two control groups, this is formed with some relevant variables such as differences in age, disciplines studies and additional professional activities, but the common denominator is that all are university professors.

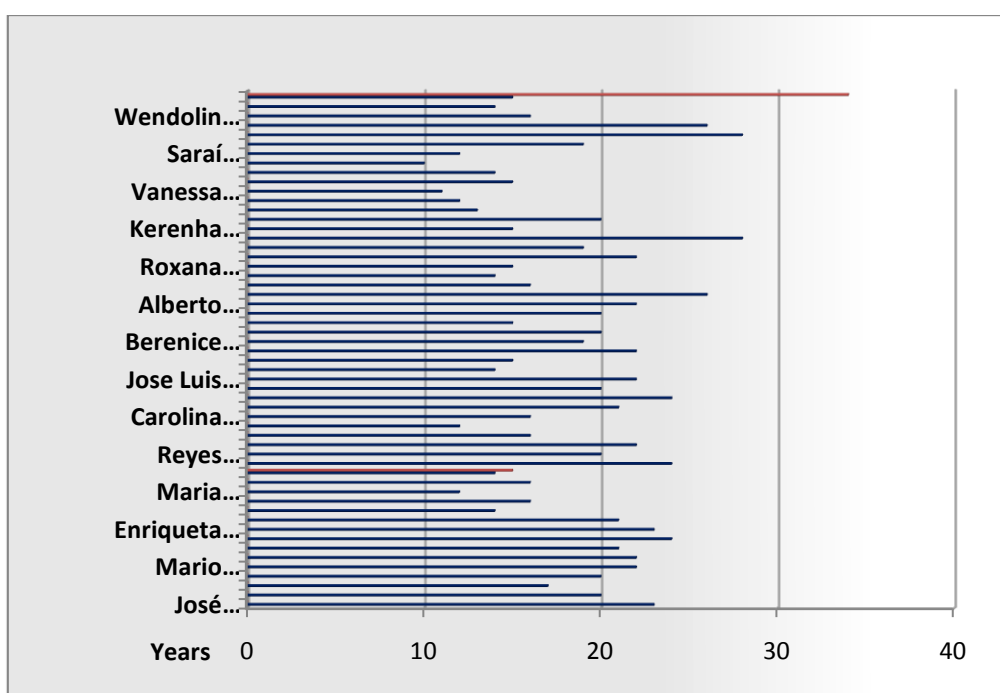


Figure 1. Experience of university professors.

In the multidisciplinary group is detected in general patterns of behavior that apply to teaching techniques as deeply rooted of earlier decades, however, applied the teaching process considering that "The pace of introduction of the concept map depends on local conditions of the school, the student's level and the difficulty of the subject" (Gonzalez 2008) laid out the benefits of acquiring knowledge in a more easy and dynamic with very specific practices , establishing a common code and of good communication, between teachers and was implemented in the implemetation at the SP, despite being a group that has a little over 19 years experience on average about the subjects they teach, as shown in Figure 1.

In the case of teachers who are older than 50 years of age, was a hardy factor, to convince in the application of SP through the tool CM by resistance to change and the new methodology that they had to learn in order to teach at the university in the fields

they teach, but we obtained the first positive result was obtained using automated tools gradually.

Also through the figure 1 we can see that some elements were integrated into this new form of education despite being about to reach retirement in a few years to see for themselves the ease of obtaining tangible results in the practices of MMCC made. Key challenges in the development of this field consist of knowledge representation, search in the process of problem solving, perception and inference, resulting in the quality of teaching

Proven by own experience we know that SP combined with the CM allowed to operationalize the most important theoretical principles of cognitive constructivist model especially ML and knowledge construction.

The high performance professionals are required due to high demand in various sectors such as government and business sector generally productive in the field of human relations. In the increasingly globalized world grows the need for increased efforts of those who produce goods and services to meet customers' demands effectively, this requires people with extensive knowledge in order to apply the methods and updated policies for a good performance as a senior executive and applying SP with CM.

As much support it has the software CmapTools established the prestigious Institute for Human and Machine Cognition (IHMC) that lets you build, share and criticize knowledge based on CM. It has a user-friendly editor, the user can easily build your concept map and associated media (video, images, sounds, maps, etc..) and icons to nodes (concepts).

The distributed architecture of the system allows different media and maps are stored on different servers in a network, and can be accessed from any node in the backbone. From a pedagogical point of view, the construction of knowledge using this tool solves a common problem caused by easy access to the Internet, are, so many resources available on any subject that is extremely easy to copy and paste images, text, etc. in their own document, without really having the time to understand the issue.

In addition to this, we consider that the tools are highly flexible, and its users are from elementary school children to scientists, allowing you to apply the SP to organize and build knowledge in a friendly way by CM, as it is extremely difficult to build a correct map if you do not have a good command of the subject.

In order to strengthen, increase knowledge and experiences of the participants applying the principles of the SP with CM that through regular exercise is performed with greater ease and broaden the view of application of all knowledge, because in today's globalized world demand for professionals with a high quality profile.

Results and discussions

Working groups were formed, integrating them with a playful exercises, and then to analyze the application and study in the area of quality using the SP, in particular with Concept Maps (CM), using ICTs, as the CmapTools software that acts as an intermediary between it and the educational field that is widely known and used to develop support material. We worked in groups with teachers the didactic process by

incorporating the CM and for the special characteristics of the experts, techniques for KM with ICTs.

Choosing the optimal SP with CM according to your work area, as well as properly managing effective communication, broadcasting to an effective team, performance in time management, behaving as an assertive person using their emotional intelligence, knowledge of tools, thereby achieving the goals of an organizational system, we propose the following steps:

1. Acquire basic knowledge of SP focused on the CM with the tool CmapTools as a working system.
2. Taking into account the different styles of SP business and skills development of students
3. Knowing how to implement emotional intelligence to achieve the goals of an organizational system.
4. Management properly applied the principles of SP.
5. Transmit and apply appropriate time management and knowledge with CM.
6. Develop the intellectual tools currently supported by tools (such as CmapTools) to be in High Management.

Below are the results of work undertaken in the group, using the SP and where we see that despite the resistance to change teachers use the CmapTools (see fig. 2) and little by little advice first with simple practices and increasing the degree of difficulty, they evolve to improve the conceptualization and construction of knowledge in a more organized way with quality required.

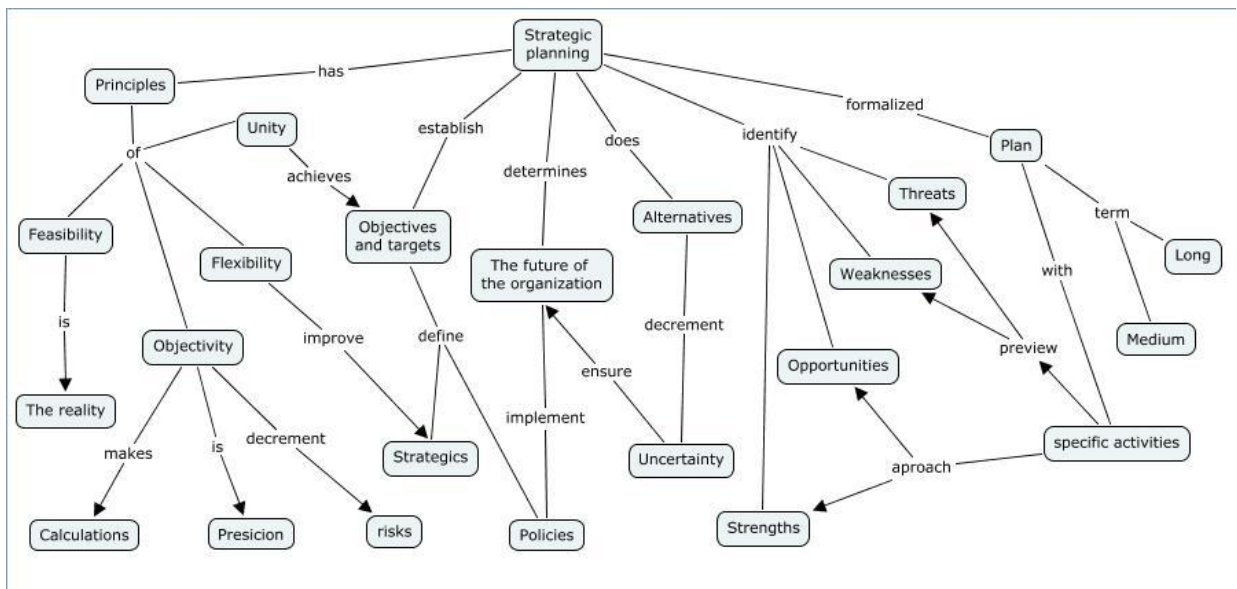


Figure 2. Concept Map Strategic Planning

We can see in Figure 2 initial concept map with some minor comments would be balanced and complete, but it is an outcome of the practices in the change process, which evolves as you practice and learn best tool CmapTools, on the same topic of SP produced by the same group, which exemplifies the knowledge gained.

Moreover, it is necessary to discuss some data obtained in this case and the fact that we

have the support of the various participants who have a university educational level in disciplines related to Social Sciences, Management, Information Technology, Engineering in Communications, Computer, Mechanical and other lesser extent, but despite the diversity, SP applied to different materials from all disciplines, to organization, draft ordinances and building the CM, the results were excellent in the dynamics of ML with students, and assessments that were conducted compared to control groups, as shown in the tables I and II.

The results shown in the tables above, spanning the last two years of implementation of SP using CM, which are favorably notorious with an average increase of 19% of students passed in the medium and long term.

47%	WOMEN
38%	More than 50 years of age
16	Average experience in years
69%	Students approved without SP & CM
89%	Students approved using SP & CM

Tabla I. Results by gender in women.

53%	MEN
45%	More than 50 years of age
20	Average experience in years
68%	Students approved without SP & CM
86%	Students approved using SP & CM

Tabla II. Results by gender in men

Conclusions

We conclude from the above that:

- In order to give continuity to the work already done in many years of basic education levels and to establish the use of SP using MMCC in the universities, for upgrades to the teachers of these levels in the SP, the ML and the use of tools such as CmapTools.
- In the field trials through this exercise, it was found that despite the resistance to change and to stand before a skeptical public and must break paradigms by applying traditional methods, the update on the implementation of new technologies such as CmapTools and the CM leads to think that the SP applied correctly, is part of the new trends in teaching applied current.
- Ensuring that teachers apply the dissemination and teaching of the maps constructed by themselves and together with students show definite improvement.
- If we consider the SP with the CM as a reflection of how students have structured knowledge, we can assert that they now know more and better. As a result students are better prepared for future learning.
- The use of the CmapTools software has been actively involved in this case the students (teachers) in the construction of knowledge, it also facilitates collaborative learning

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Experts teachers: quality factor in higher education

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Key words: Quality teaching, Meaningful learning, Quality in learning, Teaching quality in higher education.

Introduction

Further liberalization of the previous reference framework will be required to respond with effective approaches to the challenges of the new situation. You will need to rethink the school its current mission and its future vision, with a real leadership more able people. The accreditation of educational establishments is function of the level of quality, appearance, fortunately, objectively.

In this regard the European model EFQM (European Foundation for Quality Management) is being implemented successfully in several autonomous communities, leading to an improvement in the management and creating more opportunities for the improvement of teaching and/or research (Burillo)(, Alfonso, González and postoffice, 1999).

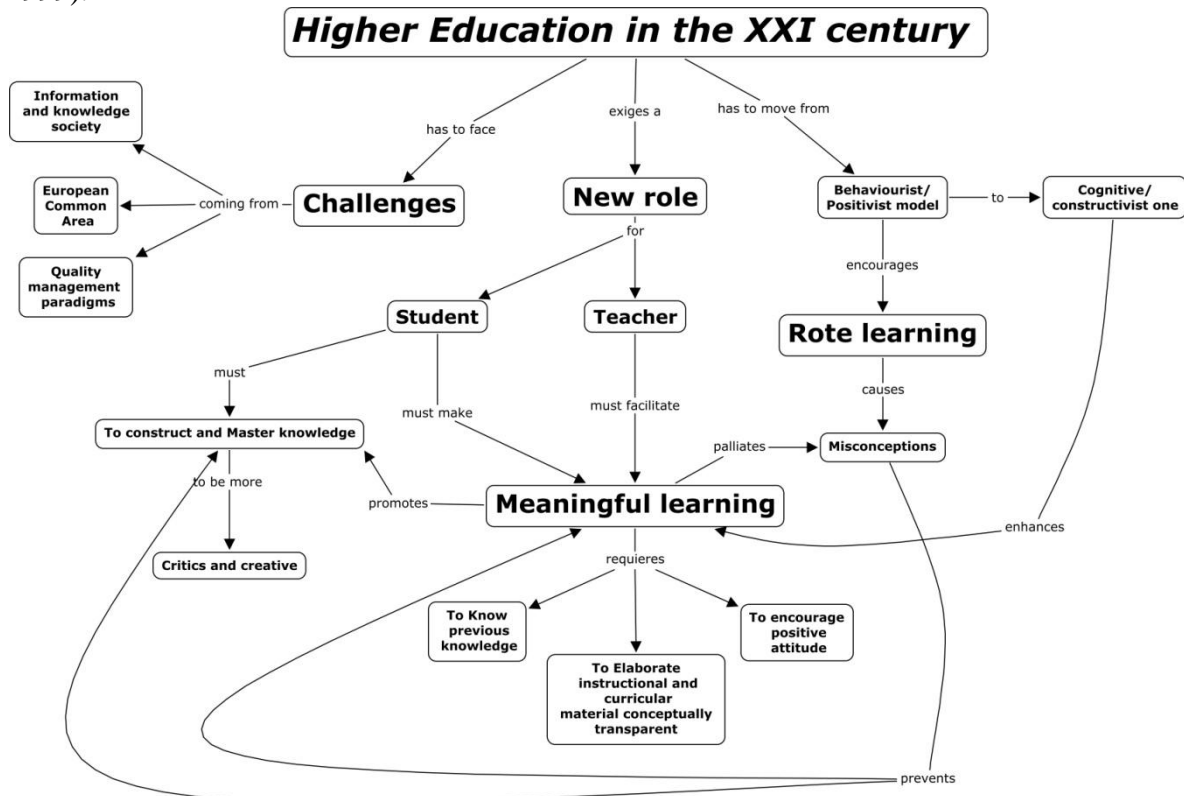


Figure 1. Concept map on Higher Education in the XXI century (Gonzalez, 2011)

Requirements of the new culture of quality

What is it meant by quality in higher education? The ENQA (European Network for Quality Assurance), in his work Standards and Guidelines for Quality Assurance in the European Higher Education Area, says that, "Quality in Higher Education is a description of the effectiveness of everything that is done to ensure that diligent students can derive maximum benefit from the educational opportunities available to them and also fulfill the requirements for the" "award for which they are working".

This idea carries the concepts of effectiveness (product) and efficiency (Economics and, therefore, optimization of the process).

Methodology

For the elaboration and implementation of initiatives we used the epistemological "V" Gowin as well as the MMCC and misconceptions that make operating the most relevant theoretical principles of cognitive constructivist model, especially meaningful learning and knowledge construction. Interviews with faculty experts and his diagnosis used the MMCC and misconceptions. Work with eight groups of the public University of Navarre (UPNA, Spain) in two degrees and five groups of National Polytechnic Institute (IPN, Mexico) in the computer engineering area. Both cases used ICTs to meet objectives.

Design

In general, to develop a practice of laboratory using the V of Gowin, we must perform on a sheet, a design similar to the one shown in the figure, and then respond to each of the spaces reserved for the listed elements (in Appendix b are examples made by the students and their evolution during the course), (also attached a CD-ROM also examples).

- We need the event which will be studied at the apex. The central part raises the questions of study; these are not simple questions, they are closely related to the subject of research.
- Identifies records and transformations that must be performed in order to develop the research.
- You must also specify theories, principles / laws and concepts that will enable the understanding and interpretation of the collected data (records and transformations).
- Developed the research, on the basis of conceptual knowledge and with the changes by hand, there are the claims of knowledge of the event or subject studied.
- Achieved the knowledge of the motive of study event, raises him practical, aesthetic, moral or social value of research, i.e., statements of value.
- Finally, invites researchers to realize that "his vision of the world" motivates and guides their actions as such, i.e., determines the selection of resources (theoretical and methodological) to understand the studied events since it "rationality" that motivates his actions is immersed in a philosophy.

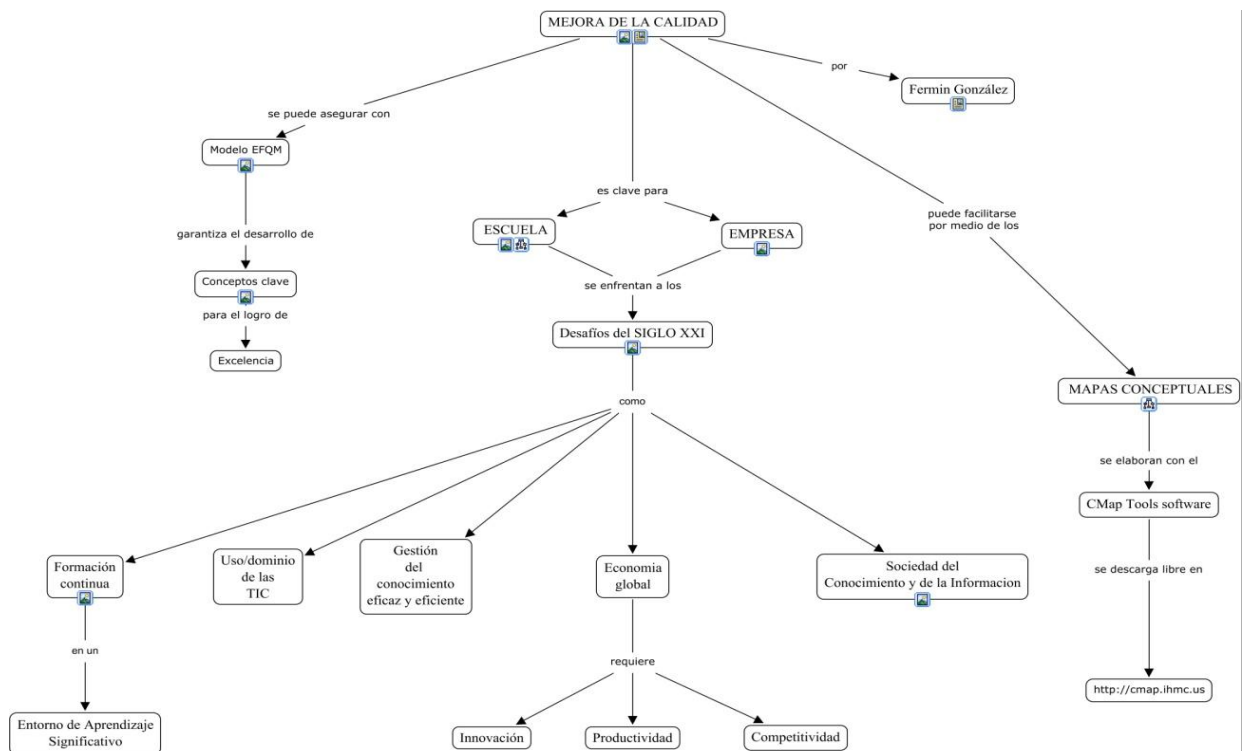


Figura 4. Los mapas conceptuales y la mejora de la calidad (González. 2011)

Achievements and results

The efficiency and effectiveness of the teachers showed definite improvements. If we consider the MMCC as a reflection of the way in which teachers have structured knowledge, can assert now distinguish teach and explain more and better.

Teachers are in a better position and prepared for future learning. Using CmapTools software has been actively involved teachers in the construction of knowledge, facilitating collaborative learning.

It was achieved in goals, development and involvement of people, social responsibility, learning, innovation and continuous improvement.

In this regard of the variables that could impact the performance academic of the three working groups, could be established that they had significant correlations motivation toward study, anxiety for the academics results and expectations of achievement, in relation to the varying learning styles and meta-cognitive strategies employed to study.

The use of strategies of teaching-learning requires time and dedication by teachers in comparison with a class. The teachers who participated in the research process consider that different to the traditional class strategies implies a re-organization and selection of topics to work over a semester because it takes more time to develop them in class.

Set forth the Working Group strategic planning from a line of research to reaffirm the commitment of the unit of computing or computer labs with the different groups involved in the search for new knowledge related to the incorporate of pedagogical innovations with or without the use of technology.

Support policies of the Organization as a group of research to create networks of research with the entities that support both national and international.

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Measurement of service quality by servqual method in banking sector

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Key words: Service Quality, Servqual, Banking Services

Introduction

Today marketing of services has become at least as important as the marketing of goods. Customers pay attention to various factors while evaluating services taken. Physical characteristics of the business, behavior of employees, the atmosphere of the business and trust to the business are some features that are effective.

There are distinctive features of services from goods. These features in general are being touched, being heterogeneous, being nondurable, being unclaimed and simultaneously production and consumption (Grönroos, 1990; 28). Services do not have physical presence, so they are intangible, invisible and can not be formed an opinion by taste, hearing and smelling senses, in short "abstract" goods. Service is provided by human so standardization of service is impossible. Therefore, the service varies depending on the person servicing. So, services are heterogeneous. Goods are produced and stocked whereas services are produced and obliged to consume at the time of production. Services do not have the physical strength and life in contrast to goods. With them, in the service sector there is no possibility of ownership transfer of a property.

The quality of service is more difficult to measure because of listed distinctive features. However, quality must be measurable for the improvement. In fact, some features such as the physical characteristics of the goods, durability and meeting the function of the expected features can be used as a hint during the evaluation process to make the measurement of the quality of the goods. However, this measurement is getting more difficult because of the peculiar features of the services. Businesses use service quality to make a difference, provide a competitive advantage, increase productivity, ensure customer loyalty, protect price competition and create a positive image for public.(Atlan,Atan and Eaton, 2003: 3).

The difficulty of measuring service quality depends on impossibility of predicting customers' expectations all the time because the service quality depends on the customer's perception. Service quality is affected from service offering people, technical features of service and general corporate image of business that provide service. (Terpstra, Sarathy, 1993; 85).

In the study, service quality of the bank is evaluated as a result of matching customers' expectations and perceptions about bank service provided. In this context, firstly

concept of service quality is mentioned and later service quality is measured by servqual scale.

Service Quality

Service Quality is the comparison of customers' expectations before service taken and service performance after service benefited and forms the direction and degree of expected and perceived performance (Parasuraman, Zeithaml, Berry, 1988; 13). According to a further recognition, service quality is the evaluation of process between customer and service providers (Oral, Yuksel 2006; 80).

In addition, service quality is composed of technical and functional quality. Technical quality is what the customer takes about service whereas functional quality is about service delivery process (Grönroos, 1984; 65).

In the light of all these definitions service quality is the comparison of customers' expectations about service delivery and evaluation of this service taken. When customers compare expectations and actual service delivery, service is perceived as qualified if actual service delivery exceeds expectations. But, service is evaluated as poor quality unless actual service meets expectations.

The important point of service quality is the meeting customer's service quality expectations. Definition, measurement, control, communication and management of quality are difficult. Service quality is determined by the consumer not by manufacturer-dealer (Küçükaltan, 2007; 62).

Service Quality dimensions are physical features, reliability, responsiveness, competence, courtesy, credibility, confidence, accessibility, communication and empathy. From these dimensions five of them are included in this study; physical features, reliability, responsiveness, confidence and empathy. Physical features dimension consist of buildings, facilities, equipment, personnel and appearance of communication materials. Reliability dimension means providing the service as promised reliably and accurately, responsiveness dimension means helping customers and providing service timely, confidence dimension means being away from risk, danger and suspicion and having qualified and polite employees, empathy dimension means business to show interest and be sensitive to customers (Zeithaml, Parasuraman, Berry, 1990; 21-22). Listed five dimensions are used by Servqual scale. For this reason, in this study five dimensions of service quality are discussed because of using servqual scale.

Reliability and validity of a Servqual scale is proven and this scale is applied in many areas of the service sector. This scale can be applied to organizations which provide service more than one point and to assess and compare services on every point. For instance, services provided in bank branches. Servqual scale is used within the business, and also used to compare situation among competitors (Alakavuk, 2007, 338-229).

Measurement of Service quality by Servqual Method in Banking Sector

This study is about determination of customers' expectations and perceptions about their private banks that they operate. In this context, survey forms are created according to

phrases in the context of Servqual scale and the data are analyzed by using SPSS 16 program and the results are interpreted.

Aim of the Study

Servqual method that is commonly used to measure quality of services applied to a private bank's customers in the banking sector. The five dimensions of service quality; physical features, reliability, responsiveness, confidence and empathy are included in the study. In this context, the purpose of this study is evaluating private bank customers' expectations and perceptions of the services provided by the bank in the framework of these five dimensions.

Scope and Constraints of the Study

The study covers customers of a private bank that operate in branch in İzmir. It is impossible to reach all the customers that operate in branch when expenses of research, personnel needs and time constraint are taken into account. Therefore, the systematic sampling method is applied to one of every 5 customer who come to bank branch for operations and waiting on the line and survey is applied to customers sampled. For this purpose, 500 questionnaires is produced, distributed, and 392 of these questionnaires are returned. Return rate is $392/500 = 78.4\%$. As a result of investigations it is found that 52 of the questionnaire are incomplete, inaccurate and contradictory filled so they are excluded from the scope of research. Therefore, 340 questionnaires are included in the study. The sample volume is confirmed as 340.

Findings of the study

Findings of the research consist of demographic features findings and service quality findings.

Findings About Demographic Features

Findings about demographic features are given below.

Table 1: Demographic Features of Participants

GENDER	NUMBER	PERCENTAGE	OCCUPATION	NUMBER	PERCENTAGE
Female	124	36,5	Business Partner	8	2,3
Male	216	63,5	Self-employed	48	14,1
AGE GROUPS			Worker	86	25,3
21-25	54	15,9	Retired	42	12,4
26-30	86	25,3	Housewife	18	5,3
31-35	65	19,1	Unemployed	2	0,6

36-40	27	7,9	Student	53	15,6
46-50	29	8,5	INCOME		
51-60	34	10,0	Less than 1000	30	8,8
60-	6	1,8	1001-2500	142	41,7
EDUCATION			4501-7500	34	10
Primary School	21	6,2	7501-10000	11	3,4
High School	101	29,7	More than 10000	9	2,6
Undergraduate	117	34,4			
Graduate	55	16,2			

37% of the participants are female and 63% are male. According to findings most of the survey respondents are male. According to this finding, men use more banking transactions more than women. The distribution of respondents by age groups are as follows: 21-25 age group is 16% of respondents, 26-30 years age group is 25%, 31-35 age group is 19%, 36-40 age group is 8% percent, 41-45 age group is 11%, 46-50 age group is 9%, 51-60 age group is 10% and over 60 age group is 2% of the respondents. According to these findings, most respondents are in 26–30 age group and they are young people. 6% of the respondents are primary school graduates, 30% of them are high school graduates, 14% of them are associate degree, 34% of them undergraduate and 16% of them graduate degree. According to these findings, most respondents have undergraduate education. This situation indicates that education levels of respondents are high. 9% of respondents earn less than 1000, 42% of the respondents earn 1001–2500, 34% of the respondents earn 2501–4500, 10% of the respondents earn 4501–7500, 3% of the respondents earn 7501–10000 and 3% of the respondents earn more than 10000. This findings indicate that majority of the respondents have income between 1001 and 2500. The respondents are in middle-income group. 2% of the respondents are business partner, 14 % of them are self-employed, 25% of them are civil servants, 25% of them are workers, 12% of them are retired, 5% of them are housewife, 1% of them are unemployed and 16% of them are students. These findings indicate that the respondents consist of workers and civil servants in general. Participants are workers and civil servants so it is normal that they are in middle-income group.

Findings About Service Quality

Phrases of servqual scale that is prepared to reveal customers' perceptions and expectations related to bank services are evaluated by 5-point Likert scale. Customers compare the features of the bank that they make transactions with an ideal bank-owned feature. As a result of comparison servqual score is calculated.

Servqual Score= Perception Score - Expectation Score

Table 2: Perception, Expectation and Servqual Scores of Customers About Bank's Service Quality

PERCEPTION				EXPECTATION			SERVQUAL SCORE			
	N	MIN	MAK	AVE.	MIN	MAK	AVE.	DIFF.	SIZE	TOTAL
A1	340	1	5	4,0765	3	5	4,7088	-0,6323	-0,6426	-0,9956
A2	340	1	5	4,0647	2	5	4,5618	-0,4971		
A3	340	1	5	3,9265	2	5	4,4265	-0,5		
A4	340	1	5	3,7059	2	5	4,6471	-0,9412		
A5	340	1	5	3,9176	2	5	4,7647	-0,8471	-0,9559	
A6	340	1	5	3,0500	2	5	4,7794	-1,7294		
A7	340	1	5	4,0206	2	5	4,7618	-0,7412		
A8	340	1	5	3,9912	3	5	4,7765	-0,7853		
A9	340	2	5	3,9176	3	5	4,7559	-0,8383		
A10	340	2	5	4,0206	3	5	4,8147	-0,7941		
A11	340	1	5	3,8353	2	5	4,6882	-0,8529	-1,1386	
A12	340	1	5	3,2824	1	5	4,4824	-1,2		
A13	340	1	5	3,0147	3	5	4,6324	-1,6177		
A14	340	1	5	3,4059	3	5	4,5412	-1,1353		
A15	340	1	5	3,2941	2	5	4,4941	-1,2		
A16	340	1	5	3,6471	1	5	4,5529	-0,9058		
A17	340	1	5	3,2824	1	5	4,3412	-1,0588	-1,0226	
A18	340	1	5	3,1029	1	5	4,3971	-1,2942		
A19	340	1	5	3,4235	2	5	4,5147	-1,0912		
A20	340	1	5	3,7765	3	5	4,7294	-0,9529		
A21	340	1	5	3,7000	3	5	4,6765	-0,9765		
A22	340	1	5	3,8676	2	5	4,5912	-0,7236	-1,2155	
A23	340	1	5	3,4441	2	5	4,5412	-1,0971		
A24	340	1	5	3,1412	1	5	4,3706	-1,2294		
A25	340	1	5	3,2941	2	5	4,4412	-1,1471		
A26	340	1	5	3,1412	2	5	4,4206	-1,2794		
A27	340	1	5	3,2559	1	5	4,4618	-1,2059		

The negative (-) servqual score that is the difference between average perception score and average expectation score indicates that bank can not meet the expectations of customers and service quality is low. Table 2 has the evaluation distribution of expectation and perception questions for the five dimensions and there are average and servqual scores. For each phrases, expectation scores exceeds perception scores. This result shows that service quality of bank is not at expectation level.

Table 3: Perception, Expectation, Average and SERVQUAL Scores of Service Quality Dimentions

PERCEPTION				%	EXPECTATION		%	SQ
	N	AVE.	ST. DEV.		AVE.	ST. DEV.		
PHYSICAL PROPERTIES	340	3,9434	0,9686	22	4,5860	0,6692	20,03	-0,6426

RELIABILITY	340	3,8196	0,9007	21,32	4,7755	0,5135	20,86	-0,9559
RESPONSIVENESS	340	3,3945	1,1498	18,94	4,5332	0,7043	19,80	-1,1386
CONFIDENCE	340	3,5524	1,0707	19,82	4,5750	0,6555	19,98	-1,0226
EMPATHY	340	3,2081	1,2106	17,90	4,4235	0,7631	19,32	-1,2155

As shown in Table 3, perception, expectation and sevqual scores of five dimensions of service quality (physical features, reliability, responsiveness, confidence and empathy), were determined.

There are four expressions in physical feature dimension. When Servqual differences of the four expressions are examined, all are found negative. The expression that least meet the expectations is “Advertisements and hand-outs are clear and easy to understand” with the value of -0,9412, and the minimum difference is “Working environment and buildings of banks seem nice” with the value of -0,4971. According to these findings, advertisements and hand-outs distributed by the banks do not meet the customers' expectations. Banks should pay attention to advertisements and hand-outs to be descriptive, basic, easy to understand and detailed. Weight of expectation and perception are compared for physical features and it is found that expectation weight is 20.03%, while perception weight is 22%. This situation indicates that the expectations of customers are met in terms of physical features.

There are six expressions in reliability dimension. In these expressions, the maximum difference between expectations and perceptions is “Bank that I take service does not make mistake about bank transactions.” with the value of -1.7294, the minimum difference is “The bank that I take service meets the commitments in time” with the value of -0.7412. According to findings, bank should pay more attention to bank transactions. In general, the reliability dimension expectation weight is 20.86%, while perception weight is 21.32%. This situation indicates that bank meets the expectations of customers in terms of reliability, bank even exceeds expectations.

There are seven expressions in responsiveness dimension. The maximum difference between perception and expectation is “Employees of the bank that I take the service eliminates long waiting queue” with value of -1.6177, the minimum difference is “The bank behaves sincerely to solve the problem when one of the customers have problem” with the value of -0.8529. According to the findings, customers are not satisfied to wait on the queue. Bank should prevent long queue. Bank should make attractive promotions and prizes to make transactions by internet banking and ATM’s instead of having transactions in the bank branch. In general, the responsiveness dimension expectation weight is 19.80%, while perception weight is 18.94%. This situation indicates that customers’ expectations are not met exactly.

There are six expressions in confidence dimension. In these expressions, the maximum difference between perception and expectation is “Employees of the bank that I take service, see the interest of customers’ above everything” with the value of -1.2942, the minimum value is “Technological infrastructure of the bank that I take service is adequate” with the value of -0. 7236. According to the findings, customers think that their interests are neglected by the bank. Customers should feel that bank deals with them. However, the technological infrastructure of the bank meets customers' expectations. Customer expectation weight is 19.98%, while perception weight is

19.82%. This situation indicates that bank can not meet customers' expectations in terms of confidence fully. Bank should have operations to ensure confidence to customers. For instance, bank can tend to have social responsibility campaigns to show interest to customers and society.

There are four expressions in empathy dimension. The maximum difference between perception and expectation is "The bank that I take service informs customers about alternative investment instruments" with the value of -1.2794, the minimum difference is "The bank that I take service form a portfolio in order to decrease risk while assessing savings" with value of -1.1471. According to the result obtained, the bank gives insufficient information to customers about alternative investment instruments. However, bank directs customers to alternative investment instrument to avoid further damage and to distribute risk. In this regard, customers perceive the service positively. In general, the empathy dimension expectation weight is 19.32%, while perception weight is 17.90%. This situation indicates that bank can not meet customers' expectations in terms of empathy exactly.

As a result of comparison of Servqual scores in terms of service quality, physical features dimension has the lowest score with -0.6426 while empathy dimension has the highest score with -1.2155. According to the findings obtained, customers perceive physical appearance of employees, working environment and buildings positively from physical features. However, bank customers think that bank operations are not sufficient about avoiding customer interests, informing about alternative investment instruments and especially informing about account decrease and increases.

Conclusion and Recommendations

Today the concept of service has broadened and the intense competitive environment between organizations make service to be given more qualified. Due to the development of the concept of service, quality concept has also become more important for businesses. Compared with manufacturing firms, service businesses should pay more attention to quality.

Ensuring and improving service quality is an important strategy for businesses to have competitive advantage. This strategy of the business provides positive perception of corporate image and prestige, increase profitability, create customer satisfaction and customer loyalty in the long-term.

Measurement of service quality is more difficult for services because of distinctive features from goods. Many methods and models have improved for the measurement of service quality. From these models, Servqual is the most known and widely used method.

In the study, participants are the customers of a private bank who are in the branch for transaction. In general, the majority of respondents are male and in 26-30 years age group, has a graduate degree, have the income in the range of 1001-2500 and respondents are workers and civil servants.

For each of the phrase that takes place in Servqual scale, customers' expectations values exceed perception. This situation shows that bank's service quality level is lower than

expected level. The bank's services can meet customers' expectations for physical features and reliability dimensions while bank can not meet he customers' expectations exactly for responsiveness, confidence and empathy dimensions. When the dimensions are compared with each other, customers perceive physical appearance of bank positive but customers think that bank can not empathize.

Banks in general should provide more confidence to customers. Confidence is very important in the banking sector. Customers' confidence to employees is valuable in terms of investment trust. For this reason banks should educate employees continuously. Banks should train employees in certain periods and should inform them about the new investment instruments. Employees should have motivating activities for working responsively. The banks that fail to create confidence and think about customers' interests are always one step behind the competition. Changing the physical appearance of the bank is not sufficient for the service to be perceived as qualified. As well as physical features, other features should be emphasized.

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HAFITe: a theoretical model as a Tool to Help Promoting the Involvement of Employees in the Company

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Introduction

The 5S's are considered as one of the most well known and extended workplace organizational methodologies to approach continuous improvement processes. The reason why it is so well known is due mainly to the immediate results it generates when applied (Bayo M. et al., 2010).

When revising the literature we can see on one side, the existence of texts that explain in detail how to implement the 5S's (Osada, 1991, Barrick et al., 2001, Hirano, 1990, Imai, 1986) and, on the other hand, a set of articles that refer to the advantages and barriers that arise when being implemented either in Japanese, European or American companies (Ho, 1998, Ho, 1999, Gapp et al., 2008, Farris et al., 2009, Gilgeous et al., 1999, Bayo M. et al., 2010, Kobayashi et al., 2008) .

In addition, different researches reveal that when Western companies implement the methodology of the 5S's they only focus in two of its aspects (*seiri* and *seiso*), leaving aside the holistic understanding of the entire concept (Ho, 1998, Douglas, 2002, Gapp et al., 2008, Kobayashi et al., 2008).

Why use the 5S's?

Different authors agree in stating that the key to company productivity and competitiveness lies in guiding the improvement in processes and people (Imai, 1986, Ohno, 1988, Shingo, 1989, Womack and Jones, 2003).

With regard to the processes it can be stated that continuous-flow production and customer-focused processes (internal and external) constitute the two pillars of

production and over which the tools developed interact to eliminate waste (Kanban, SMED, Jikoda, TPM, 5S's, among the most significant).

With regard to the people, these authors attribute to the methodology of the 5S's the path to introduce a company into continuous improvement by developing habits such as neatness, cleaning and discipline.

The lack of the 5S's leads a company to an inefficiency of the processes, to the generation of waste, the low morale of employees, bad quality of the products and services and to high production costs (Imai, 1986, Ohno, 1988, Shingo, 1989, Womack and Jones, 2003).

The problem of the 5S's

Different researches reveal that certain conditions are necessary for a 5S's programme to develop successfully within companies. In this sense, O'hEocha states that the management of improvement and any practice of change require a strong leadership which leads from example and not with words (O'hEocha, 2000).

Ho and Cicmil consider that the most important aspect to implement the 5S's is the commitment of all the company members (Ho and Cicmil, 1996). Corbett and Rastrick maintain that the influence of the cultural factors is an important aspect for a business' success and for quality improvement (Corbett and Rastrick, 2000).

Although the 5S's are composed of five easy steps to understand, in the practice their implementation is influenced by human factors that interfere in the effectiveness of this technique (Warwood and Knowles, 2004).

Other researches show that the success of the 5S's in Eastern companies is due to the positive influence exerted by the cultural and religious aspects of their beliefs. Nevertheless, this influence is absent in Western companies and therefore their implementation ends up focusing on the most superficial and basic aspects of the technique (*seiri* and *seiso*) leaving aside the holistic understanding of the entire methodology, especially regarding the change in the person's behavior (Kobayashi et al., 2008, Magaña-Campos and Aspinwall, 2003).

The fact is that up until now nobody has explained in detail which scientific principles do the 5S's support - if any - which in some way could explain why there are five S's, how do they operate, how do they influence people, and how do they influence the improvement of processes in any company.

Considering the aforementioned and since the year 2009, the Industrial Organization Department of the University of Navarra has been developing a research that intends to answer these questions.

The project structured for such purpose is composed of two main stages. The first stage corresponds to the theoretical foundation on which the scientific basis of the methodology of the 5S's is identified and clarified from the fields of organizational behavior and continuous improvement.

A theoretical model named **HAFITe** was formulated in this stage which explains how to have an influence on people's behavior and on an improvement of the processes and operations of a company from systematically applying the principles of the 5S's.

The second stage, soon-to-be developed, is aimed at validating the **HAFITe Model**. The purpose of this article is to present the results of the first stage of the research project. For practical purposes the article is divided into two parts. The first part will address the aspects that can be considered as scientific fundamentals for the methodology of the 5S's and the second part will explain the general structure of the HAFITe Model.

Scientific foundation for the 5S's

A bibliographic analysis allows one to establish that the methodology of the 5S's can be based on the fields of knowledge related to continuous improvement and organizational behavior. For a better understanding, below is a brief exposition from each of the aforementioned fields.

From the field of continuous improvement: seiri, seiton and seiketsu in the processes and operations

Experience shows that it is only possible to add value to the product or services through the processes, by affecting their characteristics. Nevertheless, this which is so fundamental is left aside because the immediate considerations and the economic-financial mentality of the shareholders and managers of companies have been placed above the daily reality of creating value for the client (Womack and Jones, 2003).

Therefore, in order to achieve a greater level of efficiency of the production, the literature and the experience suggest it is necessary to analyse and improve the process before the operations (Shingo, 1989).

Improve processes

The description and improvement of the processes can be performed by means of applying different techniques which aim at eliminating or minimizing those steps that do not add value, from identifying the client's needs; that is, to analyse the process and re-design it to arrange all the operations in continuous-flow (Galloway, 1994, Womack and Jones, 2003, Shingo, 1989, Gryna et al., 2007).

In short, what the different methodologies suggest is to affect the basic characteristics of any process (time, cost, impact in the quality, add value or not) and thereby improve it.

Improve operations

Improving the operations consists in affecting the actions which allow transforming an entry into a result.

The study of the operations is related to the study of the time and motion as well as with the principles of the economy of motion. All these considered techniques search for a greater efficiency to perform a task in a workplace. Furthermore, these techniques serve

to understand the nature and the true cost of the work and therefore reduce and control the costs, balancing the flow of process, improving the working conditions and environment, as well as motivating the people (Meyers, 2000).

Basically, Mayer considers that the study of motion offers a great saving potential to any company allowing eliminating elements from a task, combining elements of one task with another, re-organising elements of a task to make it easier and arranging the components and tools close to the point of use, among others.

Standardize the improvements

Any process or operation improvement must be planned and undertaken and finally assessed in order to establish the degree of progress of the improvement.

Thus, included within the language of quality is the concept of continuous improvement cycle initially developed in the 1930's by Walter Shewhart and later popularised by W. Edwards Deming in Japan (Deming, 2000).

A complement to the PDCA cycle consists in standardizing all the actions to prevent an operation or process returning to its initial conditions, after the first round of the cycle has been applied. This is named the SDCA cycle (Deming, 2000).

In accordance to the abovementioned, what is evident is that the improvement both of the processes and the operations demands separating what is necessary from what is unnecessary, and for this to be discarded (*seiri*), to arrange the processes so that their activities are logical and generate efficient work-flow or to arrange the elements and tools of an operation for their easy use (*seiton*) and, finally to standardize all the improvements for these to last in time (*seiketsu*).

Thus, it can be asserted that, within methodology of the 5S's, *seiri*, *seiton* and *seiketsu*, are based on the fields of continuous improvement, specifically with regard both to processes and operations (figure 1).

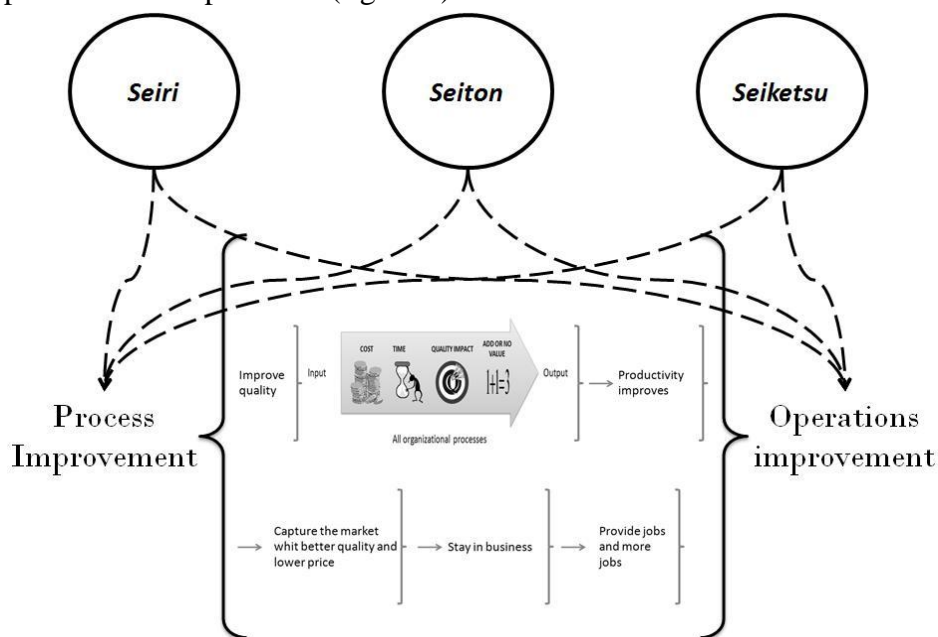


Fig. 1 Seiri, seiton and seiketsu in the processes and operations

From the field of organizational behavior

Within the company understood as a fully coordinated social unit, formed by people, which operates in a relatively constant way with the aim of achieving a set of joint goals, a discipline named organizational behavior arises in charge of investigating the influence that people, groups and the structure have over the behavior in companies and, to apply the knowledge achieved to improve their effectiveness (Robbins, 1993).

Robbins proposed a theoretical model which tries to explain and predict how people are conducted within a company and in what way the individual behavior, the group behavior and the company's structure affect productivity, staff rotation, absenteeism and satisfaction at the workplace.

Likewise, the model shows how the company's formal structure, the way in which the tasks are designed and the physical environment is arranged, the human resources policies, among others, are variables that affect both the individual and the group's behavior.

Due to the subject matter that concerns the investigation, below is a brief description of what the 5S's sweeping and self-discipline pillars are based on, from the organizational behavior model.

Order and cleaning, stimulation to increase motivation and reduce work-related stress.

There have been many theories in the last 35 years that relate the workplace environment with the levels of job satisfaction, worker's motivation and stress (Björklund, 2001, Vischer, 2007, Cooper and Dewe, 2004).

Research has proven that aspects such as spatial organization, architectural details and environmental conditions (order, cleanliness availability and access to resources, visual access from the workplace), are associated to motivation, stress, performance and even to social interaction at the workplace (McCoy and Evans, 2005, Vischer, 2007, Fairbrother and Warn, 2003, Leong et al., 1996, Sullivan and Bhagat, 1992, Burke, 1988).

This has led some authors to develop the concept of environmental comfort as something that goes beyond simply guaranteeing the employee's health and safety in the workplace (Vischer, 2005).

Environmental comfort includes three categories: Physical, functional and physiological comfort, which together make the work environment stimulate employees for them to achieve a higher performance when developing their tasks (Vischer, 2007).

Physical comfort is related with the basic conditions to guarantee employees' safety, cleanliness and accessibility throughout the company. Functional comfort is aimed at the support that in ergonomic terms must be given to employees, on one side, to keep a healthy lifestyle, and on the other, to achieve a greater efficiency in the development of their tasks. Finally, psychological comfort is related with those working environment conditions which enable reinforcing the feeling of belonging and loyalty towards the company (Vischer, 2007, Sundstrom, 1986).

Therefore, it can be stated that both cleanliness and neatness, at any level of the organization, contribute significantly to employees' motivation and to their reduction of stress levels. It thereby helps to achieve a healthy and productive work force.

In this same way, it can be stated that *seiso* and *seiton*, pillars of the 5S's methodology are based on the field of organizational behavior and specifically on that related to increasing motivation and reducing work-related stress (figure 2).

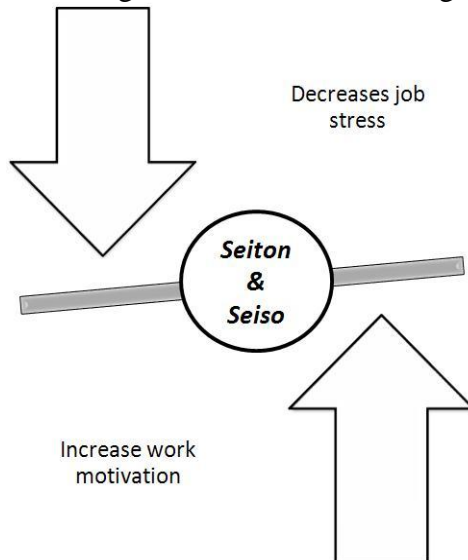


Fig. 2 Order and cleaning to increase motivation and reduce work stress

Discipline as part of the training process

Organizational learning has been defined as the process that increases the knowledge of the organization and the people that form it, generating a culture that facilitates and enables the conditions to develop new capabilities, to design new products and services, to increase the already existing offer and improve the processes aimed at durability (Argyris, 1995, Garzón C. and Fisher, 2008, Senge, 1990, Choo, 1998).

Experts in the subject of organizational learning state that learning means changing behavior; it is any permanent change in people's behavior by means of education and experience (Robbins, 1993, Muchinsky, 2007, Swieringa and Wierdsma, 1992). The purpose of this change is to achieve a form of behavior which adapts better to the goals of the person learning and of the organization.

In the field of education, discipline has started to be viewed as a gradual process in which an apprentice is progressively led to share objectives, to see himself as part of a community, to recognise his role, his responsibilities and their meaning. Thus, the lacking skills must be taught: respect, order, the search for a suitable atmosphere, among many other aspects (Cotera B., 2009, Liendo and Valenzuela, 2004).

In other words, discipline conceived within a training process is synonymous with change of behavior, which must be proven, not only with what and how much knowledge has been acquired but what is actually done with it. Thus, the change of behavior is with the aim of improving the quality of someone's actions (Swieringa and Wierdsma, 1992).

After these last considerations it is stated that *shitsuke* as pillar of the 5S's methodology is also based on the field of organizational behavior and specifically on that related to peoples' learning (figure 3).

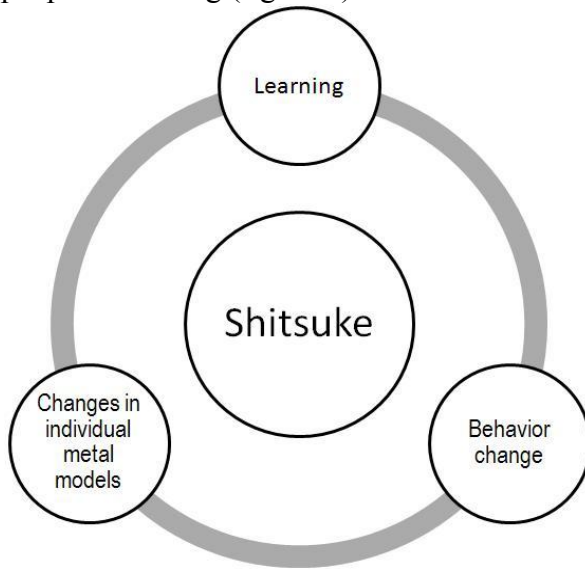


Fig. 3 Discipline as a learning process

The 5S's from a scientific point of view

As a summary we can assert that the 5S's are composed of a set of activities which allow people's behavior to be favourably influenced and also to improve the processes (including the operations) of an organization.

In other words, and as seen on figure 4, we are stating that the 5S's have a scientific basis which explain why there are five S's, how they influence people, the workplace environment and how they influence the improvement of processes in any organization.

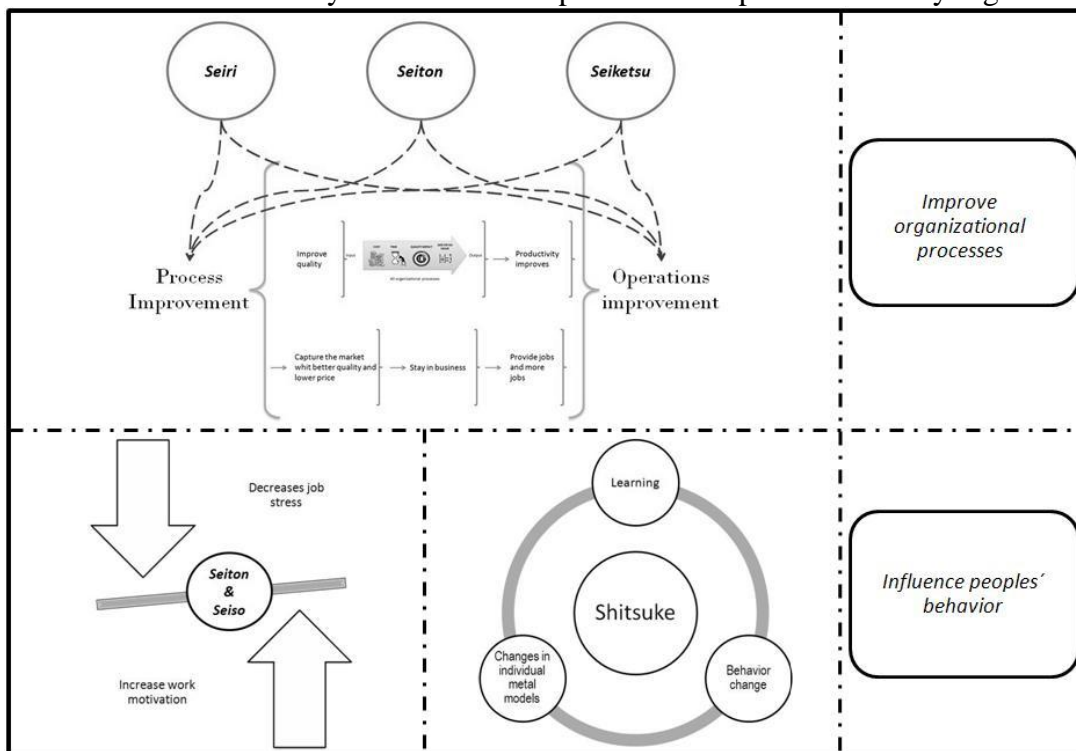


Fig. 4 The 5S's in the processes and in peoples' behavior.

Thus, this basis allows us to separate the principles of the 5S's from the beliefs of the Japanese culture and prove that their implementation is a basic step for any organization to begin on the path of sustainable continuous improvement.

HAFITe model general structure

We believe that the way of applying the principles of the 5S's does not only consist in using a set of techniques that allow putting things in order, eliminating what is unnecessary, keeping the machines and the workplace clean and finally follow up on the results by means of audits.

Nor are we asserting that the techniques to implement the 5S's are badly designed or that their application is pointless. What we maintain is that these must be applied from identifying peoples' needs (employees) and not exclusively based on the company's own interests.

This aspect which may seem trivial is possibly what can explain the success of the 5S's in the Japanese culture. To be organised and clean has a profound and significant meaning for the Japanese people. It is possible that the perception could currently be different, although this will not be discussed in this article.

On the contrary, in the West the application of the 5S's is mainly due to the company's interest. In fact, they are implemented and maintained if they can prove an increase in productivity and a reduction of the production costs. It is sufficient to take a look at the literature regarding the implementation of the methodology of the 5S's and to state that all the documentation is aimed at improving the workplace in order for the tasks to be developed more efficiently.

The abovementioned reveals that to be able to implement the principles of the 5S's it is necessary to jointly consider the needs and interest of the people and of the company.

On the other hand, any company that wishes to achieve the desired and sustained levels of profitability, quality and productivity must have the support from its most important capital: Its employees.

We believe that the key lies in allowing people, as Deming states, to feel proud of the work they carry out, for them to see they are important and that their task contributes significantly to the company's development and they can collaborate in improving the system (Deming, 2000). From this perspective, it is about promoting employees' true involvement in the company.

It is under these considerations that **HAFITe** or Help Tool to Promote Employee Involvement within the Company, emerges as a theoretical model which explains how a company can implement the principles of the 5S's from a scientific approach thereby influencing employees' behavior and improving the company's processes.

How does the HAFITe Model operate?

Now then, as we can see on figure 5 and in a bottom-up and left-right interpretation, we can say that the HAFITe Model focuses on two main objectives: First, to influence employee’s behavior and, second to improve the company’s processes.

As is known, many companies start by improving their processes and operations, which does not mean, of course, that this is wrong. The critical point is however, that by starting to improve the processes and operations the effort is concentrated in attending what could be called the “technical” aspects and in the majority of cases this can leave the feeling that these improvements entail eliminating job positions and laying off staff.

Naturally, this generates a negative effect on employees’ perception due to the introduction of continuous improvement programmes and therefore these end up by colliding with the human relations problems, as stated by Womack and Jones in their book Lean Thinking (Womack and Jones, 2003).

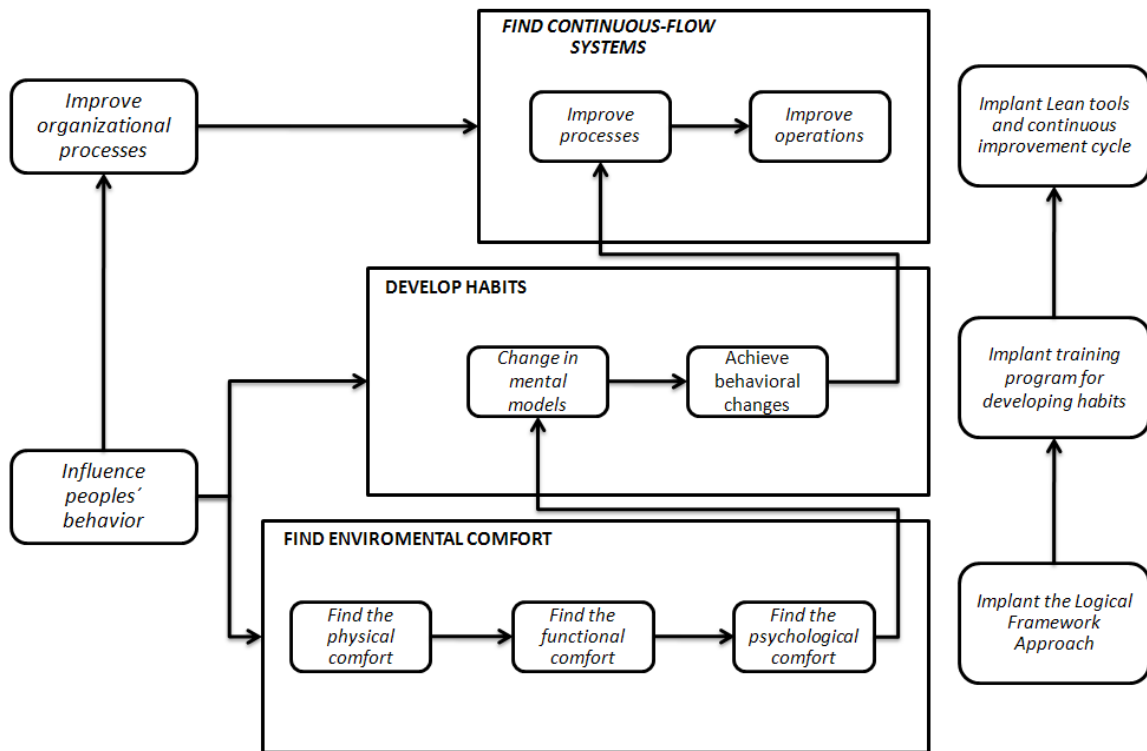


Fig. 5 HAFITe Model general structure.

However and continuing with figure 5, we believe that three deployment stages are required to achieve these two objectives, two of them aimed at influencing employees’ behavior and the last one, aimed at improving the company’s processes and operations.

Find environmental comfort

The first stage must find environmental comfort which according to Vischer’s model involves working in physical, functional and psychological comfort to increase employees’ levels of motivation and reduce their possible causes for stress.

To find environmental comfort within the company the **HAFITe Model** proposes using the methodology known in the social sphere as **Logical Framework Approach (LFA)**.

The Logical Framework approach is a methodology which highlights linkages between the different views identifying their particular interests and the resources or mandates with which they can be in favour or against a solution proposal. It is a methodology that improves the engagement of those involved (in this case the employees) by considering at the same time the perception of the problems and the future image expected to be achieved when the problems have been solved. It is therefore ideal to generate a shared vision of all those involved from the construction of consensus (NORAD, 1999).

For our purposes, this methodology has been adapted to be able to identify and solve problems related to environmental comfort. The following steps of the FLA will essentially be applied:

- **Participation analysis:** The problems in the environmental comfort must be identified from the groups involved (areas, offices, sections, floors, staff, supervisors, mid-level managers and directors, among others) according to Vischer's model.
- **Problem analysis:** Consists in identifying the cause-effect relationships between the major problems found in the analysis of participants and thereby be able to reach the root of the problems.
- **Objectives analysis:** Consists in identifying the future desired situations in each of the comfort categories and identifying the means-end relationships which allow reaching the desired situation.
- **Alternatives analysis:** Consists in analysing the possible alternative solutions of the problems to reach the future solution desired. This is an exercise of creativity and idea generation.
- **Project planning:** Consists in preparing and presenting the activities, resources and costs necessary to develop the proposal(s) for solving the problems. All the information is condensed into a single Logical Framework Matrix or LFM

Develop habits

The second deployment stage of the **HAFITe Model** has the aim of generating changes in peoples' mentality and behavior through developing habits.

For this purpose it is necessary to provide a training programme aimed at developing habits. This training programme is not at odds with the technical training. On the contrary, it complements it by allowing employees to acquire a series of habits which are favourable for their personal growth, as well as for the fulfilment of their task or/and professional activities.

The habit development programme proposed by the **HAFITe Model** is characterised by the following aspects: firstly, it allows people to recognise their own limitations and inefficiencies with the aim of identifying the need of a change in thinking.

A person's attitudes and behaviors will not change unless they are not tackled from the root, that is, from the paradigms from which the attitude and the behavior flow from (Covey, 1989).

Secondly, the programme allows each person to identify what habits he needs to develop for his personal growth (**mental, spiritual, social and family**) and thereby improve his professional performance. At the same time, the programme provides a set of techniques to start acquiring new habits.

We know that one single act does not make a habit, nor do several repeated ones at random or under certain circumstances. A habit is a repetition of meaningful acts: Knowing what is done and why it is done, wanting to always act in the same way regardless of the circumstances and the environment. The abovementioned supposes an arduous and persevering task for the person who wants to acquire a habit. This is a tremendous process and commitment.

Find continuous-flow systems

The third stage for the deployment of the **HAFITe Model** wants to improve the processes and operations with the aim of achieving continuous-flow to obtain a specific product (good or service or a combination of the two). For such purpose, the Model resorts to applying Lean tools and continuous improvement cycle proposed by Deming with the aim of establishing a route of action.

The activities proposed by the **HAFITe Model** to introduce improvements in the processes and operations are the following:

- **Define processes:** Which implies elaborating the map of processes and establishing relations, discovering the client's needs (internal and external), and identifying the critical process, among other aspects.
- **Distinguish between the activities which add value and those which don't:** An operations flow diagram must be elaborated for this purpose, as well as a SIPOC (Supplier, Input, Process, Output, Customer) matrix and it is necessary to clearly establish process indicators.
- **Arrange the process in continuous flow:** Which consists mainly in eliminating tasks that do not add value, eliminating the need for inspection points, move the inspection points before the problems occur, eliminating the need of storing, eliminating unnecessary elements in a workplace (improvement of operations), combining the elements of a task with another (improvement of operations) and reorganising a task's elements in order to make it easier (improvement in operations).

All these activities must be undertaken with the participation of the operators or their representatives in improvement teams. Their active participation allows promoting a greater employee involvement within the company.

Some final considerations

The creation of the **HAFITe Model** conforms to a bibliographic review based on two areas of knowledge. On one hand, on the theory developed around the concepts of

continuous improvement, and on the other, on the theory related to the field of organizational behavior. In other words, the model is built from the point of view of the processes and of the company's employees.

HAFITe is a people-oriented model. That is, it focuses first in making the human capital - the most valued asset for any company - acquire a level of commitment with the company to which it dedicates most of its time. Regardless of whether the employee develops his task in a workshop or in an office, the most important thing is that he finds wellbeing and physical, psychical and/or emotional satisfaction when developing his activities, which contributes to his personal development.

An employee's attitude may vary as he feels that his work is another input for his personal development. These changes together with a greater transparency in the company's management and communication, are the bases that this work proposes as an initial path to approach company improvement.

Once this aspect has been achieved which is crucial for any organizational improvement, the Model focuses on improving the processes and operations (an improvement which is difficult to fully achieve if it doesn't have the help and the commitment from all the people involved).

The following advantages are expected when applying the **HAFITe Model**:

- a) Introduction of a company in the path of continuous improvement by means of a scientific approach specific of the **HAFITe Model**.
- b) Increase of productivity due to the development of training programmes aimed at changing people's mentality (change of habits).
- c) Increase in employees' morale as there is an improvement of the environmental comfort in its three aspects: Physical, functional and psychological.
- d) Reduction of the degree of absenteeism and staff rotation as the environmental comfort improves in its three aspects: Physical, functional and psychological.
- e) Increase of the company employee engagement as all the staff is involved in identifying and solving problems from consensus-building and shared vision.
- f) Increase of productivity due to the introduction of improvements both in the processes and operations.

The following step now, which was object of an applied research, is to validate the theoretical model proposed by implementing and monitoring it in companies of the industrial and services sector.

Once the **HAFITe Model** has been validated and adjusted, with the collaboration from the company's that promote the application of continuous improvement, this model may be implemented in any type of company that wishes to be constant with the purpose of improving the product or service to become competitive, stay in the business and to be a permanent source of employment and work satisfaction.

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Customer satisfaction metrics in health service organizations: evidence from the Greek hospitality sector

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Introduction

A firm's understanding of how its clients evaluate the services offered is crucial to the development of sound initiatives targeting at maintaining and improving the client basis of a firm. Especially in the field of health marketing, the patient is a unique customer in the sense that he/she does not usually voluntarily seek for medical services. When, however, these services are required, it is common to believe that beyond the outcome of the treatment and the process of being treated the average customer may well seek for the best available service. Changes in the legislative and political environment in the EU lead to heightened competition among different health care providers, who in turn start to realise that the provision of customer satisfaction is a key element of success and long term viability. This is true even in the case of public hospitals, where the State demands for further utilisation of scarce resources and better quality of services to the citizens. Hence, the need for health care organisations to have accurate representation of citizens' (patients') perceptions of quality and satisfaction is imperative. Noticeably, the availability of variables and models pertaining to satisfaction and quality provide a unique research opportunity to the health service sector.

The relationship between service quality and satisfaction, expressed as either a distinction or an association between the two, remains at the forefront of many academic- and practitioner-oriented research endeavours in many areas (Anderson and Fornell, 1994; Brown and Swartz, 1989; Fornell, 1992; Host and Andersen, 2004; Lassar et al., 2000; Spreng and MacKoy, 1996). Despite a significant interest in service quality and its dimensions (e.g. reliability, responsiveness), very little research has investigated the effects of specific dimensions of service quality on satisfaction and loyalty (Jamal and Anastasiadou, 2009; Bloemer et al., 1999; Wong and Sohal, 2003).

Originally, the concept of service quality has been introduced to replace the *missing product* in services and the so-called *service concept* has been identified as an idea of how the quality-generating resources should function and how they can be transformed to provide satisfaction to the customer (Gronroos, 2001). The dimensions of quality emerge to give an equivalent of the product features where the customer either consumes outcomes (in products) or processes (in services) (Grönroos, 1998). The same author mentioned*"I never thought that the service quality model would be anything other than a conceptual model that would help researchers and practitioners to understand the need for satisfying elements of a marketing model in a service context.....However services marketing research took another avenue here.....We should probably have had a model of perceived service features instead of service*

quality. That way, much of the confusing and time-consuming discussion of the relationship between service quality and customer satisfaction could have avoided.....” (2001,p.151).

Despite these concerns and the apparent confusion, much of the previous service quality and customer satisfaction researches have been concentrated on the SERVQUAL instrument and also few efforts have been made to test a two-component model of service quality that includes both technical and functional quality (Kang, 2006). Moreover, despite a significant interest in service quality and its dimensions (e.g. reliability, responsiveness), very little research has investigated the direct effects of physical and interactive features on satisfaction (Jamal and Anastasiadou, 2009; Pantouvakis, 2010; Bloemer et al., 1999; Wong and Sohal, 2003). Hence the main purpose of this study is to assess the influence of physical and interactive elements of services on overall satisfaction, according to *Grönroos*' (2001) thoughts.

On the other hand, health services and other non-profit organizations are increasingly embracing the marketing concept, which involves a total organizational effort to satisfy customers *and* meet organizational objectives. While business firms often strive to make a profit, non-profit organizations such as hospitals have a different “bottom line”.

Patients' satisfaction and assessments of health service quality

Much has been written in the area of service quality and customer satisfaction within the context of health care services (Nelson et al., 1992). Special emphasis has been given to the distinction between patient-perceived service quality and patient (perceived or expected) satisfaction (e.g. Jun et al., 1998; Taylor, 1994). The most pervasive issues in relation to that are the following three:

The first issue addresses the need to approach patients' satisfaction and health service quality as previously discussed, albeit within the conditions that prevail within the health service context. Hospitals are complex organizations that offer a wide range of services covering customer needs or requirements for a “total” service. They are in the sense of Berry's “multi-service organizations” (Berry, 1995), where a core and essential service (treatment) may be identified rather objectively, whereas a peripheral service element is what determines the quality perceived or the satisfaction experienced (Gabbott and Hogg, 1996). Especially in the context of public hospitals the challenges are even higher due to their non-profit nature and their pursuit of general public/social interest (Butler and Collins, 1995). In these non-profit environments attention on quality and satisfaction for both customers and employees seem to be at the center of every endeavor (Eckerlund et al., 2000). Within this context, a large collection of studies appeared since the late 1980s focusing on hospital and medical services' patient satisfaction (e.g. Comley and DeMeyer, 2001; Brown and Swartz, 1989; Donabedian, 1988' Fisk et al., 1990; Gilbert et al., 1992; Hall, 1996; Nelson, 1990; Shikiar et al., 1999; Singh, 1990; Smith et al., 1986; Ware and Hays, 1988; Woodside et al., 1989). On the other hand, quality of the health care service is often evaluated by patients considerably differently from clinically based objective measures of quality, mainly due to the information asymmetry observed between the health care provider and the recipient of the service. It thus seems that patients tend to make decisions based on their subjective evaluations, which makes their perceptions of quality and satisfaction very

important. The question of whether quality or satisfaction leads to the other still remains inconclusive in the relevant literature (McAlexander et al., 1994; Oswald et al., 1998), but certain studies (Bolos and Pitts, 1999; Sureshcandar et al., 2002) identify a positive correlation between the two.

The second issue of interest thus involves the way health service satisfaction or quality is operationalized. Patients' satisfaction, for example, should be considered as a multidimensional construct. Past studies indicate that access (including items such as convenient location, waiting time, convenient hours, etc.) (Hall and Press, 1996; McKinley et al., 1997; Piette, 1999), communication (including time spend, thorough explanation of tests and procedures, etc.) (Cooper-Patrick et al., 1999; Joos et al., 1996; Piette, 1999; Roter et al., 1997), and outcomes (Bayley et al., 1995; Cooper-Patrick et al., 1999; Hall and Dornan, 1988; Kyes et al., 1999; Piette, 1999; Rutledge and Nascimento, 1996) can be good predictors of patients' overall health care satisfaction. Additionally, much has been written in respect to patient perceptions of service quality (e.g. Babakus and Mangold, 1992; Bopp 1990; Bowers et al., 1994; Butler et al., 1996; Cronin and Taylor, 1994; Hill and McCrory, 1997; Lytle and Mokwa, 1992; Reidenbach and Sandifer-Smallwood, 1990; Roberts, 1998; Soliman, 1992; Vandamme and Leunis, 1993). Dimensions such as caring (Jun et al., 1998; Williams et al., 1998), empathy, reliability and responsiveness (Bowers et al., 1994; Calleja and Gauci, 1999; O'Connor et al., 1999) may characterize perceptions of patients' quality of received service from the American school's point of view. The Nordic school's "technical" quality in the health care environment, also referred to as "quality-in-fact", is defined primarily on the basis of the technical accuracy of the diagnoses and procedures. Various techniques for measuring technical quality have been proposed and are currently in use in health care organizations (Joint Commission for Accreditation of Health Care Organizations, 1987). Because this information is not generally available to the public, knowledge of the technical quality of health care services remains within the purview of health care professionals and administrators (Bopp, 1990). On the contrary, the Nordic school's "functional" quality still remains in the forefront of every customer's assessment of the health care service provided.

The third pervasive issue relates to the appropriateness of the measuring instruments. As it has been pointed out previously, SERVQUAL models have been used in the health care sector with inconsistent results. Disconfirmation or "gap analysis" models seem unable to capture the relative importance customers assign on expectations regarding the "peripheral" nature of the services offered. In one of the most influential empirical studies to date, Taylor and Cronin (1994) found that patients' expectations failed to significantly predict their satisfaction. They concluded that, although the gap analysis portion of SERVQUAL may add value, it seemed inappropriate to fully capture the assessments of patients regarding quality of the health care service they receive.

Nevertheless, service quality has been introduced to replace the *missing product* in services and the so-called *service concept* has been identified as an idea of how the quality-generating resources should function and how they can be transformed to provide satisfaction to the customer (Gronroos, 2001). The dimensions of quality emerge to give an equivalent of the product features where the customer either consumes outcomes (in products) or processes (in services) (Gronroos, 1998). Finally, the two so debated constructs of quality and satisfaction, especially in long-term

relationships, tend to merge into an overall evaluation of relationship satisfaction (Leverin and Liljander, 2006). Perceptions of technical (physical or “tangible”) and “functional” (interactive or process) quality directly influence relationship satisfaction (Yap and Sweeney, 2007, Caceres and Paparoidamis, 2007). Finally Gronroos comments:

“I imagined that how well perceived service quality dimensions serve customers’ could and should be measured with customer satisfaction with the service. Quality as such should not be measured...I should probably have used the terms of technical and functional features of services instead of technical and functional quality...” (2001, p. 151).

Thus, this study takes the view that perceived service quality dimensions (service features) are strongly and directly related to satisfaction with the service provided. Our proposition is:

H1. The service quality features are directly and positively related to satisfaction with the service provided.

Methodology

Data were gathered in nine public hospitals (four of which University hospitals) in five major cities in Greece. The data collection method was that of personal interviews with respondents, conducted by especially recruited and trained interviewers inside the hospitals’ premises. The randomly selected participants were either the patients themselves (usually) or their companion(s), since both of them experience the service provision. After checking filled-in questionnaires for completeness, the final sample consisted of N=1,298 health care services’ users of all kinds. The profile of the sample can be seen in Table I and it is considered representative of the general population. A further codification question was included regarding the type of health care use by the respondents (i.e. internal or external medical services’ user) and other contextual parameters (i.e. which was the person who selected a specific hospital, other experiences of the respondent with the same hospital, etc).

Take in Table I

Information on perceived quality of the health service provided was obtained through the use of an especially developed inventory containing 11 items. These items were drawn from the relevant literature described above, and can be seen in Table II. The items were organised into two themes, one for each component of the hypothetical measurement model (i.e. physical and interactive). All 11 items were measured on a 5-point Likert scale with end-points 1 = “very bad” to 5 = “very good”.

Table in Table II

Moreover, respondents were asked to indicate their perceived satisfaction from the health care service provided by means of two items (“*total perceived satisfaction from the quality condition of the hospital’s infrastructure*”, and “*total perceived satisfaction from behaviour of the personnel - e.g. politeness, kindness etc.*”), measured on a 5-point Likert scale with end-points 1 = “very low” to 5 = “very high”.

Descriptive statistics of the service features and satisfaction, items can be seen in Table III.

Take in Table III

Analysis and results

Health service quality

In order to test the reliability of the 11-item health care service quality inventory introduced, a Cronbach alpha measure was obtained. The reliability scores of 0.84 for the physical quality component and 0.91 for the interactive quality component were considered very satisfactory, assessing the good scaling of the instrument. Cronbach alpha-if-item-deleted values were found lower than the relevant reliability scores for the two quality components for all 11 items, indicating that no item deletion was necessary to improve reliability. Therefore, all 11 items were retained for further analyses.

In order to find the interrelationships between items and verify the hypothesis for the two service features having an impact on customer satisfaction, exploratory factor analysis (EFA - Principal Components Analysis with Varimax rotation - SPSS v.12) was performed first on the 11-item inventory, followed by confirmatory factor analysis (CFA – AMOS v....). The Kaiser-Meyer-Olkin statistic in EFA was very high (0.908), indicating the existence of strong relationships among items. In all, two factors were extracted explaining 64.8% of the total variance. Table IV shows the results obtained, as follows: factor 1: *physical feature*. It deals with the main competence and tangible quality elements of the service provided and it entails core-product elements of health care service quality. Overall, it is considered to be the most important component of health service quality, accounting for 33.6% of the total variance; and factor 2: *interactive feature*. It captures the complete patient-personnel “relationship” element of the health care service quality. It presents the respondents’ opinions on the way that hospital staff of different types (e.g. medical and contact staff) behaves when it interacts with them. Overall, it is considered to be equally important component of health service quality, accounting for 31.1% of the total variance.

Take in Table IV

Before proceeding with the confirmation of the 2-factorial configuration of the 11-item inventory, the multi-normal distribution of the 11 quality variables has been checked. The observed variables were normal, with all kurtosis and skewness indices lower than |1|. Maximum Likelihood CFA (LISREL 8.72) was used as a method of CFA model estimation. The fit of the CFA model was reasonably good, with CFI: 0.98, NFI: 0.97 and RMSEA: 0.053. The standardized factor loadings also assessed convergent validity, ranging from 0.50 to 0.86. The estimated correlation between the physical and the interactive features component was 0.59, also satisfying discriminant validity (see Table IV).

Perceived health customer satisfaction as a function of quality

As a dependent variable, satisfaction was depicted by means of two items as explained above. The reliability of the 2-item perceived satisfaction construct was satisfactory (Cronbach alpha = 0.77), assessing its good scaling. Through EFA, a satisfaction factor

score was calculated per respondent and retained for future use. A similar score was calculated per respondent for the expected satisfaction construct.

Similarly with before, the multi-normal distribution of the 2 perceived satisfaction variables was assessed first. The observed variables were normal, with kurtosis and skewness indices lower than |1|. Maximum Likelihood (LISREL v8.72) was thus used as a method of the structural model estimation (Figure 2). The fit of the structural model was reasonably good, with CFI: 0.96, NFI: 0.96 and RMSEA: 0.065. The standardized factor loadings also assessed convergent validity, ranging from 0.51 to 0.86. The estimated correlations were under or very close to 0.85, also satisfying discriminant validity.

Take in Figure 2

Conclusions and further research

Almost twenty years of conceptual work have been devoted to address the divergent issues of service quality, customer satisfaction and the determinants that may be better describe the phenomena under consideration. At the very centre of this debate stands the Nordic and the American schools of thought, each following its own footing, introducing unique models and measurement instruments. The resulting impasse has led to a call for research that reconsiders the means, the ends and the methods for assessing the overall satisfaction received by the customer.

The objective pursued in this paper has been, on one hand, to study the multi-dimensionality of satisfaction and on the other, to integrate the antitheses observed in several models and move forward to develop a predictive model of customer assessments. On the basis of the results presented we, thus, provide qualitative and empirical evidence that customer satisfaction is multi-dimensional constructs.

Research into the interrelationship between physical and interactive features and overall satisfaction is important from theoretical as well as managerial perspectives. From the theoretical view this research reassesses *Grönroos's* (2001) thoughts about the confusing and time-consuming discussion of the relationship between service quality and customer satisfaction. The empirical validation of the relationships between physical and interactive features and overall satisfaction on a multinational sample in a hospitality service environment substantiated our hypothesis. Our research instrument was designed to incorporate the *Grönroos's* (2001) proposal. As such, the research instrument represents physical and interactive features of services and overall satisfaction.

Limitations and Suggestions

The limitations of our study are basically three. First, those related to the case analysed: the public hospitals in Greece. The study should be extended to other private owned enterprises, as well as other service sectors where certain modifications may be introduced. Second, special attention should be attributed to specific market segments according to their sociodemographic characteristics and factors affecting and differentiating behaviours and beliefs. Of special interest seems to be the influence of the life style and /or the media or the word of mouth in forming assessments regarding a

service organisation such as a Hospital. Finally, our conceptualisation is grounded on the disconfirmation paradigm but a replicate of this or similar study with a thorough examination of the perceived minus expected satisfaction gap as well as the factors that form this – if any – gap may well advocated from the literature.

Managerial implications

Our model can assist managers to understand how their customers assess the service experience they are offered. This is made through the principle that overall satisfaction should better pursued instead of service quality alone. Evidently overall satisfaction is a construct including the “physical”, the “interactive” and the “corporate” elements of service quality. These factors require managerial attention in efforts to improve consumer perceptions on satisfaction. From another conclusion of our study the service quality elements appear to have fundamental influence in forming overall satisfaction perceptions. This is particularly important for practitioners who may see their pricing policies of lesser effect than their quality programmes.

The potential implications of the research are numerous. From a managerial standpoint the conceptualisation can be used to quickly assess customers’ rankings of satisfaction based on the prediction power of the model. Using only five scores in every of the five identified factors the administrators can predict their customers evaluations on overall satisfaction perceived. On the other hand they may better allocate their scarce resources prioritising their policies to better and efficiently meet their customers’ needs. This may be achieved through a comprehensive analysis of satisfaction and subsequent identification of the areas that effort have to be devoted. From a competitive standpoint the identified variables can be used to compare service levels with competitors’ through the use of “enigmatic” questions. Therefore the comparisons can be made on an indirect rather than direct manner.

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Tables and Figures

Table I: Demographic characteristics of the sample, N=1,298

Demographics	Percent
Age	
15-25	16,0
26-35	12,1
36- 45	21,1
46-55	22,1
56-65	15,0
66+	13,7
Gender	
Male	48,0
Female	51,9
Education	
Primary	23,3
Secondary	45,2
University	28,7
Post graduate studies	2,8
Marital status	
Married	66,4
Divorced	4,8
Non-married	28,8

Table II: Description, postulated structure and bibliographical source of the 11-item health care service quality inventory

Item	Bibliographical source
Physical	
1. General sense of cleanliness	Olorunniwo et al (2006), Parasuraman et al (1985, 1988), Seth et al (2006)
2. Quality and appearance of the “hotel” equipment of the hospital	Olorunniwo et al (2006), Parasuraman et al (1985, 1988), Seth et al (2006)
3. Sufficiency and sanitary condition of public places (e.g. toilets)	Olorunniwo et al (2006), Parasuraman et al (1985, 1988), Seth et al (2006)
4. Quality, quantity and variety of food served	Olorunniwo et al (2006), Parasuraman et al (1985, 1988), Seth et al (2006)
5. Supplementary services offered for patients and their accompanying persons	Hallowell (1996)
6. Feeling of security and quietness	Olorunniwo et al (2006), Parasuraman et al (1985, 1988), Seth et al (2006), Groonroos (1988), Ghobadian (1994), Johnston (1995), Philip and Hazlett (1997)
Interactive	
7. Information and feedback offered by the personnel	Seth et al (2006), Philip and Hazlett (1997), Hallowell (1996)
8. Thorough treatment from the medical staff	Seth et al (2006), Philip and Hazlett (1997)
9. Politeness and attention of the contact personnel	Olorunniwo et al (2006), Parasuraman et al (1985, 1988), Seth et al (2006), Haywood-Farmer (1988)
10. Discretion, understanding and interest experienced by the contact personnel	Olorunniwo et al (2006), Parasuraman et al (1985, 1988)
11. Availability and willingness to assist of the personnel	Olorunniwo et al (2006), Parasuraman et al (1985, 1988), Mersha and Adlakha (1992), Hallowell (1996)

Table III: Descriptive statistics of the service features and satisfaction, N=1,298

	Mean	SD	Item-total correlation	Alpha if item deleted
PHYSICAL QUALITY				
(Cronbach alpha = 0.846, mean = 3.27)				
1. General sense of cleanliness	3.38	3.38	1.004	0.706
2. Quality and appearance of the “hotel” equipment of the hospital	3.24	3.23	0.991	0.717
3. Sufficiency and sanitary conditions of the public places (e.g. toilets)	3.19	3.19	1.025	0.727
4. Quality, quantity and variety of food served	3.33	3.33	0.869	0.474
5. Supplementary services offered for patients and their accompanying persons	3.13	3.13	1.018	0.580
6. Feeling of security and quietness	3.39	3.39	1.042	0.563
INTERCATIVE QUALITY				
(Cronbach alpha= 0.916, mean = 3.78)				
7. Information and explanation offered by the personnel	3.87	3.86	0.947	0.662
8. Thorough treatment from the medical staff	3.84	3.84	0.921	0.816
9. Politeness and attention of the contact personnel	3.80	3.80	0.950	0.823
10. Discretion, understanding and interest experienced by the contact personnel	3.75	3.75	0.926	0.823
11. Availability and willingness to assist of the personnel	3.64	3.64	0.908	0.750
PERCEIVED SATISFACTION				
(Cronbach alpha = 0.771, mean = 3.57)				
1. Total perceived satisfaction from the quality condition of the hospital’s infrastructure	3.37	0.92	0.528	0.779

2. Total perceived satisfaction from the behaviour of	3.78	0.90	0.597	0.701
the personnel (e.g. politeness, kindness)				

Table IV: Factor analysis results, N=1,298

A. EXPLORATORY FACTOR ANALYSIS

Item number	Item description	Factor	
		1 Physical	2 Interactive
1	General sense of Cleanliness	0.78	
2	Quality and appearance of the “hotel” equipment of the hospital	0.80	
3	Sufficiency and sanitary condition of public places (e.g. toilets)	0.82	
4	Quality, quantity and variety of food served	0.57	
5	Supplementary services offered for patients and their accompanying persons	0.68	
6	Feeling of Security and quietness	0.61	
7	Information and explanation offered by the personnel		0.72
8	Thorough treatment from the medical staff		0.85
9	Politeness and attention of the contact personnel		0.86
10	Discretion, understanding and personal interest experienced by the contact personnel		0.86
11	Availability, and willingness to assist of the personnel		0.80
	eigenvalues	3.70	3.42
	Variance explained	33.1%	31.1%

B. CONFIRMATORY FACTOR ANALYSIS

1	General sense of cleanliness	0.80
2	Quality and appearance of the “hotel” equipment of the hospital	0.81
3	Sufficiency and sanitary conditions of the public places (e.g. toilets)	0.81
4	Quality, quantity and variety of food served	0.50
5	Supplementary services offered for patients and their accompanying persons	0.61
6	Feeling of security and quietness	0.61

7	Information and explanation offered by the personnel	0.71
8	Thorough treatment from the medical staff	0.84
9	Politeness and attention of the contact personnel	0.84
10	Discretion, understanding and personal interest	0.86
11	Availability and willingness to assist of the personnel	0.81
experienced by the contact personnel		
Correlations		
Physical	Physical	1
Interactive	Physical	0.59
	Interactive	1

Note: All items measured in a five point scale (1= very bad, 5=very good).
EFA Loadings lower than 0.200 have been omitted

Figure 1: Measurement model of perceived health service satisfaction

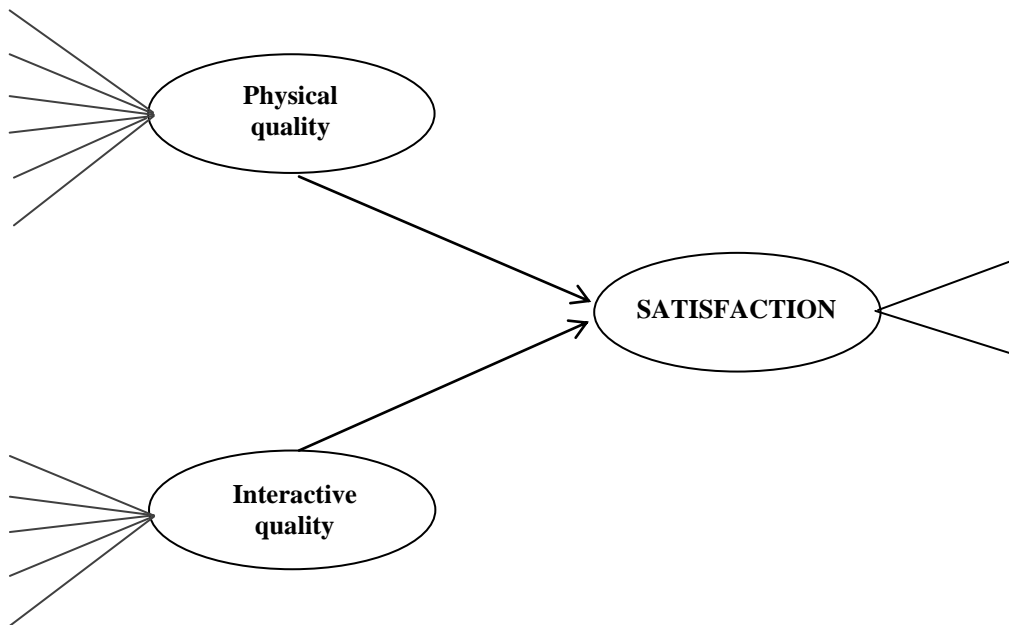
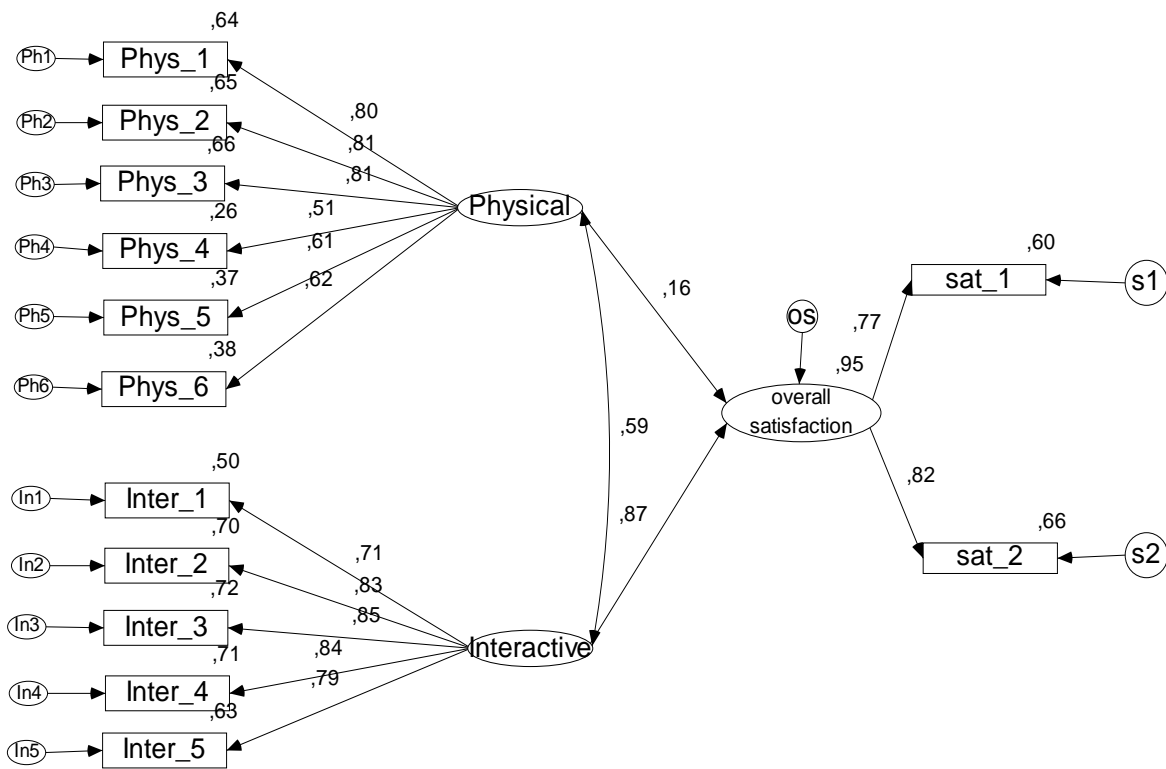


Figure 2: Structural model of perceived health service satisfaction (standardized solution)



Listening to the voice of the patient: new insights in health care service development

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Key words: Patient driven innovations, health care improvement, diaries.

Introduction

The user-driven innovation approach has received much attention in recent years (e.g. [Magnusson et al., 2003](#); [Nambisan, 2002](#)). The business community has started to realize that innovation can arise not only from within the company but also from outside by interaction with users, customers and partners. According to Nambisan ([2002](#)) there are three major roles for the customer in the innovation process: customer as resource, customer as co-creator, and customer as user. Matthing et al. ([2004](#)) found that ideas for service development generated by customers were more innovative than those from professional service developers. The authors highlight the importance of identifying and understanding latent customer needs to get more innovative ideas ([Matthing et al., 2004](#)).

In the health care sector, the tradition of working systematically with innovation is much weaker, but concepts like patient-centred care ([Epstein, 2000](#); [Stewart, 2001](#)), patient involvement ([Entwistle and Watt, 2006](#); [Hughes and Larson, 1991](#)), patient participation ([Guadagnoli and Ward, 1998](#); [Longtin et al., 2010](#)) and patient empowerment ([Anderson and Funnell, 2005](#); [Saltman, 1994](#)) have gained much attention in recent years. The general idea is that better results can be achieved when patients become active participants in health care processes. The patient role has changed from being a passive recipient to a more autonomous, active, or collaborative participant ([Tariman et al., 2009](#)). The involvement of patients in shared decision-making or self-care management is the subject of many research papers (e.g. [McWilliam, 2009](#); [Saba et al., 2006](#); [Stevenson, 2003](#)), yet the active participation of patients in the development of health care service is not widely discussed in the literature. In practice, there is still a knowledge gap on how patients can be involved in the development of health care services and there are only a few studies in this area ([Molyneux and Fulton, 2006](#); [Wensing and Grol, 1998](#)).

Traditionally, health care organizations work with surveys and interviews with patients after their treatment have been completed. This form of patient participation is rather symbolic and has limited value for developing health care services. The primary problem is that retrospective methods do not yield satisfactory guidance and understanding of the patient's perspective ([Groene et al., 2009](#)). The researchers in the service area suggest that an important aspect in the development of services is to get closer to the real patient experience ([Matthing et al., 2004](#)). Patients have a unique knowledge of their own health care problem, treatments, procedures, and medications, and they may have ideas about how different issues could be solved and improved. By coming closer to the various situations in which the patient perceives problems and starts to think about ideas, we are able to learn more about patients' view on health care services. Experiences from other contexts tell us that organizations that have greater knowledge of their customers are likely to be more successful in the development of new services ([Lusch and Vargo, 2006](#); [Pope et al., 2002](#)).

Matthing et al. (2004) suggest that organizations need to develop new methods and interaction processes to enable innovation sharing with users. Witell et al. (2011) argue that co-creation-oriented techniques designed to capture customers' value-in-use are more likely to provide ideas that are beneficial for service innovation. In this article we use a diary method to gather experiences and ideas as they are generated in the patients' own spatial and temporal context. This paper aims to draw attention to the possibilities of user-driven innovation in the health care sector. More specifically, the research question that guides the present study is: How can patients participate in health care development depending on the degree of co-production in care processes?

The article starts by presenting a theoretical framework on patient co-production and patient participation in health care service development. Next, a theoretical model for understanding patient participation in health care development depending on the degree of co-production is presented. In the methodology section we describe procedures for data collection and the sample, define the variables employed in the study and how they were measured, and present the statistical analysis. The final two sections present the results of the analyses and discuss the implications of this study.

Theoretical Framework

Patient co-production

The concept of co-production assumes that services are successful only when the people being served are involved. This perspective recognizes the patient as a resource and assumes that value cannot easily be created unless the patient actively contributes to the service. Some researchers consider this standpoint one of the most vital and important possibilities for reshaping public services ([Boyle and Harris, 2009](#)). Co-production has been defined as the degree to which the patient is involved in producing and delivering care processes ([adapted definition to the health care context, see Dabholkar, 1990](#)). Different degrees of co-production can be distinguished depending on the type of service provided ([Bovaird, 2007](#)). In an early work, Gersuny and Rosengren (1973) categorized the customer's role as being a resource, worker (co-producer), buyer or beneficiary. In a similar vein, Legnick-Hall (1996) proposed that the customer role can be both input-based (customer as a resource and co-producer) and output-based

(customer as a buyer, a user or a product). Meuter, Ostrom and Bitner (2000) proposed another model that distinguished between products made entirely by the firm (company production), customers and firm's contacts interacting (co-production), and products made entirely by the customer (customer production).

In the health care service sector, the role of the patient in service provision could range from a professional-expert orientation to patient-led production. Such a model is provided by Bovaird (2007), who proposed seven different ways in which patients can participate in and contribute to the development of health care services: 1) traditional professional service provision with user-community consultation; 2) user co-delivery of professionally designed services; 3) full user/professional co-production; 4) user co-delivery of services with professionals; 5) user-community sole delivery of professionally planned services; 6) user/community sole delivery of coplanned or codesigned services; 7) traditional self-organized community provision. Dunston et al. (2009) argued that an exclusive focus on either the provider or the patient needs to be reconsidered. Instead, they claim that a variety of dialogic and partnership approaches need to be developed.

Patient participation in health care development

There is general agreement that patient participation in health care development is underdeveloped. Health care services are delivered through processes that create value for the patients. These patients have invaluable insight into and detailed knowledge of their own care process. Despite this fact, patients are not sufficiently seen as a resource for health care development (Groene et al., 2009; Lombarts et al., 2009).

Patients can participate in health care development in many ways, ranging from satisfaction surveys, patient interviews, complaint procedures, being an expert, co-development and sole developer. The participation may also imply different degrees of involvement that determine the amount of influence patients may have over decisions regarding their own care and improvement of health care processes. Traditionally health care service providers let patients participate up to level 3, i.e., through surveys and interviews with patients after their treatment had been completed. This form of patient participation is rather symbolic and not used systematically for developing health care services. A study performed by Groene et al. (2009) showed that despite the widespread use of surveys of patients' views, hospitals reported limited practices for using the knowledge to improve health care processes.

The modern approaches call for a more active involvement of patients in health care service development (e.g. Elg et al., 2011; Entwistle and Watt, 2006; Longtin et al., 2010). Although scholars in the health care field propose a number of models and concepts for co-production, we have been able to identify only two studies that explicitly deal with patient participation in health care development (Molyneux and Fulton, 2006; Wensing and Grol, 1998). Within service research there are numerous models that can be used for understanding how patients can participate in development activities. For instance, Alam (2002) proposes a model where customer involvement in development activities ranges from passive acquisition of input, via gaining specific customer information and extensive consultation, to customer representation in development teams. In another model, Voss (1985) suggests five categories of customer integration: (1) User developed, not transferred; (2) User developed, transferred; (3) User innovation; (4) User initiated supplier innovation; and (5) Supplier innovation.

Instead of taking the innovation perspective, Edvardsson et al. (2002) propose taking an organizational view of the customer. An example of categorization of the degree of customer involvement considering this perspective is presented by Ives and Olsen (1984). This model describes different scenarios ranging from no customer involvement to great customer/user influence over the new product or service. The higher the degree of involvement, the greater the contribution of the customer/user is in the development process (Ives and Olson, 1984). It is important to list in this context the different roles that customers may have in value creation, since the categorization by Ives and Olsen (1984) formed the foundation for our own typology suggested in the discussion section: 1) No involvement - customer as buyer; 2) Symbolic involvement - Customer as a subject of interest; 3) Involvement by advice - Customer as a provider of information; 4) Involvement by weak control - Customer as an expert; 5) Involvement by doing - Customer as co-developer; 6) Involvement by strong control - Customer as sole developer (Ives and Olson, 1984).

Conceptual Model

We argue that patients may have different roles in the development of health care services depending on their degree of co-production in care processes and the context in which they find themselves. In order to understand more fully the different roles patients may have in health care development, we propose a conceptual model that hypothetically may capture this variation. The conceptual model assumes that the patient can detect value-in-context. That is, when patients are encouraged to take initiative and identify possibilities for improvement, they will be able to share the inventiveness that takes place in their everyday activities in the context. The basic and crucial point is that patients are more familiar with their own situation and therefore better able to evaluate the value-in-context of new health care services (Vargo et al., 2008).

The suggested conceptual model studies the patient contribution to health care service development from two dimensions. First, we argue that there are differences between patients who are treated for chronic diseases and those who are treated for episodic diseases. The care of these two types of diseases presupposes different degrees of co-production. In the treatment of episodic diseases the patients are subject to production where the service provider defines the process to a large extent. This is similar to the company production of Meuter et al. (2000) and Bovaird's (2007) rational professional service provision. The duration of service provision is often limited in time and scope. Chronic diseases, on the other hand, are diseases of long duration and generally slow progression. Patients have long care periods where they stay at home and feel more or less acceptable, and at other times have setbacks and need medical care. Patients who have chronic diseases need to manage their health problems as whole persons.

Second we hypothesize that there are differences if patients are in their home environment or in caregiver environments. The patients' role changes as they move between these two environments. At home the patient's health problem is one aspect of everyday life among many. In the caregiver environment, focus is reduced to the health problems. From the perspective of detecting value-in-context, we assume that there will be a difference between the patient's possibilities of participating in health care development depending on the whole person perspective at home and health problem focus in caregiver environments.

Method

Design

This study used a quasi-experimental design ([Campbell et al., 1963](#)) to examine the propositions made concerning patient participation in development of health care services. All participants were exposed to the same written instructions concerning the study, and were invited to co-develop the health care service by writing down reflections and ideas in an “Ideas Diary”. The research approach represents a realistic way of organizing user involvement, and the administration of the diaries was made by health care staff, who also will utilize the ideas for developing their respective processes.

Participants belonged to either one of two categories of care – chronic disease (rehabilitation, gastro) and episodic disease (orthopaedic surgery). Participants were either in hospital or at home whilst developing an idea. The care category and the place for ideation represent the independent variables of the study.

Independent variable	Process	Dependent variable
Care category - Episodic - Chronic	Idea generation for care process development	Topic of Idea
		Context embeddedness
		Solution orientation
Place for ideation - Home - Caregiver		Idea’s appearance
		Patient’s role
		Realizing actor
		Context for realization
		Idea generation context
		Beneficiary

Table 29 Design of the study

The Participants

Diaries from a total of 53 patients were analysed in this study. 34 patients belonged to the first category of episodic diseases, of which 13 were female and 21 male. The second category (chronic diseases) was made up of 16 patients, 14 male and 2 female. The age in the first group was higher (approximate mean 65 years), as these were to a large extent treated for hip problems which often emerge later in life relative to the chronic group (approximate mean of 45 years).

The episodic disease, in this case orthopaedic care, is signified by a standardized procedure for care with a low degree of patient participation, as this care represents a field in which clinical knowledge is high and standardized procedures are widely used. The second group consisted of patients in continuous treatment for chronic diseases. These patients either participated in a pain rehabilitation program or were in continuous treatment for stomach and intestinal disorders. The chronic group is characterised by treatments that have a high degree of patient involvement in the care process, as a main point in the treatment is to help patients manage their everyday lives in spite of their condition, and the success of the clinical treatment hinges on the active participation of the patient in form of self-care.

Data collection procedure

Patients were selected randomly for participation. The first contact with the patient was a letter describing the project, including the acceptance form that the patient should sign if he or she wants to participate in the study. It also clarified that participation was voluntary, and that it would not harm further contact with the caregivers if the patient chose not to participate. The patient was free to stop and exit the study anytime. Patients wishing to participate were given the choice of using a paper and pen diary or a blog. The instruction to the patients was to record events for fourteen consecutive days. The diary - physical and blog - had three data collection parts. In the introduction part of the diary, the patient was asked to briefly introduce themselves and present reasons for their contact with the health care system. For each day, the diary was separated into two different parts: first, an open recounting of the day's events and contacts, and second, a three-item list in which to fill in specific improvement ideas based on this everyday situation or other. This follows the procedures proposed by Elg et al. (2011) for working with patient diaries.

From the texts generated by the patients, ideas have been identified by the researchers. A large majority of ideas have been explicitly written in the idea field by the patient, whilst others have been identified in the running text by the researchers. All diaries were examined for ideas by two researchers in parallel, to ensure a consistency in the definition of an idea. In total 360 ideas were identified.

Coding

After the ideas were extracted from the 53 diaries, they were coded by the researchers on dependent variables. The variables were developed by the research team from the theoretical assumptions on co-production and user-driven innovation. For the choice of the dependent variables and their explanations, see Table 2. Ideas were coded taking the text in the diary into account, so as to fully understand the meaning for the idea. In the beginning the ideas were coded jointly by the research team to ensure the inter-user reliability of the coding process.

Dependent variable	Values
Topic of Idea	Medical care / Medication / Informational / Administrative / Attitude (of health care staff) / Psychological / Social / Daily living aids / Practical
Context embeddedness	Idea is concretely described in relation to context / Idea is abstractly described from general reflections
Solution orientation	Idea offer solution to a problem / Idea highlights a problem area
Idea's appearance	Idea from a sudden and new situation to the patient (ad hoc) / Idea emerges from a continuous problem
Patient's role	Someone should do something, create value, for the patient / Someone should do something to enable value creation of the patient / The patient is the sole value creator
Realizing actor (who should implement the idea)	Home (patient or family) / Caregiver / Extended caregiver (including other parties of health care system such as care centres and pharmacies) / Work / Other
Context for	Same as above

realization	
Idea generation context	At home / At caregiver (hospital)
Beneficiary (who benefits from the idea.)	The writing patient alone / The writing patient and others / Only other patients

Table 2 Variables for coding of ideas

Analysis

The data was then analysed using the Statistical Package for the Social Sciences (SPSS). Simple descriptive statistics such as frequency counts, percentages, means, and standard deviations were used.

Results

Types of ideas

The first analysis shows that patients can contribute ideas on a wide range of areas. Such areas encompass: Administrative matters; Attitude of health care staff; Informational subjects; Medical care; Medication; Daily living aids; Practical issues; Psychological and Social aspects. In Table 3 we present and explain the various types (topics) of ideas identified. Each idea is defined and followed by an example for illustration.

No.	Type of idea	Definition	Example
1	Administrative matters	Health care coordination of activities and processes, from a high level (e.g. political) to low level (e.g. local clinical organization). Not concerning the medical content of care	“As soon as possible, a rehabilitation team should be formed around the patient with a doctor, physiotherapist, therapist, etc. This is something I personally miss”
2	Attitude	Manners of health care staff	“I have tried to do some reading for myself, but I sometimes experience that they don’t believe me – just because I read it myself”
3	Daily living aids	Practical aids and tools for treatment as well as for a person’s daily and independent living	“A holder for crutches by the toilets where you can place them easily”
4	Informational subjects	Information and instructions given by health care to patients, relatives and society in general	“Bad information. I received an information folder on instructions after surgery for one-sided hip plastics. I had surgery for double-sided (there was no info for us)”
5	Medical care	All activities aimed at improving the health condition of the patient	“Possibility of entering the ‘hip school’ earlier”

		including clinical activities at hospital as well as self-care	
6	Medication	All substances used for medical treatment, also including alternative medicine. This includes intake, dosages, types of medicine and research	"I try to reduce the medication somewhat, but I notice I become more passive [due to the pain]. I'll take all of it for a few days more"
7	Practical issues	Strategies and actions for handling everyday problems	"I have stopped showering because it is hard to hold up my arms while washing my hair. It is much easier in the tub"
8	Psychological aspects	Mental and emotional facets	"Cultivate your hobbies or start something you have dreamt of. There is time"
9	Social aspects	Collective and shared facets including family, other patients and work	"The worries I felt before surgery were eased when I made contact with these two [other patients]"

Table 3 Different types of ideas

In the next section we connect the suggested typology of ideas with the degree of patient co-production and the context of idea generation. We want to study how the two proposed dimensions in the conceptual model influence the contribution patients can make to health care service development.

Ideas and characteristics of different patient groups

In this section we describe the characteristics and ideas generated by the four groups of patients suggested in our conceptual model. The four groups are: patients with chronic diseases at home; patients with chronic diseases at caregiver; patients with episodic diseases at home; and patients with episodic diseases at care giver. The summary of the results is presented in Table 4.

	Home	Caregiver
Chronic Disease	(n=88) Focus on types of ideas 5, 1, 7 76% Negative Incident 50% Concrete Experience Problem oriented 24% (76% solution oriented) Ad hoc 25% 50% for own value creation (30% other, 20% shared) 56% ideas realized in home	(n=55) Focus on types of ideas 5, 1, 2, 4 91% Negative Incident 49% Concrete Experience Problem oriented 27% (73% solution oriented) Ad hoc 29% 6% for own value creation (66% other, 29% shared) 6% ideas realized in home
Episodic Disease	(n=91) Focus on types of ideas 3, 7, 5, 4 53% Negative Incident	(n=95) Focus on types of ideas 1, 4, 2, 3 86% Negative Incident

65% Concrete Experience Problem oriented 17% (83% solution oriented) Ad hoc 42% 58% for own value creation (10% other, 32% shared) 80% ideas realized in home	75% Concrete Experience Problem oriented 34% (66% solution oriented) Ad hoc 80% 8% for own value creation (73% other, 20% shared) 6% ideas realized in home
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Table 4 Characteristics and ideas generated by the four groups of patients

Patients with chronic diseases at home

This group of patients developed mostly ideas in the areas of medical care (31, 82%), administrative matters (18, 18%) and practical issues (15, 91%).

The majority of ideas in this group were generated as result of a negative incident (76%). Patients experienced some problems, difficulties and shortcomings and described implications from this negative experience, as well as possible solutions and suggestions for improvements. A relatively high number of ideas (50%) was developed abstractly from general reflections and not from the context in which the patient operated. The majority of the ideas in this context are solution oriented (76%), which means that concrete suggestions for improvements were made. Only 25% of ideas can be characterised as ad hoc, as opposed to 75% of ideas which emerged from a continuous problem. In 50% of ideas the patient is the sole value creator, in 30% others should create value for the benefit of the patient and 20% ideas imply a co-creation of value with others. Most ideas in this context are intended to be realised at home by patients or family.

Patients with chronic diseases at caregiver

Patients in this group provided ideas on medical care (32, 73%), administrative matters (16, 36%), attitude (14, 55%) and informational subjects (14, 55%). In this context even more ideas appeared from a negative incident (91%). Only 9% of ideas appeared as result of some positive experience. There was only a small difference in the context embeddedness between chronic patients at home and at caregiver, and in this group 51% of ideas appeared from the general reflection on the course of sickness. The difference was also small for the next two variables: solution orientation and idea appearance. The majority of ideas were solution-oriented independent of whether the ideas were generated at home or health care (76% at caregiver vs. 73% at home). The ideas for chronic patients mostly appeared from continuously experienced problems (71% at caregiver vs. 75% at home). The difference was however observed in the patient's role in value creation. In the caregiver context only 6% of ideas were generated for own value creation and as many as 66% ideas implied that someone else should do something to resolve the problems and difficulties experienced by the patient. Only 6% of ideas could be realized by the patient at home. The resting 94% were supposed to be realized by caregiver, extended caregiver (including other parts of the care organization, such as local health centres and pharmacies), employer and other.

Patients with episodic diseases at home

The ideas generated by this group concerned mostly daily living aids (24, 75%), practical issues (23, 76%), medical care (14, 85%) and informational subjects (10,

89%). In this group of patients the smallest percentage of ideas stemmed from the negative context and more ideas resulted from some positive event (47%). The difference with patients with chronic disease at home was also that more ideas were developed from the context (65%) than from general reflection. Furthermore, the distinction of this group is the highest percentage of ideas that were solution oriented (83%). Only 17% of ideas included description of some need for change without giving any suggestion about how this could be achieved. More ideas appeared from a continuous problem (58%) than from a sudden and new situation (ad hoc), but the percentage of ad hoc ideas was higher for patients with episodic diseases (42% in contrast to 25% for chronic patients at home). The majority of ideas (90%) were developed for own value creation (58%) and for co-creation with others (32%). Only 10% of ideas implied that others should do something for the patient. Consequently, the greater number of ideas (80%) was supposed to be realized at home.

Patients with episodic diseases at caregiver

Most ideas in this context were generated on administrative matters (30, 9%), informational subjects (23, 1%), attitude (13, 27%), and daily living aids (10, 62%). Similar to chronic patients at caregiver, the high percentage of ideas resulted from dissatisfaction with health care provision and services (86%). As described in the previous section the same patient group at home had a much higher percentage of ideas developed from some positive event. As in all three other groups the ideas were primarily solution oriented (66%), but the proportion of problem-oriented ideas was higher for this group. There were three distinctive characteristics of patients with episodic diseases at caregiver. First, this group had the highest number of ideas generated from concrete experience (75%), which means that ideas arose from the situation in which patients currently finds themselves. Second, 80% of ideas were occurring ad hoc from new circumstances for the patient and not from general reflection. Similar to the chronic patients at caregiver, most ideas implied that others should change something to improve the patient's situation and satisfaction and the majority of ideas (92%) were supposed to be realised primarily by the caregiver.

Discussion

Our results show that patient's contribution to development of health care services is different depending on the two dimensions: episodic disease vs. chronic disease, and whether they are at home or at a caregiver. Based on these two dimensions, each square represents different degrees of patient co-production.

The first dimension (episodic disease vs. chronic disease) determines the amount of influence a patient may have over decisions regarding their own care and improvement of health care processes. Patients with chronic diseases are very often experts on their health problems and exhibit a higher degree of co-production in their care process. They usually have an active role in managing their own health and have greater influence on the decisions regarding their care. On the contrary, patients with episodic disease experience the health problems only temporarily and their understanding of the sickness and treatment procedures is often limited and fragmented.

The second dimension (patient at home and at caregiver) influences the role that the patient has as co-producer of the care process. At home, patients are responsible for

their own care, while the physician and caregiver have the responsibilities at the caregiver. At home, both types of patients are producers of their everyday life, while the two types of patients have different roles in co-production at the caregiver. Patients with an episodic disease often take the role of “patient as a product”, while patients with a chronic disease become co-producers of their care process. We argue that these different roles of the patient will influence the potential for patient co-creation in the health care process.

In the development of health care services, ideas are often generated from the patients’ experienced situation, problems and social interaction. The type of ideas and their characteristics differ depending on whether the patient is at home or at caregiver. By combining the two dimensions and the identification of the patient roles in co-production we were able to identify four different roles the patient may have in the development of health care services. The four roles are illustrated in Figure 1.

	Home	Caregiver
Chronic Disease	Patient as co-developer (patient as producer)	Patient as an expert (patient as co-producer)
Episodic Disease	Patient as sole developer (patient as producer)	Patient as provider of information (patient as a product)

Figure 1 Four patients’ roles in the development of health care services (the patient’s role in co-production is given in parentheses).

Patients with chronic disease at home were labelled as co-developers. The main characteristic of this group was that the generated ideas mostly concerned medical care and administrative matters for improving treatment of the health care problem. Many ideas emerged from a continuous problem, which the patients could solve themselves or with involvement of caregiver. Patients in this group often had very concrete suggestions about what could be done to improve their health, well-being and quality of life. Health care providers that involve patients in health care service development in this context may gain valuable insights *in self-care* activities and determining what factors can be addressed when supporting self-care processes.

The chronic patient at the caregiver had a slightly different role, which was described as patient as expert. As shown in the results most ideas were generated from continuously experienced problems and reflected the unsatisfied needs of the patient. Most of the ideas concerned medical care (32, 7%), administrative matters (16, 4%), attitude and informational subjects (14, 6%), and were supposed to be realized by the caregiver. The expert knowledge was reflected by the fact that patients with chronic disease provided most ideas concerning treatment of their health problems (included in the medical care category).

In contrast, for patients with episodic disease at the caregiver only 8 (9%) of the ideas were related to medical care. The role of patients with episodic disease at the caregiver can be described as provider of information. Most ideas appear ad hoc as a result of some negative experience and are embedded in concrete situations. A patient in this context provides constant feedback on their care experience, observed deficiencies and

the actions that must be taken to rectify these deficiencies. Since patients with an episodic disease usually have a limited knowledge about their sickness and treatment procedures, they primarily don't generate ideas on medical care, but on administrative matters, informational deficiencies and attitude problems of health care staff. Although the ideas emerged from concrete situations, it seems that the same type of information could also be gained by using traditional market research methods such as questionnaire surveys and interviews. Since the administration of diaries is more costly and time consuming, the benefits of applying this methodology in this context are limited.

Finally, the role of patients with episodic disease at home is best described as the patient as sole developer. The majority of ideas were supposed to be realised at home by the patients themselves. Patients in this context mostly developed ideas that concerned daily living aids (24, 75%) and practical issues (23, 76%) that aimed to provide support for temporary disabilities and other special conditions. The ideas in the area of medical care and informational subjects mostly included improvements for self-care and criticisms and advice to caregiver on information provided on postoperative care at home. There were few ideas that were problem oriented, which in other contexts usually implied that the problematic area was highlighted without giving any concrete solutions. Patients with episodic care at home could contribute not only ideas for improvement, but also concrete suggestions for how different issues could be resolved and facilitated for the patient. Health care providers using diaries in this context may gain valuable information on how the recovery process at home can be enhanced.

Conclusions

Our research makes several contributions to on-going research discussion on the role of patients in the production and development of health care services. In particular, our research shows that patients can contribute differently to the development of health care services depending on the degree of co-production of the health care service. There is an emphasis in research and practice on utilizing the patient as co-producer of the health care service, but there is scarce research on the implications for the development of health care services when increasing the degree of patient co-production.

Based on our research, we describe four different roles for the contribution of patients to the development of health care services. The four roles are:

1. Patient as provider of information (patient with episodic disease at caregiver)
Patients in this context provide constant feedback on their care, observed deficiencies and actions, and mostly develop ideas on administrative matters, informational deficiencies and attitude problems of health care staff to be realised by the caregiver.
2. Patient as an expert (patient with chronic disease at caregiver)
Most ideas reflected the unsatisfied needs of the patient and concerned medical care, administrative matters, attitude and informational subjects and were supposed to be realized by the caregiver.
3. Patient as co-developer (patient with chronic disease at home)
The generated ideas mostly emerged from a continuous problem and concerned medical care (to a wide extent self-care) and administrative matters for improving treatment of the health care problem. The improvements were

supposed to be realized by the patient themselves at home or by co-production with caregiver.

4. Patient as sole developer (patient with episodic disease at home)
Patients with chronic diseases that are characterized by higher degree of co-production generated different types of ideas than patients with episodic diseases. The first group mostly provided ideas on medical care, while the contribution of the latter group in this respect was rather limited. Patients with chronic diseases also developed more ideas from the continuous problem and from the general reflection on the course of sickness, whereas the ideas from patients with episodic diseases appeared more ad hoc from experiences of different situations.

The place where ideas are generated also plays an important role for the kind of contribution patients can make to the development of health care services. Depending on whether patients are at home or at a caregiver they develop different sets of ideas. Ideas generated at home concern self-care and strategies and actions for handling everyday problems to a greater extent and are supposed to be realized at home where the patient is the sole value creator. On the contrary, ideas generated at a caregiver emerge more often from a negative incident and primarily concern problems related to health care service provision, such as administrative issues, attitudes of health care staff and informational deficiencies.

The managerial implications of our research are that the choice of method for involving the patient in the development of health care services should be guided by the potential of the patient to contribute ideas on new services. This means that for patients with chronic diseases, methods that activate the patient in service development should be used, since these patients have a large potential and experiences that the personnel at the caregiver do not have access to. In contrast, for the development of services for patients with episodic diseases traditional market research methods can be used. For the development of self-care in the home, both types of patients can preferably be highly involved in the development of such services.

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The “Factory of problems”: Improvement of the Quality Improvement Process

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Introduction

This paper is the result of research done at the Dept. of Management of the Polytechnic School of the University of Mondragon aimed at identifying areas that help improve the competitiveness of companies through Continuous Improvement Programs.

A substantial part is made up of Case Studies which aim to collect relevant information within organisations wishing to improve their Continuous Improvement Process.

This article starts with an introduction to Continuous Improvement and the need to improve the processes of continuous improvement itself; it concludes by stating the need to conduct research within the company to find key factors and that managers need evidence that these factors affect the competitiveness of the company in order for them to take decisions for change.

This is followed by an introduction to Organizational Learning, the conceptual basis required for participants in Continuous Improvement Processes to learn to carry out action in a group and which is different from the original situation. In this section, we stress the importance of learning through evidence shown in the images.

In the third part we give some example situations in which we learn, that is to say, where new knowledge is gained and behaviour is changed at the same time, based on evidence. These examples involve a learning process for both managers of Continuous Improvement and for those responsible for leading improvement projects.

We conclude presenting recommendations.

Improving the Continuous Improvement Process

Continuous Improvement is an ongoing effort aimed at improving the quality of products, services or processes; the central idea is to improve the way activities are performed in different areas, seeking greater productivity and competitiveness.

Generally, in small companies the activities carried out under the umbrella of continuous improvement are part of everyday life, taken on by the few employees of the company who see this as an additional responsibility. As the complexity of the company grows, both in terms of internal processes and contacts with the outside world, opportunities for improvement are also becoming more complex. Consequently the need arises to organize the activities for the so-called Continuous Improvement Process.

In general, when an organisation designs a Continuous Improvement Process, or improves the already existing one, it does not start with a clean slate but uses a different procedure to when the rest of the production processes are designed. Commonly, an example of "best practice" (programs, tools, deployments, etc.) found outside the own organisation is "copied". There are many best practices that have been implemented in organisations all over the world: the 8D or Global 8D problem solving method of Ford (Rambaud, 2006), the practices of the Toyota Production System such as 5S, JIT, Kaizen, ... (Santos, 2006), Motorola's Six Sigma Program (Pande, 2001), the 7 basic tools of Ishikawa to solve simple problems (Ishikawa, 1985) and (Prat, 2005), ... etc. and in most cases a multinational has made these practices popular.

Organisations tend to adopt the most popular Continuous Improvement Programs of the time (containing tools, methodologies, deployment, etc.), but there is evidence that a Continuous Improvement Program that has been successful in one particular organisation does not necessarily guarantee success in another organization. Companies where competitiveness is closely related to the success of the Continuous Improvement Process have an enormous interest in identifying all the stages of this "adoption process" to eradicate potential obstacles.

In our experience, managers responsible for making decisions about how to improve their continuous improvement process have a viewpoint that is based on the experiences from the past 30 years and are apprehensive about novelties from outside (and which also resemble the already existing methods). This is explained by (Tort et al., 2010) who stated that when managers search for external information from other successful managers or successful best practices, they find it difficult to find clear cause-effect relationships, compelling enough to change aspects to adapt them to their own company.

Today's managers are willing to make changes, but faced with an increasingly complex environment, this decision is more and more often subject to finding evidence that clearly shows a need to change or evidence of the impact on the competitiveness of a specific change: "If it is not evident, I'm not changing anything". This attitude of "act only on evidence" among managers is related to a growing movement with the name of Evidence Based Management (EBMgt) (Pfeffer et al., 2006) which has its origins in Evidence Based Medicine (Sackett, 2002).

Agreeing with (Tort et al. 2010) that organisations should enhance EBMgt by tapping into internal information sources (Internal EBMgt), rather than external ones, during the years 2007-2011 we researched the Continuous Improvement Processes from organisations with the aim of finding improvements and establish routines that cause the desired changes. As a result of the above research, a Continuous Improvement model was conceived forming the baseline or first draft of the process design ((Eguren et al., 2009), and an evaluation system was designed for the Continuous Improvement Model

to monitor the results of the model and evaluate the impact of improvements on the continuous improvement process (Eguren et al., 2011).

At this point, our main interest is focused on Organizational Learning: the identification and design of routines for maximum output of the Continuous Improvement Process and how these routines are incorporated into the habits of a group.

Organizational Learning and Continuous Improvement

Implementing a new Continuous Improvement Process, or improving an existing one, involves Organisational Learning (Garvin, 1993) and that individuals adopt new group habits; precisely those habits that the organisation decided to learn at an earlier stage.

The behaviour of individuals who have to change is heavily influenced by their "mental models", the perception of the environment based on their knowledge and ways of understanding the system (Senge, 1993) but which will change as the person participates in experiences.

Experience-based learning

With a view to learning the Continuous Improvement Process in the shortest possible time, we rely on the school of thought promoted by experiential learning (Kolb, 1984), which argues that individuals learn more through experience-based cycles rather than through transmission of information, that is to say, the more experiences the individual is exposed to, the faster the learning process. The individual who participates in an experience observes and feels, captures the information and feelings, processes the events with his mental model, and creates new concepts based on how the experience is understood modifying his mental model. We would like to stress that a learning cycle does not end until the individual establishes a plan to check the validity of the applied concepts which he has learned and undergoes the new experience to start the next cycle.

Therefore, for an organization to quickly learn the Continuous Improvement Process:

- the "Wheels of Learning" should not be isolated
- the full cycle of the "Wheels of Learning" must be completed.
- individual participants must be willing to question their own mental models
- participating individuals must find ways to apply what they have understood from the experiences in order to question their mental models
- individual participants must be willing to change their habits in the future if necessary.

This means that individuals won't learn if they remain seated during the training period, or while watching a demonstration of know-how of others, if they don't actively search, endeavour to identify concepts, form ideas in their mind how to apply these in practice, and actually do so.

Types of knowledge

We distinguish two types of knowledge to learn in the Continuous Improvement Process depending on the target processes of the organisation, which in turn contain two types of knowledge (know-how and know-why):

- Knowledge aimed at preventing problems. These are related to the organisation's business activities; the idea is to learn how know-how and know-why interact in the systems to increase competitiveness of the Organisation to avoid problems or seize opportunities in the future. This knowledge is acquired by applying the scientific method based on statistical thinking.
- Knowledge aimed at learning to solve problems. This is related to the activities of the Continuous Improvement Process; the idea is to learn how know-how and know-why interact in Continuous Improvement to enhance the competitiveness of the Organisation through the skills of its human resources who learn to learn at an accelerated rate (Bessant et al., 2001). Thus, it boils down to learning the scientific method, to working in a team, to communicating, to selecting projects for improvement, to knowing how to manage resources for improvement, to creating ways to train people, ... etc..

Previous knowledge is absorbed in a "tacit" (you can do it but you don't know why, neither can it be transmitted through any written medium) or "explicit" manner (concepts are recognised in what you do, and these can be transmitted on any medium) (Nonaka et al., 1995).

When dealing with not very tangible processes such as the Continuous Improvement Process, the tacit component can be very large so that improvement of the process itself is difficult and slow.

Knowledge Transfer

Finally, organizations must take into account how knowledge is transmitted to wherever they see fit and we feel we should rely on the four stages contained (Nonaka et al., 1995) in the "knowledge spiral creation" in organisations to stress the importance of each of them in the context of Continuous Improvement.

- *Combination*: explicit knowledge is generated in the form of systematic standards, etc. from analysing and combining existing explicit concepts or knowledge. We emphasize the importance of regularly drawing up training documentation by people responsible for the Continuous Improvement Process based on existing material and conclusions drawn from experimenting within the Organization itself, e.g. "standards for experimenting".
- *Socialisation*: tacit knowledge is generated in individuals when pooling their experiences (e.g., applying the standard generated in the previous process). We would like to emphasize the importance of presenting Improvement Projects to other teams, to business partners, to management, etc., and in particular, to those responsible for the Continuous Improvement Process following a standard in order to incorporate knowledge in all processes, including that of Continuous Improvement.
- *Externalisation*: explicit knowledge is generated turning tacit knowledge that is difficult to communicate into tangible knowledge by using metaphors or analogies and start a discussion with the aim of generating new conceptual

knowledge. We consider this activity of vital importance for members of the management team involved in the Continuous Improvement process (a process that is usually "hidden" in the company) and team leaders who have to somehow transmit the findings in a comprehensible manner. Further on, several examples will be shown.

- *Internalisation*: tacit knowledge is generated in the form of mental models or shared practices, as a result of analysing the experiences gained during the implementation of new knowledge. This is one of the vital stages in learning the Continuous Improvement process as it pursues that people involved in other processes of the organisations adopt shared habits of the Continuous Improvement process.

Strategies to help change mental models

Once manners to generate knowledge and channels to transmit it have been established, the information reaches the individual who, as a rule, is reluctant to changing mental models and therefore to learning. This phenomenon called "*autopoiesis*" is already thoroughly explored by (Robert, 2005) in his research on success factors in continuous improvement teams.

According to experts, the causes of this reluctance primarily lie in communication problems with oneself and others: inability to recognize and compare our own mental models (Stewart, 1997) and inability to make our own models understood by others (Argyris et al., 1978).

Moreover experts in information visualization stress this aspect and strongly affirm that learning depends heavily on the visualization of what has to be learned: "When we understand something, we say: I see, it is clear" (Dürsteler, 2000), but the visual illiteracy we suffer from obstructs the process (Dürsteler, 2010). This handicap is also widespread, to a much lesser degree of course, amongst statisticians who try to obtain information from processing data, and there is very interesting literature in this regard from a statistical evidence specialist from the University of Yale (Tuffle, 2004).

To conclude, we take note of some of the suggestions of these experts and put forward others that have served us in experiences which we will show at a later stage:

- Develop the ability of reflection: stimulate slow thinking to become fully aware of the mental models
- Develop the ability of research: have a more open attitude about the suppositions behind our actions and help others to do the same
- Enhance visual thinking in the company.
 - Stress the ability of visual thinking, in their four steps, "Looking", "Seeing" "Imagining" and "Showing" (Roam, 2010): so, work with the eyes and brain during the activities of the Continuous Improvement Process.

- Use visual rather than text-based presentations. "Converting every concept into an image is the challenge and, at the same time, the solution" (Dürsteler, 2003)
- Boost the process of "Externalisation" creating metaphors related to tacit knowledge of the company which are complex issues to tackle otherwise and which will enable group reflection.

Proposed Strategy for Improving the Continuous Improvement Process

At this point, if an organization wishes to improve its Continuous Improvement Process, we suggest creating a team with relevant people in this process, experts in carrying out continuous improvement processes and experts in learning methodologies. Furthermore, carry out internal research systematically starting with the list below, paying particular attention to the weaker sections.

- i. Ensure that Management of the Organization is convinced that the Continuous Improvement Process has a strong bearing on competitiveness of the company and that it is another business unit with which to obtain benefits; identify the existing strategic lines on which it should be hinged. (Maybe it does not fit in the management's business objectives because it is oversized, poorly targeted, it is seen as a fad, etc.).
 - Define the critical mass of people needed for the challenge and how they should be deployed
- ii. Identify the main activities of the Continuous Improvement Process, the activity flow and expected results of each phase; if flows and requirements are not established, the process will likely not yield a maximum return.
- iii. Identify the activities to improve/learn and requirements or expected functions.
- iv. Identify the important concepts of this activity ("know-why").
- v. Define routines or operating procedures to know how to perform Continuous Improvement ("know-how" to do it).
- vi. Select the appropriate individuals willing to learn from the different groups.
- vii. Secure experiences for the first "Wheels of Learning" of the individuals.
- viii. Accompany the individuals in their experiences.
- ix. Develop mechanisms to identify improvements in routines and to create new ideas or concepts.
- x. Develop knowledge transfer processes.

Keep in mind that the learning individuals are from different hierarchies and departments in the company, from Management who have to learn to manage the

Continuous Improvement Process to the individuals involved, and also the teams that have to work with the Improvement Projects.

Research must be conducted thoroughly; metrics must be used in order to check variables related to hypothesis against outcomes relevant to the organisation. In our experience (Eguren et al.,) these metrics are usually given for evaluation purposes to a large and varied community of the organisation, evaluating is also a reflection exercise that generates common behaviours in the community.

Examples of Improving the Continuous Improvement Process. Case Studies

The examples presented below contain explicit knowledge generated in research work being carried internally during the period 2009-2012 in a multinational in the automotive sector belonging to the MCC group in order to help the organisation improve the part of the Continuous Improvement Process related to work on projects using a methodology similar to Six Sigma.

The researches obtain most of their information from participant observation; the researchers are not merely passive observers but active trainers in the various cases that have been addressed and can influence the process of change. For this reason and following the recommendations of numerous authors, for example (McCutcheon et al., 1993), research is based on case studies in the form of Action Research (IA).

The criterion we used to select the examples shown here has been a mixture of the difficulty of the objective, the impact of joining concepts with images on evidence, the possibility to share results in other organisations, simplicity of the proposed solution and a successful outcome.

The examples are shown following the next diagram:

- i. Characteristics of individual protagonists
- ii. Problem description of the Continuous Improvement Process
- iii. Diagnosis (specialist in Organizational Learning and Continuous Improvement)
- iv. Key concepts used in the solution
- v. Proposed solution
- vi. Feedback from protagonists

Example 1. "The Factory of Problems": The business of Continuous Improvement

Characteristics of individual protagonists

After 2 years of working on major reforms to the Continuous Improvement Process with many resources allocated, in 2010 the promoters of this process wanted to get all the managers together who were directly or indirectly responsible for projects to discuss the experience, identify best practices and determine future plans.

Description of the problem

The call for the reflection workshop was generally well received (90% acceptance) but some difficulties arose in defining the agenda for the day. The Promoters of Continuous

Improvement wanted the managers of the Organization to learn from the Continuous Improvement Process and a commitment that they are going to improve it, but the experience of the attendees is essentially tacit and there will be difficulties to verbalise and transfer it.

Diagnosis

The research team has been in the company for 2 years and has identified elements in the relevant people that might be interesting to address:

- There is an attitude which is also common in other organisations: management does not consider the Continuous Improvement Process as a process that actually generates value and therefore they do not see the need to organise it as another business unit. This creates a conflict as the boundaries of the resources and responsibilities are not clearly marked.
- Managers of other business units are in perfect control of the responsibilities of their department but have difficulty measuring their employees according to the Continuous Improvement Process: they need guidelines, routines.
- Teams complain that managers only come to ask "How's the defective rate going?" but do not ask "What have you discovered and how?"

The 10 key concepts used in the solution: “The Factory of Problems”

First of all, the "tacit" knowledge to be transmitted must be identified, i.e. the concepts in an "Internalisation" process (Nonaka et al., 1995). From here on it must be shared verbally until they acquire a certain significance and clarity so it can actually be written down. Then the concepts that are behind the proposed solution are stated ("explicit" knowledge):

- 1) Continuous Improvement can yield great benefits to our business if the fire cannot be put out by firemen but instead it is rekindled time on time again.
- 2) Continuous Improvement is a process and in our main business we perform lean projects leading to peak performance.
- 3) We need standards for the process (we need to put Six Sigma in Standards, ...)
- 4) The process must be performed as simple and straightforward possible: no oversizing the stages and copying what others do
- 5) We have to identify what the "thing" is that goes around our Continuous Process and which will provide us with added value: Projects
- 6) We only accept “project-orders” that give profit to business
- 7) We need to measure the output of the process adequately
- 8) We need individuals that learn from each stage and managers who can manage: It is clear that the skills for Continuous Improvement Process are different and not everyone is able to tackle this job.
- 9) Learning has to be fast and this process cannot be stopped: the factory should be sized properly according to our "orders" and "market trends"
- 10) Boost visualisation in the entire factory with the slogan "LOOK: What do you SEE? . “IMAGINE what it is going on”. Look for it. Then "SHOW" so that others "LOOK and SEE"

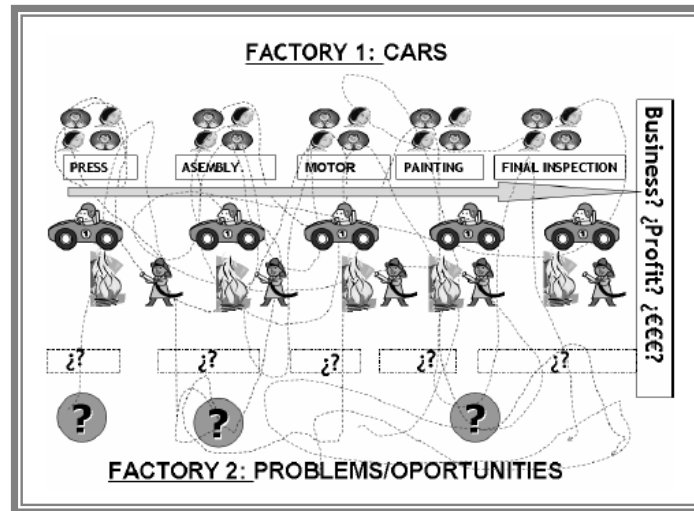


Figure 1. The hidden business: Improving Yield in “Factory 2”

Proposed solution

Use a video presentation to transmit the knowledge through the "Externalisation" process (Nonaka et al., 1995). This document contains:

- Visualisation of the "factory 2" or "Factory of problems". See figure (1)
- Visualisation of the activities of the Continuous Improvement Process in question, and current flow of Projects with the "bottlenecks" and inefficient activities, figure (2).
- Visualisation of growth of Factory 2 and indicators for managers who want accelerated growth: for example "branches and buds", with respect to teams (branches) working on projects (buds). See figure (3).

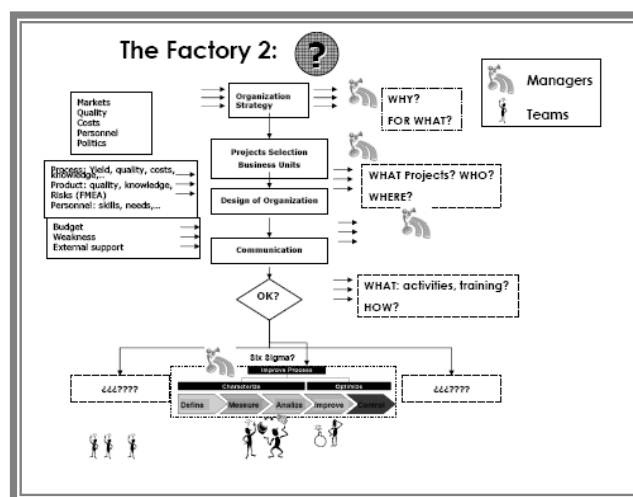


Figure 2. The Continuous Improvement Process

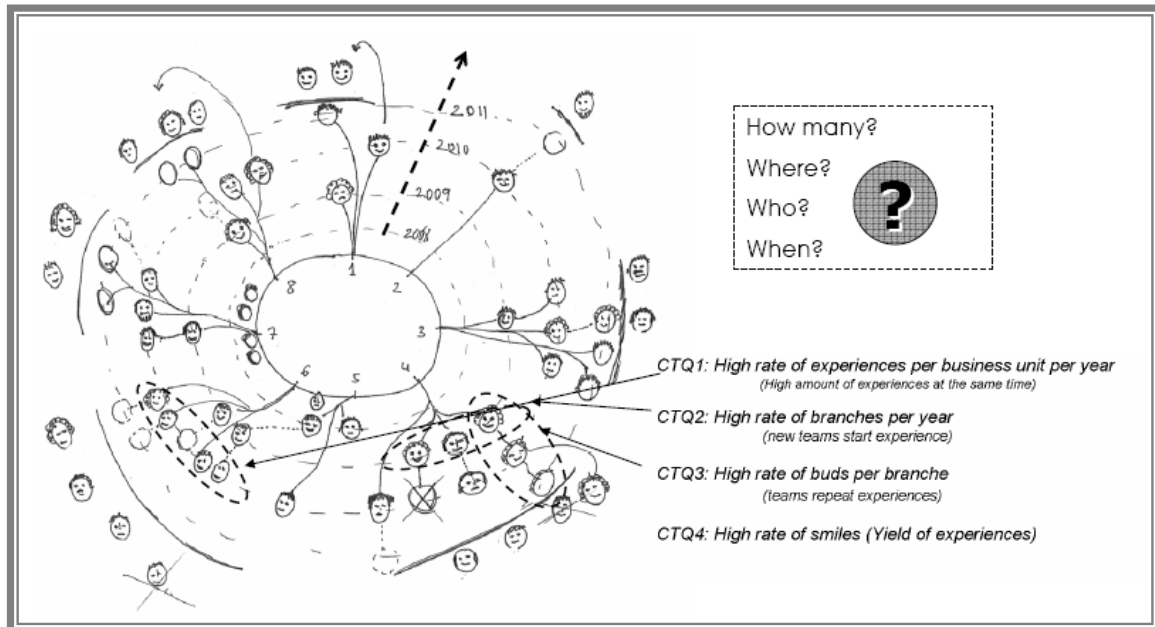


Figure 3. The Growth of Factory 2 and Indicators (CTQ's)

Feedback from protagonists

The reflection workshop was a total success. A fluent communication, high participation and creation of a collective mental model on the activities of the "Factory of problems". Extrapolate complex tacit knowledge from metaphors ("factory of problems", "look, see, imagine and show", "many branches but few buds") which from now on may be used explicitly by the organisation to see the "tacit" concepts. We had a lot of feedback, such as: *it was very important to "see" our process and our difficulties, faced with "evidence" of this type, we are better informed now and better prepared to make decisions.* These comments are aligned with the concepts presented in paragraph 2 related to Evidence Based Management (Pfeffer et al., 2006).

Example 2. "Learning from evidence". Visualization of scientific method

In this example we have the trendy words "scientific method" and "statistical thinking", which because of having little tacit and explicit knowledge in the organisation associated it is difficult to improve the elements associated to these skills.

Characteristics of individual protagonists

Individuals undergoing training at work for 2 years in the Six Sigma DMAIC methodology, by working in improvement projects with a tutor who accompanies the trainee.

Managers are also responsible for accompanying these teams and assessing the learning outcomes from the perspective of the Continuous Improvement Process.

Description of the problem

Teams trying to learn the Six Sigma DMAIC methodology applying the wheel of learning (Kolb,) on several projects and trying to identify the root causes of problems, have difficulty in being methodical and learning is slow leading to a low-output "factory of problems".

Individuals are used to "the other factory", and struggle to change their usual way of proceeding with the processes of the organisation where action is a reaction to "putting out fires" problems; they are not very scientific in their methods and the variability of the information leads to a misinterpretation of their environment.

Diagnosis

We cannot adequately communicate what the "scientific method" involves and as a result they don't "see" it. Nor do their managers "see" it so that the latter do not rectify or provide guidance in the process.

We must improve training in the "scientific method" and "statistical thinking".

The 8 key concepts used in the solution: "Learning from evidence"

- 1) In my brain I have a MENTAL MODEL that determines how I act
- 2) I question my mental model going out to LOOK letting myself be guided by the QUESTIONS I ask myself.
- 3) I create theories when I LOOK at my surroundings and I SEE patterns
- 4) I admit I can be wrong: I question myself
- 5) I IMAGINE evidences externally to confirm my theories
- 6) I PLAN to collect information to look and see the evidence that I imagine
- 7) I go outside, LOOK and SEE. If there is evidence, I am right
- 8) Learning alone does not serve my purpose. I have to SHOW what I have learned so that others when they LOOK and SEE change their mental models.
- 9) Before moving forward, I must TRAVEL BACK
- 10) "if I want to show the evidence of my results, if I want to question my mental model, if the questions are these, if I imagine that I see specific evidence, if I imagine it in some images, ... what data do I need to collect to see it and how do I show it will they understand? Is that enough? Do I have to improve something before starting?"

Proposed solution

- An image of the process is created to be used as a reference each time we wish to emphasize a certain aspect of one of the phases, see figure (4).
- It is supported by templates that help produce the know-how of the Deduction, the hardest part. See figure (5).

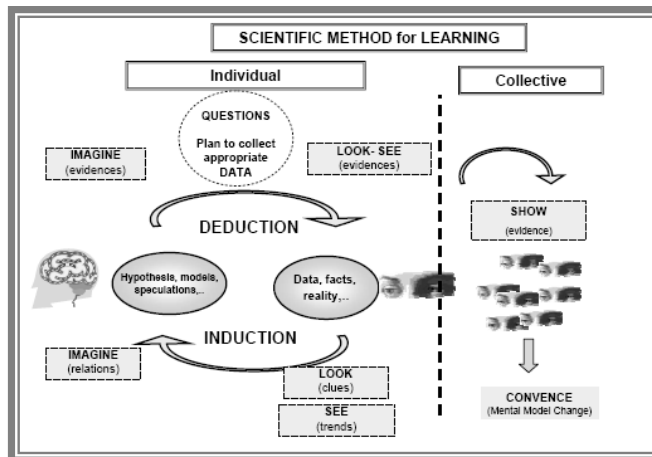


Figure 4. Visual representation of activities related to Scientific Method

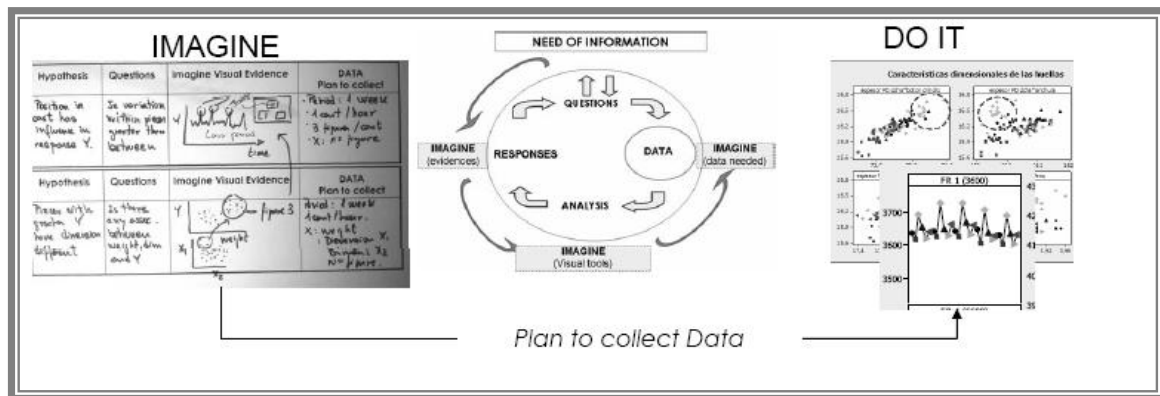


Figure 5. Templates for teams: Statistical Thinking routines

Feedback from protagonists

Visualisation of the process helps us as trainers to communicate the methodology, it helps leaders within their teams and it helps managers. Again "eyes" and "brains" arise with which we must search images and show evidences to convince oneself and others and therefore change mental models.

We know better where to go and keep working on ways of conveying the skills necessary to analyse the information. In this sense we have made some statistical tools from the program redundant and instead boost the creation of personal images.

Conclusions

Given the fact that others in the organisations show an interest in improving their Continuous Improvement Process, we suggest that they proceed with internal research as opposed to copying successful programs and best practices from outside (there may be a hint, but not the same flavour).

In general the Continuous Improvement Process is designed and implemented by individuals who are already contracted to do other things, so they have to learn the new process. We think it is important to show the concepts of Organizational Learning as the basis for managing behavioural change.

It is becoming more common to take action based on evidence: both managers and non-managers. The Evidence Based Management (EBMgt) Movement (Pfeffer et al., 2006) is an example. If we wish change and we want others to change, we have to show evidence that there is profit in changing; if not, there won't be any change.

The Continuous Improvement Process must show evidence that this is important business for the Organization. "The factory of problems" must be sized properly and work has to be performed so that the output is on the same level as for the rest of the processes, and will compete with other processes to obtain resources, technologies, innovations, etc. ...

Finally, since the challenge is to achieve high returns quickly, it is important to identify the "know-why" and "know-how" of the "Factory of Problems" and therefore we believe it important to enhance the skills of visual thinking and visual managing of knowledge within the skills of data-based information processing.

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Determining ISO 9001 effectiveness and the influential critical factors in manufacturing companies

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Paper type: Research paper

Introduction

It is vital for companies to develop and maintain an effective Quality Management System (QMS) through which they can develop better ways to ensure that their customers are satisfied with the quality of products/services and subsequently enhance their efficiency and competitiveness in today's business environment (Magd, 2008). The effective deployment of a QMS according to the ISO 9001 standard has been widely recognized in recent years as a means of enhancing company performance and thereby building a sustainable competitive advantage (Koc, 2007). If developed and implemented effectively, the benefits/advantages of the ISO 9001 QMS exceed its costs/disadvantages and thus the performance of any company is improved (Augustyn and Pheby, 2000).

Dumond (1994) defines "effectiveness" as the extent to which a function meets its goals, while Oztas *et al.* (2007) describe "effectiveness" as the degree to which results meet prescribed goals. From a QMS point of view, Kam and Tang (1997) state that if the system's prescribed qualitative objectives are achieved, then it is considered effective. The ISO 9001 standard also defines "effectiveness" as the extent to which the anticipated objectives are achieved (ISO 9001, 2000). Van der Spiegel *et al.* (2007) suggest that ISO 9001 effectiveness should be tested by evaluating the degree to which the standard's pre-established objectives are met. Thus, it is difficult to evaluate ISO 9001 effectiveness without defining the purposes that the system has been set to achieve (Al-Nakeeb *et al.*, 1998).

However, the effectiveness of the ISO 9001 standard in enhancing a firm's competitive performance is highly controversial (Yeung *et al.*, 2003). Studies evaluating whether ISO 9001 implementation makes a difference to an organization's performance show mixed results (Singh, 2008; Heras *et al.*, 2008). In practice, the performance of the ISO 9001 QMS is often unsatisfactory due to its ineffective implementation. The benefits and advantages of ISO 9001 are subject to a company's conformance to critical success factors (Augustyn and Pheby, 2000). Many researchers such as Jang and Lin (2008),

Magd (2008), Feng *et al.* (2008), Sroufe and Curkovic (2008), Zeng *et al.* (2007), Cheng *et al.* (2007), Zaramdini, (2007), Terziovski and Power (2007), Park *et al.* (2007), Gotzamani *et al.* (2007), Boiral and Roy (2007), suggest a number of factors that might have an impact on the implementation of a QMS such as ISO 9001. These factors are identified as barriers and/or motives for the implementation of ISO 9001.

Given that many businesses fail to achieve an improvement in quality and competitive benefits through the ISO 9001 standard, it is important to take a closer look at the issues surrounding its successful implementation (Lin and Jang, 2008). Zeng *et al.* (2007) state that, despite the studies that show the successful adoption of ISO 9001, the problems in implementing the standard, which may affect its sustainable implementation, need to be explored. Sampaio *et al.* (2009) also suggest that the determination of the ISO 9001 critical success factors is an interesting topic that deserves deeper future analysis. Similarly, Augustyn and Pheby (2000) mention that the list of the critical success factors is by no means comprehensive and that it constitutes the core structure of aspects that need to be addressed while deciding on ISO 9001 as a QMS. So, they suggest further research into this area in order to reflect the dynamics of a business environment and the needs of various economic sectors.

In order to fill the above mentioned literature gap, the present study explores ISO 9001 effectiveness in manufacturing companies. The purpose of the study is to evaluate ISO 9001 effectiveness based on its components (the ISO 9001 objectives) and to determine the critical factors that significantly affect the standard's effectiveness. The latent constructs of ISO 9001 effectiveness and the latent constructs of the critical factors for the effective implementation of ISO 9001 are extracted through Exploratory Factor Analyses (EFA). The critical factors that significantly affect ISO 9001 effectiveness are determined through the Multiple Linear Regression Analysis.

The rest of the paper is structured as follows: in the first part, reviewing the literature, the ISO 9001 objectives and the influencing critical factors are identified, leading to the formulation of the research questions in the present study. In the next part of the paper, the methodology of a research project carried out in Greek manufacturing companies is described. This is followed by the analysis and the respective results. In the next part of the paper, the results are discussed and the final conclusions are presented. Finally, the practical implications, the limitations of the study and future research recommendations are presented.

Literature review

Identifying the ISO 9001 objectives

According to ISO (2008) and the ISO 9001 standard (ISO 9001, 2008), the aims of the standard are the following: prevention of nonconformities, continuous improvement and customer satisfaction focus. Gotzamani (2005) considers that the main aim of ISO 9001 is the enhancement of the QMS effectiveness through continuous improvement activities, prevention of nonconformities and customer satisfaction focus. Similarly, Goetsch and Davis (2005) support that the objective of ISO 9001 is the provision of consistent products with customer requirements, in other words the establishment of a system that addresses the prevention of nonconformities, continuous improvement and customer satisfaction focus. Briscoe *et al.* (2005) also state that the goal of ISO 9001

includes providing products or services that conform to customer quality requirements, achieving continuous improvement and enhancing customer satisfaction. From the above it is obvious that, as many authors have also suggested (Gotzamani *et al.*, 2007; Heras *et al.*, 2006; van der Spiegel *et al.*, 2004; and Tang *et al.*, 2004), the prevention of nonconformities, continuous improvement and customer satisfaction focus are the main objectives of the ISO 9001 standard.

The “prevention of nonconformities” objective of the ISO 9001 standard is assessed in the present study through the indicators/variables used by Singh (2008) and Kathuria (2000), while the “continuous improvement” objective is assessed through the indicators/variables used by Singh (2008), Conca *et al.* (2004) and Tsim *et al.* (2002), (Table I). Finally the “customer satisfaction focus” objective of ISO 9001 is assessed in the present study through the indicators/variables used by Singh (2008), Gotzamani *et al.* (2007), Yang (2008), Redshaw (2000), Singh *et al.* (2006), Conca *et al.* (2004), Tsim *et al.* (2002), (Table I).

Critical factors for the effective implementation of ISO 9001

According to Augustyn and Pheby (2000), the improvement of ISO 9001 effectiveness requires the adoption of the right approaches during the standard’s development and maintenance. They assess ISO 9001 effectiveness evaluating the degree to which a company’s approach towards implementing a QMS conforms with critical success factors. A review of the literature suggests that numerous such factors have been identified as crucial to the successful implementation of ISO 9001. These factors are described as barriers/difficulties or motives for the implementation of a QMS according to ISO 9001 (Psomas *et al.*, 2010).

Firstly, given that the ISO 9001 standard has already been revised many times since its first publication, and secondly, that nearly one thousand companies worldwide have already been ISO 9001 certified (ISO, 2008), an improvement has been made with regard to the knowledge and understanding of what the ISO 9001 standard really is. So, the nature of the difficulties faced during the standard’s implementation has evolved to the extent that they now appear to be considerably different than before (Singh *et al.*, 2006). Sroufe and Curkovic (2008) identify the following barriers as influencing ISO 9001 effectiveness: the lack of top management involvement, the small size of firms, registration and audit fees, the loss of productivity during training/registration/auditing, excessive requirements, increased paperwork and documentation, the minimal improvement in product marketing and non-compliance after registration. Magd (2008) consider the lack of top management commitment and qualified personnel, insufficient training with respect to quality issues, the lack of financial resources, and the failure to define responsibility and authority for personnel, as the main barriers to the effective implementation of ISO 9001. Feng *et al.* (2008) mention that difficulties such as top management and the organization’s own commitment, the low resources available, the costs required to maintain the level of documentation, the philosophical quality aspects of the organization, ineffective employee training and company size, should be carefully considered for enhancing ISO 9001 effectiveness. Cheng *et al.* (2007) also consider the lack of senior management commitment, employee resistance to change and inadequate training and support as significant barriers to the successful implementation of ISO 9001. Boiral and Roy (2007) refer to barriers such as time constraint, increased paperwork, employee complaints with regard to documentation, the lack of human

resources and the involvement of top management and employees as well as the incompatibility with the existing culture. Park *et al.* (2007) state that the main barriers decreasing ISO 9001 success refer to company policy and cultural background, the standard's requirements, the intangible effects of the QMS, inadequate support from the certification body and a non customer focused organizational policy. Gotzamani (2005) exploring the difficulties companies faced while conforming to the ISO 9001 requirements, reaches the conclusion that the significant barriers or pitfalls in implementing the standard are the following: the change of company culture, adaptation of "paper certificates", management commitment, unrealistic requirements and ritualistic implementation, poor adaptation of the previous versions of ISO 9001 and the conventional quality audit process. Bhuiyan and Alam (2005) note that the main barriers to the effective establishment and maintenance of ISO 9001 are factors such as the lack of management support and training, an inadequate perception of quality, resource constraints and employee resistance to change.

Beyond the barriers that are characterized as critical factors for ISO 9001 effectiveness, the motives for implementing such a QMS are also identified in the literature as critical factors of major importance. Gotzamani *et al.* (2007) note that the successful implementation of ISO 9001 depends on the degree to which a company seeks the certification as a way to improve quality and not as the result of external pressure. Similarly, Feng *et al.* (2008) state that companies which seek ISO 9001 certification for external reasons are likely to fail or gain fewer benefits due to their narrow focus, while companies that seek certification to improve the quality of products and services tend to gain greater benefits from the ISO 9001 certification process. Jang and Lin (2008) state that reducing cost, improving quality, gaining marketing advantages, avoiding export barriers and customer demands are motives of major importance for being ISO 9001 certified. Magd (2008) considers as motivational factors influencing ISO 9001 implementation the following: the improvement of the QMS efficiency, the pressures from competitors/foreign partners, customer satisfaction, market share increase, avoiding potential export barriers, government demands, export increase and the use of the certificate as a marketing/promotional tool. Zaramdini (2007) mentions that improving product and service quality, processes and procedures, productivity, efficiency, the public image and the competitive advantage, while at the same time reducing incidents, rejections and complaints, are significant motives for enhancing the benefits derived from ISO 9001 implementation. Boiral and Roy (2007) refer to motives such as increased rules and regulations, customer pressure, quality improvement, company image and rigor in management, the implementation of strong internal controls and the inspiration of employees. Bayati and Taghavi (2007) note that customer demand, the desire to stay in business and the improvement of the QMS are all significant motives for the effective implementation of the ISO 9001 standard. Terziovski and Power (2007) state that a company's will to adopt a continuous improvement strategy, improve its business performance, reduce waste, react in environmental factors and the pressure from customers and competitors are significant motives for seeking ISO 9001 registration. Singh *et al.* (2006) mentions the following motivational factors influencing the effectiveness of the ISO 9001 QMS: meeting customer expectations, adopting a performance improvement strategy, gaining an advantage over competing firms, improving operational efficiency/productivity, product quality and export potential and reducing production cost. Williams (2004) also states that the success in recovering the initial investment in ISO 9001 implementation depends on the motives that drive a company to seek registration such as customer

demand, quality improvement, considering quality as part of a business strategy, the pressure from competitors, marketing strategy, Non-EU-government requirements and EU regulations.

Research questions formulation

Literature is still unclear regarding the current status of the implementation of the ISO 9001 QMS (Lee *et al.*, 2009). Jang and Lin (2008) state that whether or not the long-term effectiveness or the real value of ISO 9001, is related to the depth to which it is implemented, it is a topic that deserves further investigation. According to Lee *et al.* (2009), if ISO 9001 patterns do influence the performance of the ISO 9001 certified organizations, then researchers should study issues with regard to the development of the ISO 9001 implementation strategy in order to provide practical guidelines for managers. With a well-developed strategy, the implementation of the standard can be better aligned within the environment of a company, so as to accomplish competitive advantages and optimal performance (Lee *et al.*, 2009). Similarly, Lin and Jang (2008) suggest that future conceptual development and empirical research should consider factors that affect ISO 9001 performance. Herath *et al.* (2007) also note that a future empirical investigation should take into consideration a broad range of business factors influencing the effective implementation of a QMS such as ISO 9001.

Based on the literature review presented above and the research proposals suggested by numerous authors, the following research questions are formulated:

RQ₁: What is the underlying structure (latent constructs) of ISO 9001 effectiveness in manufacturing companies?

RQ₂: What is the level to which manufacturing companies achieve ISO 9001 effectiveness?

RQ₃: What is the underlying structure (latent constructs) of the critical factors for the effective implementation of ISO 9001 in manufacturing companies?

RQ₄: Which critical factors have a significant impact on ISO 9001 effectiveness in manufacturing companies?

Research methodology

Questionnaire development

Survey research is one of the most widely used methods for collecting primary data and much of the prior research in quality management has been survey-based (Kannan and Tan, 2007). It is worth noting that the majority of research about ISO 9001 has been conducted via quantitative approaches, predominantly through postal questionnaires (Magd, 2008). In order to answer the above formulated research questions, a research project was carried out in Greek manufacturing companies, using a questionnaire as the data collection method. The design of the questionnaire was primarily based on the definition of ISO 9001 effectiveness as well as the three objectives of the ISO 9001 standard and their indicators identified through an extensive literature review; and secondly, on those factors that according to the literature influence ISO 9001 effectiveness. The questionnaire was reviewed by academics and pilot-tested by professionals and auditors of certification bodies. Based on their suggestions, a few questions were edited and re-phrased in order to improve their clarity.

The final version of the questionnaire consists of three parts. The first part includes questions on the demographic profile of the company. The second part concerns ISO 9001 effectiveness and contains statements with regard to the indicators of the ISO 9001 objectives (prevention of nonconformities, continuous improvement and customer satisfaction focus). Finally, the last part of the questionnaire contains statements regarding the ISO 9001 barriers/difficulties and motives that are described in the literature as critical factors influencing ISO 9001 effectiveness. Respondents were asked to indicate the degree of agreement or disagreement with these statements, using a seven-point Likert scale, where 1 represented “strongly disagree” and 7 represented “strongly agree”.

Sample

A sample of 700 companies was randomly selected from a list of about 3500 ISO 9001 certified Greek manufacturing companies that were recorded in the data base of ICAP (the largest business information and consulting firm in Greece). The questionnaire was sent to the quality managers of these companies through the postal system and e-mails. In order to increase the rate of the responding companies, two follow-up reminder e-mails were sent and telephone contact was also made with many of the sample companies. Finally, 146 completed questionnaires were received – a response rate of 20.8%.

Given that the responses were returned within a 16-week period, the early and late responding companies were compared in terms of the number of their employees (Chi-square test) and the questionnaire items (One-Way ANOVA) and no statistically significant differences were found. Furthermore, several non-responding companies stated, when contacted, that the major reason for not participating in the research project was lack of time. So, it is apparent that non-response bias is not likely to be an issue in the final sample.

Data Analysis

The number of the responding companies in the present research project is deemed, according to Hair *et al.* (2005), large enough for multivariate data analysis. So, EFA are applied to extract the latent constructs of ISO 9001 effectiveness and the latent constructs of the critical factors for the effective implementation of ISO 9001. The impact of the critical factors on ISO 9001 effectiveness is assessed through Multiple Linear Regression Analysis. The statistical package SPSS 15 is used for data processing.

Results

The company profiles

The vast majority of the responding manufacturing companies are small and medium-sized (SMEs), given that 86.3% of them employ less than 250 employees. However, based on the Commission Recommendation 2003/361/EC concerning the definition of SMEs, they can be further categorized as follows: 25.3% as micro enterprises (< 10 employees), 33% as small enterprises (10-50 employees), 28.1% as medium enterprises (50-250 employees), and 13.6% as non-SMEs (> 250 employees). The products that the

participating companies manufacture include food and beverage, basic metal and fabricated products, rubber and plastic products, non-metallic minerals, chemical products, electric/electronic materials, machinery, furniture, medicines/cosmetics and various industrial products. Regarding the educational level of the company quality managers, the majority of them are university graduates (60.3%), while a rate of 24.7% possesses a master's degree. It is worth noting that 82.2% of the ISO 9001 certified manufacturing companies have been implementing the QMS for more than three years and 57% for more than six years.

EFA of the ISO 9001 objectives

The indicators of the ISO 9001 objectives identified in the literature are used as measured variables of an EFA (varimax rotation method). The result is the establishment of three latent constructs (Kaiser-Meyer-Olkin = 0.919, Bartlett's test of Sphericity = 1530.971, $p = 0.000$, MSA > 0.868, eigenvalue > 1, Cumulative Variance = 67.64%). These latent constructs are explained using the measured variable loadings and can be labeled in accordance with the three ISO 9001 objectives identified in the literature, namely continuous improvement, customer satisfaction focus and prevention of nonconformities (Table I).

The reliability of these latent constructs is confirmed through Cronbach's alpha coefficients that are higher than 0.858. It is worth noting that values of 0.6 to 0.7 are deemed the lower acceptable limit of Cronbach's alpha coefficients (Hair *et al.*, 2005). Bearing in mind the sample size of the responding companies ($n = 146$) and the guidelines of Hair *et al.* (2005) for identifying the practically and statistically significant factor loadings (loadings > ± 0.50 are generally considered necessary for practical significance, while loadings > ± 0.45 are considered statistically significant for sample sizes of around 150), the factor loadings of the variables used in the EFA can be judged as practically and statistically significant. From Table I, we also observe that the squared factor loadings are satisfactorily high, which indicates that a high percentage of a measured variable's variance is explained by the respective latent construct. Based on the responses made by the representatives of the participating companies, the mean values of the latent constructs are also calculated (Table I). According to these values, the latent constructs can be set in the following descending order: prevention of nonconformities, customer satisfaction focus and continuous improvement. It is also obvious that the ISO 9001 objectives reflecting ISO 9001 effectiveness are achieved to a notable extent from the sample manufacturing SMEs.

EFA of the Critical Factors for the effective implementation of ISO 9001

Table II indicates the measured variables of the critical factors for the effective implementation of ISO 9001. These variables are used as the basis for an EFA (varimax rotation method). The result is the establishment of five latent constructs to which the critical factors are refined (Kaiser-Meyer-Olkin = 0.863, Bartlett's test of Sphericity = 2190.305, $p = 0.000$, MSA > 0.717, eigenvalue > 1, Cumulative Variance = 71.46%). These constructs are explained using the loadings of the measured variables and can be labeled as follows: internal motivation, employee attributes, company attributes, external environment attributes and quality system attributes (Table II).

The reliability of these latent constructs is confirmed through Cronbach's alpha coefficients that are higher than 0.72. Bearing in mind the sample size of the responding companies ($n = 146$) and the guidelines of Hair *et al.* (2005), the factor loadings of the variables used in the EFA can be judged as practically and statistically significant. From Table II, we also observe that the squared factor loadings are satisfactorily high, which indicates that a high percentage of a measured variable's variance is explained by the respective latent construct.

The impact of the Critical Factors on ISO 9001 Effectiveness

The Multiple Linear Regression Analysis is conducted in order to examine the impact of the critical factors on ISO 9001 effectiveness. The five latent constructs of the critical factors for the effective implementation of ISO 9001 are used as independent variables that are regressed to the dependent variable "ISO 9001 effectiveness" (mean value of the ISO 9001 objectives). The factor scores (metric variables) of the latent constructs that are created through the EFA are used for the purpose of the regression analysis. Using the standardized and the studentized residuals, we examined the assumptions required for the regression analysis and more specifically the linearity, homoscedasticity, independence and normality. So, according to Hair *et al.* (2005), we made specific tests for each assumption to check for violations. The results showed that these assumptions were not violated. Finally, the multi-collinearity among the independent variables was checked and not confirmed.

Assessing the overall model fit, the results show that the regression is statistically significant (p -value = 0.000 and Adjusted R Square = 0.559). Estimating the regression model, the results show that all the independent variables (the latent constructs of the critical factors) have a statistically significant impact on the dependent variable "ISO 9001 effectiveness". More specifically, the results show that the critical factors with a significant impact on ISO 9001 effectiveness are described by the following latent constructs: company attributes ($p = 0.000$, beta standardized coefficient = 0.527), internal motivation ($p = 0.000$, beta standardized coefficient = 0.368), employee attributes ($p = 0.000$, beta standardized coefficient = 0.304), quality system attributes ($p = 0.000$, beta standardized coefficient = 0.215) and external environment attributes ($p = 0.007$, beta standardized coefficient = 0.151).

Table I: Exploratory Factor Analysis of the ISO 9001 objectives

Kaiser-Meyer-Olkin = 0.919		Factors		
Measured variables	Continuous improvement	Customer satisfaction focus	Prevention of nonconformities	
	Factor loadings			
Developing an organizational structure supporting continuous improvement	0.812			
Continuous monitoring and improving processes, procedures and products	0.810			
Achieving measured and explicit quality goals	0.704			
Continuous improving employee work	0.700			
Drawing an effective plan for continuous quality improvement	0.696			
Company collects quality information for system, processes and product improvement	0.592			
Company assurance of meeting customer requirements with regard to products		0.768		
Company activities increasing the level of customer satisfaction		0.749		
Company focus on customer expectations and requirements		0.720		
Customer understanding of product value		0.708		
Personal contact between employees and customers		0.570		
Customer complaints consist a major company priority		0.533		
Product conformance to specifications in accordance with audit results				0.826
Reduced nonconformity problems through quality processing, storage, packaging				0.766
Efficient product, process and quality design				0.763
Product and procedure control throughout production steps				0.644
Eigenvalue	8.43	1.26		1.12
Comulative Variance %	52.71	60.59		67.64
Cronbach a	0.900	0.858		0.885
Mean value¹	5.55	5.86		5.93

¹: 1=strongly disagree, 7= strongly agree.

Table II: Exploratory Factor Analysis of the critical factors for the effective implementation of ISO 9001

Kaiser-Meyer-Olkin = 0.863		Factors				
Measured variables	Internal motivation	Employee attributes	Company attributes	External attributes	Quality system attributes	
	Factor loadings					
Efficiency improvement	0.895					
Decrease of cost production and waste products	0.867					
Product quality improvement	0.862					
Internal process improvement	0.754					
Meeting customer needs and expectations	0.741					
Improvement of a company's image	0.741					
Know-how of employees		0.814				
Employees' acceptance of the changes required		0.797				
Employees' training in the quality standard		0.777				
Employees' involvement and commitment		0.767				
The adequacy of the number of employees		0.569				
Equipment and infrastructure required			0.844			
Appropriateness of company size			0.742			
Calibration and adjustment of instruments and machines			0.701			
The frequency of the internal audits			0.678			
The pressure from competitive manufacturing companies				0.903		
Market pressure (breaking into domestic and foreign markets)				0.890		
Customer pressure				0.878		
Volume of paperwork					0.808	
Financial resources required					0.807	
Time of implementation					0.665	
Eigenvalue	8.31	2.39	2.10	1.62	1.30	
Comulative Variance %	37.78	48.65	58.19	65.55	71.46	
Cronbach a	0.930	0.876	0.817	0.914	0.721	

¹: 1=strongly disagree, 7=strongly agree.

Discussion

The company profiles

It is obvious from the present study that the ISO 9001 certified Greek manufacturing companies are mostly SMEs (based on the number of employees). However, this characteristic of the Greek manufacturing sector is not revealed for first time. The ISO 9001 certified Greek manufacturing companies studied by Psomas *et al.* (2011) are also SMEs. The findings of the study of Psomas *et al.* (2011) and the present study are in accordance with Panigyrakis *et al.* (2009) who state that the size of the Greek manufacturing companies in general is quiet small. Moreover, the above research findings confirm Psychogios and Szamosi (2007) who mention that the majority of Greek businesses are not only small sized but family oriented. Bearing this in mind, an explanation may be given with regard to the small and medium size of the Greek manufacturing companies. In other words, given that most of the Greek companies are family owned, it seems that the family characteristic influencing company size has been maintained, irrespective of the high import and export orientation and expansion of many of these companies.

The rather long experience of the Greek manufacturing companies of ISO 9001, demonstrate that not only have these companies followed the world company trend with regard to the implementation and certification of the ISO 9001 QMS (at least from the beginning of the previous decade), but also that these companies have already realized that the quality improvement is a prerequisite for survival in today's business competitive environment. The high educational level of company quality managers also strengthens this point of view. The sample of the Greek manufacturing companies studied by Psomas *et al.* (2011) also displayed a long experience of the ISO 9001 standard, given that they had also been certified under the previous version of the standard (ISO 9001:2000).

Analyzing and evaluating ISO 9001 effectiveness

Reviewing the literature relating to the ISO 9001 standard, we observe that there is a general consensus among experts and academics with regard to the aims that define ISO 9001 effectiveness. The present study provides empirical evidence to support this consensus regarding the underlying structure (latent constructs) of ISO 9001 effectiveness. More specifically, the present research findings confirm that indeed, as far as the manufacturing sector is concerned, the main pillars of ISO 9001 effectiveness reflecting the standard's objectives are those that are described by the standard itself as well as by numerous authors in the academic literature, namely continuous improvement, customer satisfaction focus and prevention of nonconformities.

Furthermore, the present research study reveals that the manufacturing companies do achieve the ISO 9001 objectives. In other words, the level to which these objectives are achieved is deemed satisfactory. More specifically, the ISO 9001 certified manufacturing companies seem to be more familiar with techniques of preventing nonconformities and focusing on customer satisfaction. In doing so, they finally manage to continuously improve their processes and products. The rather long period of time that the sample manufacturing companies have adopted the ISO 9001 standard may justify the high level to which the ISO 9001 objectives have been met. Moreover, the

export orientation of many of these companies and the fact that many of the suppliers of these companies come from foreign countries, create a strong and competitive business environment that also necessitates manufacturing companies to successfully achieve the objectives of the international standard. In other words, in order for a company to survive in such a business environment or to cope with competitors, it is absolutely necessary that it aim to minimize the rate of nonconformities (this is best achieved through prevention and not detection), focus on customer satisfaction and improve products, services and processes continuously.

However, based on the results of the present study, it is obvious that there is still room for a further increase in the degree to which the ISO 9001 objectives are achieved. This means that the manufacturing companies have not yet fully achieved ISO 9001 effectiveness. The effective implementation of a QMS such as ISO 9001 may require the manufacturing companies adopt a more integrated approach with regard to quality management or move forward to the total quality approach. However, such an opportunity is better provided by the recently launched revised version of the ISO 9001 standard (ISO 9001:2008), to which the vast majority of the sample companies have been recently certified. So, the manufacturing companies, in the years to come, having had more experience in implementing the revised ISO 9001:2008 standard, can establish a more robust and effective QMS.

The purpose of the study of Oztas *et al.* (2007) is similar to the purpose of the present study, even though they focus on the construction sector while the present study focuses on the manufacturing sector. However, the present study explores ISO 9001 effectiveness through assessing the degree to which the ISO 9001 objectives are achieved, while, on the contrary, in the study of Oztas *et al.* (2007), ISO 9001 effectiveness is evaluated by combining the achievement of the QMS requirements with a firm's prescribed quality objectives. Similar to the present study, the study of Jang and Lin (2008) describes the long-term effectiveness and the real value of ISO 9001, based on manufacturing SMEs. However, they are not based on the definition of ISO 9001 effectiveness, in other words on the ISO 9001 objectives, as the present study is, but on the standard's requirements.

Critical Factors influencing ISO 9001 effectiveness

Certain critical factors influence a company's effort to achieve the ISO 9001 objectives, meaning ISO 9001 effectiveness. Consequently, these factors influence a company's effort to increase ISO 9001 effectiveness to even higher levels, in other words to excellent levels. The present research study reveals that these factors form specific critical areas that concern the internal and external business environment. More specifically, analyzing the critical factors for the effective implementation of ISO 9001, five latent constructs are extracted. Elements of the internal business environment (concerning company characteristics/infrastructures, human resources and internal motives for the ISO 9001 certification), the ISO 9001 QMS and the external market constitute the main critical areas for the effective implementation of ISO 9001. Based on the significance of these critical areas, which is also revealed through the data analysis, it is obvious that increasing the level of achievement of the ISO 9001 objectives mostly depends on factors reflecting the internal business environment (company characteristics/infrastructures, internal motives and employees). However, factors not concerning a company's internal environment, that is the QMS and market

characteristics, also have a significant impact on ISO 9001 effectiveness but of lower level. So, the present study reveals that implementing the ISO 9001 standard effectively, in other words fully achieving the ISO 9001 objectives, mostly depends on company robustness and secondarily on the QMS characteristics and the pressure from the competitive market. This means that it is the company itself that can make the difference in enhancing ISO 9001 effectiveness through its infrastructures and characteristics, motives for real quality improvement and employees. Similarly, Gotzamani *et al.* (2006) state that the true value-added stems from a company's efforts and success to build internal special strengths and efficiencies. Bearing in mind the high level of achievement of the ISO 9001 objectives by the sample manufacturing SMEs, it seems that these companies manage and control the significant critical factors influencing ISO 9001 effectiveness well, obviously due to their ample experience in implementing the standard.

Williams (2004), similar to the purpose of the present study, explores the factors influencing the successful ISO 9001 registration process of industrial companies. According to his results, and similarly to the present study, the following significant factors are determined: the motives that drive a company to seek registration coming from the internal and external business environment and the way the standard is communicated to and perceived by the workforce. However, the present study in manufacturing companies reveals two extra critical areas that have a more significant impact on ISO 9001 effectiveness, namely the company attributes and the quality system attributes.

Magd (2006), studying the effective implementation of ISO 9001 in manufacturing companies, as does the present study, recommends companies use the gap analysis to assess their actual abilities against ISO 9001 requirements, carefully plan a QMS and perform the cost-effective analysis. In doing so, the characteristics of the internal and external business environment should be taken into consideration. Thus, similar to the present study's findings, the internal motivation of a company, company attributes, external environment attributes and quality system attributes are also determined by Magd (2006), as significant factors for ISO 9001 effectiveness. The difference between the two studies concerns the employee attributes that only the present study reveals as a significant factor for ISO 9001 effectiveness.

Similar to the present study, Wahid and Corner (2009), identify the critical success factors in ISO 9001 maintenance during the post-certification period. However, their study focuses on a large service organization, while the present study is based on a sample of manufacturing SMEs. The critical success factors identified by Wahid and Corner (2009) concern human resources, the technical side of the QMS and the company's efforts for continuous improvement. These critical success factors are quite similar to three out of the five latent constructs extracted through the present study, namely employee attributes, the quality system attributes and internal motivation. Comparing the critical success factors revealed from both studies and bearing in mind that they refer to different business sectors and company sizes, it is obvious that the most significant latent construct (company attributes) and the least significant latent construct (external environment attributes) revealed in the present study, are not determined by Wahid and Corner (2009).

Conclusions

The ISO 9001 certified Greek manufacturing SMEs, which have ample experience in implementing the standard based on the efforts of educated quality managers, constitute a suitable sample of companies for exploring ISO 9001 effectiveness and the conditions in which it is achieved. Bearing this in mind and stimulated by the suggestions made by many authors, the present study aims at analyzing and evaluating ISO 9001 effectiveness based on its definition as well as analyzing and determining the most influential critical factors.

By definition, ISO 9001 effectiveness concerns the degree to which the standard's objectives are achieved. These objectives are specifically determined not only by the standard itself but by many academics and experts worldwide. The present study validates the ISO 9001 objectives identified in the literature and the standard itself, namely continuous improvement, customer satisfaction focus and prevention of nonconformities. It is worth noting that according to the results of the present study, the manufacturing companies achieve the ISO 9001 objectives to a high degree, however, not an excellent one. This means that even though ISO 9001 effectiveness in the manufacturing companies is deemed satisfactory, it has not yet been fully achieved.

The critical factors for the effective implementation of ISO 9001 form specific latent constructs – critical areas, namely internal motivation, employee attributes, company attributes, external environment attributes and the quality system attributes. However, not all the critical areas have the same significance in enhancing ISO 9001 effectiveness. According to the results of the present study, even though all the latent constructs of the critical factors are proved to be significant for ISO 9001 effectiveness, the critical areas concerning the internal business environment (company characteristics/infrastructures, internal motives and employees) seem to have a higher impact on the degree to which the ISO 9001 objectives are achieved. So, from the above mentioned it is apparent that the effective implementation of a QMS such as ISO 9001 mostly depends on a company's strong and robust internal environment. However, it is worth mentioning that the high level of achievement of the ISO 9001 objectives by the manufacturing SMEs demonstrate that these companies have arranged the significant critical factors in such a way that they positively influence ISO 9001 effectiveness.

Practical implications

Based on the present study's findings, a quality manager of a manufacturing SME can assess ISO 9001 effectiveness through the objectives of the standard itself. In other words, the degree to which the ISO 9001 objectives are achieved can be evaluated through the indicators of the prevention of nonconformities, continuous improvement and customer satisfaction focus. By measuring and evaluating these objectives, and furthermore by managing and controlling the significant critical factors that influence a company's effort to effectively implement the standard, a company can be further improved and increase ISO 9001 effectiveness. Furthermore, increasing the effectiveness of a QMS such as ISO 9001 helps a company decrease the gap of the business excellence level. Consequently, manufacturing SMEs can set the foundations in order to be more competitive and to withstand the current downturn. This may further help the whole Greek economy in its effort for an increase in growth and a successful return to the international financial markets.

Limitations and future research recommendations

The study presented in this paper suffers from some limitations that give rise to suggestions for future research. The data used in this study constitute subjective business evidence obtained from quality managers. This fact, especially with respect to the effectiveness measures, entails the risk of receiving biased responses. So, future research is recommended using objective data that will be drawn from the documents of the ISO 9001 QMS and will reflect quantitative indices.

Given that the sample of the responding companies is limited to small-medium Greek manufacturing companies from different fields, it is worth examining whether the present study's findings with regard to the degree to which companies achieve the ISO 9001 objectives (ISO 9001 effectiveness) and the underlying structure of the critical factors that significantly influence ISO 9001 effectiveness, are affected by variables such as company size, the manufacturing sub-sector and economic environment. In other words, these variables should be taken into consideration in future studies in order to detect whether there are any statistically significant differences among the sub-samples that are created based on these variables.

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The influence of human resources management on project success and business excellence. The Polish case

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Introduction

The theory and practice of the functioning of present-day enterprises show that human resources constitute the most valuable and the most productive resources of any organization. It turns out that at the level of analysis of the whole organization from the point of view of the EFQM model as well as from the point of view of a single project realized within it, this fact has been confirmed with the results of various empirical studies. According to the findings introduced and discussed in Kristensen et al. (2001a) most of the areas critical to business excellence deal with people and more specifically people satisfaction. As appears from more recent research results, an increase in employee motivation and engagement will lead to an increase in customer satisfaction, which again leads to improved customer loyalty followed by increasing financial results (Kristensen et al., 2007). Thus if an organization wants to achieve business excellence it must create a change-oriented environment where the creativity of the employees is nurtured, developed and sustained through education and training, involvement and teamwork (Eskildsen et al., 1999). All findings quoted above deal with human resources management improvement of which positively influences business performance. The same relationship can be observed in case of people management and project success. According to K. N. Jha and K. C. Iyer the three Cs called 'competence', 'commitment' and 'coordination' become the key factors of the success of the project. So if in a project these three factors are managed efficiently better overall performance can be expected (Jha & Iyer, 2007).

The purpose of this article is to display the role of human factor in the efficient project realization and reveal the engagement of Polish enterprises in the management of human resources as one of the initiatives aiming at business excellence.

Within the last dozen or so years, the leading Polish enterprises made significant progress in the implementation and development of quality management systems. At the beginning of the 1990's, systems dominating in Polish enterprises were the company quality systems, the second half of the 1990's marked the expansion of ISO 9000 systems, whereas the beginning of the 21st century meant taking the first steps in the direction of Total Quality Management (TQM). Polish companies entered the path towards the TQM by implementing it as a cohesive management concept, more often, however, by adapting selected components of the TQM system (Haffer, 2002). Thus, it proves that the leading Polish companies take the same path of quality management system development as most enterprises in highly developed countries that is laid out by the environment pressure on increased effectiveness of both the quality system and the

enterprise itself (Haffer, 2005). One of the phases of the path is activating in the enterprises a self-assessment process realized in accordance with the criteria of holistic management model (leadership) which supplies an organization in an objective and comprehensive set of standards allowing the identification of its strengths as well as areas that require improvement, and provide the basis for the preparation and implementation of plans of activity integrated with its strategy (Porter & Tanner, 1996).

Apart from the commonly used holistic management models, such as the EFQM Excellence Model or Malcom Baldrige's Excellence Model, Polish enterprises may choose to apply the model of business excellence based on the guidelines of the Polish Quality Award called the Management Improvement Model (MDZ). Starting from 1995, each year on average 50 organizations compete for the Polish Quality Award, which illustrates the scale of this phenomenon in Poland. This means that self-assessment according to the criteria of the model of excellence is not yet too popular among Polish managers. Despite this fact, the activities aiming at business excellence become more intense in Polish enterprises even without the intentional use of the self-assessment model.

In the last decade also project management became an important discipline and gains more and more interest in the global and Polish economy. This concept – which was once an internal matter of an organization – today is a competitive tool increasing the quality and value offered to the clients and constitutes a justified and right approach towards organization management, the environments and conditions of contemporary business. What in reference books is described as 'project success' constitutes one of the fundamental concepts in project management and is identified with successful realization of projects which lead to the achievement of the intended goal. Project management aims at facilitating the entire project realization process in order to accomplish its intended goal in an efficient and effective way. Project management efficiency constitutes a comprehensive set of project success factors in relation to organizational and external circumstances in which an organization operates.

Project management is a very complex discipline that may be examined from various angles and within multiple generalizations. Strategic paradigm assumes that a project may be perceived through its product as the method of realization of an organization's strategy. Organizations and clients always look at the project through the prism of a generated product. On the other hand, process paradigm wants the project to be seen as a sequence of activities and processes which are to be accomplished. These processes need to be managed in such a way which ensures that the project will be completed. Finally, the project may be seen through the prism of human paradigm as a certain area of exchange, relations and activities among people. Projects are created by people, and so project management relates first of all to the formation of groups of specialized individuals from various areas of an organization for a specified period of time in order to fulfil a particular task. Once a given project is complete, the group is dissolved and its members are delegated to other tasks, projects, or back to previous operational tasks connected with their positions. Also for this reason human factor plays an incredibly important role in project management and is called by many authors its key element (Van Der Merwe, 2002).

Research methodology

The data presented in this article come from three research projects. The first two of them were concerned with the engagement of Polish enterprises in the initiatives aiming at business excellence carried out in the years 2004-2005 and 2006-2007. As a result, two sample groups of enterprises were researched: sample group PL2005 composed of 79 companies, and PL2007 of 230 enterprises. Selection of the sample groups was carried out with the use of various sources of information about enterprises, including the lists of “the five hundred” and “the thousand” best enterprises in the Polish economy published in economic magazines as well as three databases: “2005 firms. Marketing CD”, “Polish quality leaders” and “Business gazelles”. That means that achieved samples were purposeful ones as they were drawn from the databases including the most active companies in the Polish economy. Both studies applied a similar research procedure and used the same research questionnaire.

Representatives of the highest managerial positions were asked to assess the engagement of the companies that they managed in initiatives aiming at business excellence on a scale from 0 to 100, regardless of the fact whether they use any of the holistic management models or not. Assessment criteria adopted in the research were the indicators of the EFQM Excellence Model. Measurement scales included 51 sub-criteria forming 9 more aggregated criteria, identical to those that make up the EFQM Model. Based on these criteria the respondents were able to assess the progress that the organizations they manage have made towards organizational excellence. Next, with the gathered data, a model was created basing on the Danish Business Excellence Index (DBEI) (Kristensen et al., 2001a). Estimation of the model was conducted with the use of the method of least squares with the SmartPLS software (Ringle et al., 2007). The results of correlation and estimation of the created model encouraged the discussion of the conditions of Polish enterprises and made it possible to determine the efforts which should be made for their further development.

The third research project titled “Project management efficiency in the enterprises operating in Poland” was realized between June and July 2008. The research resulted in purposive sample PL2008, mostly formed on the basis of the member list of the Polish Project Management Association. From the full list of 658 entities (considering only one representative for each entity) the entities representing different organizations than enterprises were removed (e.g. universities, agencies, foundations and state entities). This way 363 entities were selected. An Internet survey was distributed mainly in the environment of the Polish Project Management Association, however, it was also directed individually to selected enterprises which, as it was arbitrarily decided, showed certain advancement in project management. In total, 70 respondents participated in the research.

The respondents were asked among all to verify a list of project success factors in order to assess their importance in a recently realized project, using the scale from 0 to 5, where: 0 meant that a given factor was insignificant for project success, 1 meant that a given factor had very little significance, 2 – little significance, 3 – medium significance, 4 – big significance, and 5 – very big significance in project success. This way it was possible to identify factors increasing project management efficiency in enterprises operating in Poland.

Characteristics of the EFQM Model and the Danish Business Excellence Index (DBEI)

The main reason for founding the European Quality Award by the European Foundation for Quality Management was the need for appreciating organizational excellence of European companies. The EFQM Excellence Model provides methodical frames for those who apply for the award and has also become the most commonly used model for the implementation of the Total Quality Management (TQM) model in Europe (Westlund, 2001). The EFQM Model consists of nine elements grouped in two categories of assessment criteria: enablers and results. The enablers include five criteria, namely: leadership, policy and strategy, personnel management, partnership, resources and processes, whereas the group of results includes four criteria: client results, employee results, social results and financial results. The enablers represent how the organization is functioning, while the results concentrate on the achievements in relation to organization stakeholders, their measurement and determining their target levels (EFQM, 1999). The EFQM Model is based on the logical assumption that there is an internal interrelation between the enabler criteria that may be expressed as follows: leadership drives the policy and strategy, personnel management, partnership and resources, and these three elements have an impact on the results of activity by means of processes (EFQM, 1999). This approach emphasizing the need for balancing the model, allows for the optimization of the synergy effect between its elements which is in agreement with the general assumption of the model (Westlund, 2001). Sustainable development implies such an internal enabler structure according to which the improvement of results is accomplished only when the input of all the enabler elements is the same.

The Danish Business Excellence Index (DBEI) was published by the Danish Association for Quality Management together with the Aarhus School of Business and an independent research company Markeds/Consult A/S in order to determine a universal benchmarking system for Danish enterprises based on business excellence principles. The ideas behind the index were introduced and discussed in Kristensen and Juhl (1999) as well as in Kristensen et al. (2001a, 2001b, 2003). The EFQM Model was selected as an obvious starting point for the development of business excellence measurement system, as it is the most popular self-assessment tool in Europe. The studies conducted by the European Foundation for Quality Management show that nearly 60% of enterprises conducting self-assessment apply the EFQM Model (Hakes, 1997). The DBEI accounts for nine criteria of the EFQM Model, however, it was assumed that there are four underlying fundamental components (management, people, systems and results) which interact in the way shown in figure 1.

Thus, the DBEI suggests combining nine areas of the EFQM Model, which makes it possible to explain their mutual relations. The explanation of these interrelations is based on the following assumptions:

- management quality is the primary cause (causative factor) of business excellence;
- good results are the function of both the effective use of the system and the intellectual capital (people) of an enterprise;
- the quality of people has a direct and an indirect impact on the achieved results through systems.

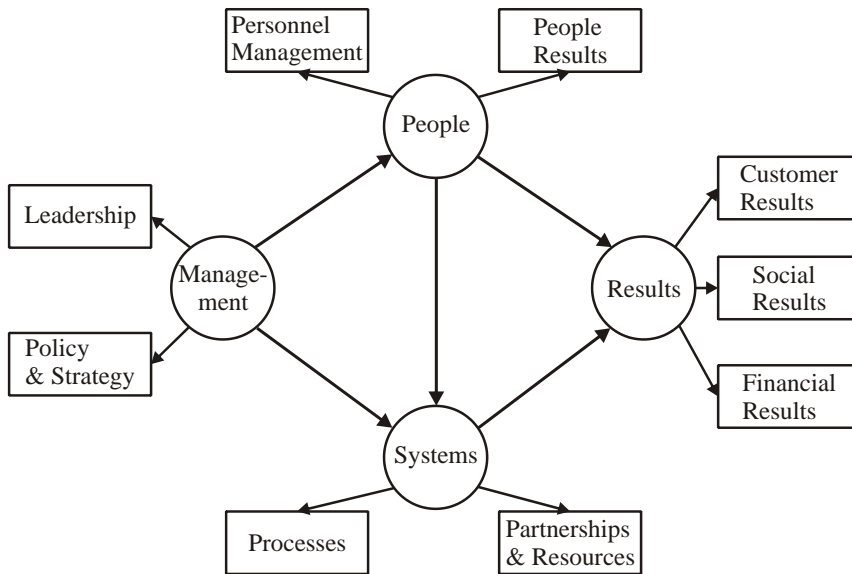


Figure 1. Danish Business Excellence Index (DBEI)

The Danish Model of Business Excellence is estimated with the least square method (PLS). This estimation technique allows for receiving results for each model element in relation to any enterprise. Consequently, all four components of the model may be analyzed at an aggregated level, with the division into the nine elements of the EFQM Model, as well as at an operational level based on evaluations within the 0 to 100 scale for each question of the measurement instrument (Kristensen et al., 2003). This article focuses on the evaluation made at the aggregated level.

Progress of enterprises towards organizational excellence

Figure 2 presents the results of self-assessment of chief management showing the efforts that the Polish enterprises make in the four self-assessment areas of the DBEI model calculated for both research groups: PL2005 and PL2007.

Polish companies are seen by their managers as fairly well managed. This is good news, since the quality of management is the main factor determining business excellence. However, it turns out that managers of Polish enterprises place a lot of emphasis on systems but tend to neglect the people. The data clearly show that human resources management is a weak point for Polish enterprises. Still, the consoling fact is that self-assessment results in all four areas of the DBEI model have improved for both of the researched sample groups: PL2005 and PL2007. It appears that through several years of Poland's functioning within the EU structures, the Polish companies have made visible progress on their way to excellence.

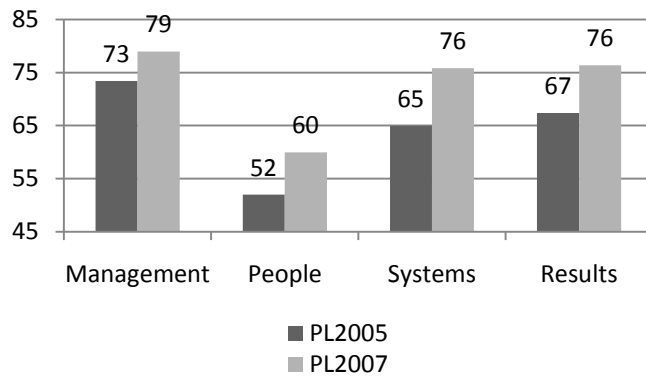


Figure 2. Self-assessment results of Polish enterprises according to the DBEI model (PL2005 and PL2007)

Figure 3 presents the results of the Danish Business Excellence Model estimation on the basis of the data received from Polish enterprises.

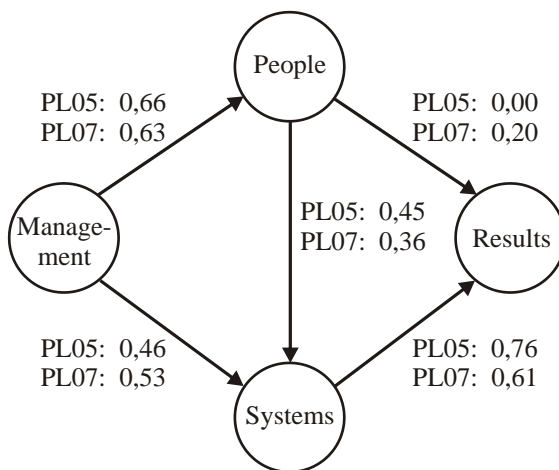


Figure 3. Estimation results for Polish enterprises according to the DBEI model (PL2005, PL2007)

Standardized regression coefficients allow for the assessment of the impact of independent variables (explanatory) on dependent variables (explained) depicted in the figure as circles to which arrows are pointing. The higher their values, the more significant their impact²⁶. Standardized regression coefficients shown in figure 3 indicate that the increase in the “management” index will have a positive impact on the “people” index and the “systems” index for both presented samples. However, the impact on the “people” index will be much greater than on the „systems” index. Moreover, in the sample PL2005 we can observe the lack of strong relationship between the indices of “people” and the “results”. However, this relationship appears in the

²⁶ Regression analysis provides values of standardized regression coefficients (β) for particular explanatory variables. Standardized values of regression coefficients (β) indicate how much the value of an explained variable changes due to standardized change in a given explanatory variable, that is with the change in an explanatory variable by one standard deviation. The comparison of the values of standardized regression coefficients (β) allows determining which of the explanatory variables had the greatest impact on process efficiency. In other words, the Beta values refer to the net impact on single variables.

sample PL2007. This means that Polish companies in 2005 were still in a phase of accomplishing their results through system solutions rather than through human resources management which confirms the previously drawn conclusions. After a few years of functioning of the Polish economy within the EU structures the role of human factor as the indicator of business activity results has increased. This means that managers of Polish enterprises begin to attach greater importance to human resources management, but also that efficiency and, what follows, the employees' contribution to the results achieved by the Polish companies are growing.

Project success factors in companies

Project success factors are key variables explaining its success (Diallo, Thuiller, 2005). Paying attention and caring about the factors improves the effectiveness of all project management processes. They can also be referred to as “lever” or “stimuli” which can be used by project managers or project organization to increase the probability of achieving the desired project result (Westerveld, 2003). Project success factors enjoy a considerable interest as a research area investigated by scientists worldwide (Hyvari, 2006). The first attempt to define them was made in a paper written in 1967 by I.M. Rubin and W. Seeling, in which they studied the impact of project manager's experience on project success. Empirical studies showed that the previous experience of the person heading the project exerted a marginal influence on its success. However, most of the works written later completely opposed the thesis. Some of them were quoted above.

Although individual projects differ one from another, which is a result of their nature, some common factors can be found which considerably increase the chances of success of any project. This is reflected in empirical studies conducted in Poland as well as in scientific literature worldwide disseminating study results and regularities concerning the impact of various factors on project success.

In a study carried out with the sample PL2008, six groups of project success factors were tested including factors connected directly with project, factors connected with project manager, factors connected with project team, factors connected with project implementing organization, macrosurroundings factors and microsurroundings factors. The initial four groups were included in the so-called internal factors, whereas the other two were classified as external factors. Similar division was created by J.K. Pinto and D.P. Selvin, who suggested that project success is linked to both egzogenic and endogenic factors (Pinto, Selvin, 1988).

The data presented in figure 4 provide information about the average assessment of the importance of individual groups of factors for project success. Two groups of internal factors were assessed highest, namely factors connected with project manager and factors connected with project team, both with the average assessment of 3.9. Then the respondents placed factors connected directly with project (average assessment of 3.7), followed by factors connected with project implementing organization (average assessment of 3,5). The last two positions were held by external factors such as microsurroundings factors with the average assessment of 3.1 and macrosurroundings factors with the average assessment of 2.6.

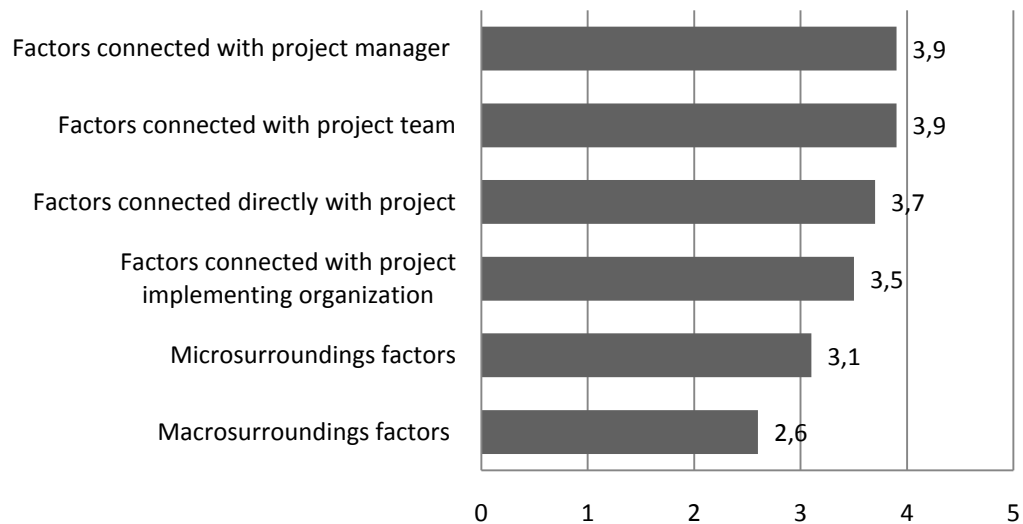


Figure 4. Average assessment of the importance of individual groups of factors for project success

Table 1 includes a list of project success factors ordered according to their importance for project success. Out of 87 analysed factors, 29 were marked 4.0 and higher. A list of factors critical for project success has been created as a result. The list includes only internal factors – 13 factors connected with project manager (45%), 9 factors connected with project team (31%), 6 factors connected directly with project (21%) and 1 factor connected with project implementing organization – atmosphere of cooperation (3%). A vast majority of 76% of the items on the list of factors critical for project success is related to people.

Table 1. Assessment of the importance of project success factors – an overall list. Source: own study based on the results of a survey of companies

No	Factor connected with project manager	Factor connected with project team	Factors connected directly with project	Factor connected with project implementing organization	Factor name	Average mark
FACTORS CRITICAL FOR PROJECT SUCCESS – LIST OF 29						
1	X	-	-	-	commitment of project manager	4.6
2	X	-	-	-	sense of responsibility of project manager	4.5
3	-	-	X	-	clearly defined project objectives (clear and understandable project vision)	4.4
4	-	X	-	-	commitment of project team members	4.4
5	X	-	-	-	ability of project manager to react to changes	4.4
6	-	X	-	-	sense of responsibility of project team members for project results	4.4
7	X	-	-	-	communicative skills of project manager	4.3
8	X	-	-	-	leadership skills of project manager	4.3
9	-	X	-	-	professional / specialist competences of project team members	4.3
10	X	-	-	-	formal and informal authority of project manager	4.3
11	-	X	-	-	communicative skills of project team members	4.3
12	X	-	-	-	skills of project manager in coordination of activities and works	4.3
13	-	-	-	X	atmosphere of cooperation	4.2
14	-	X	-	-	proper composition of project team	4.2
15	-	X	-	-	atmosphere stimulating creativity of project team members	4.2
16	-	X	-	-	acceptance and good relations among team members	4.2
17	X	-	-	-	speed of decision-making of project manager	4.2

18	X	-	-	-	previous experience of project manager at a similar post	4.1
19	-	X	-	-	clarity of division of responsibilities among team members	4.1
20	X	-	-	-	knowledge and skills of project manager in project management	4.1
21	-	X	-	-	motivation of team members	4.1
22	X	-	-	-	ability of project manager to delegate powers	4.1
23	-	-	X	-	regular supervision of implementation of project plan	4.0
24	-	-	X	-	easy access to suitable resources necessary for project implementation	4.0
25	-	-	X	-	realistic project plan	4.0
26	X	-	-	-	ability of project manager to reach compromise	4.0
27	X	-	-	-	motivation of project manager	4.0
28	-	-	X	-	detailed and clear structure of division of duties within project	4.0
29	-	-	X	-	agreement for active participation of customers (their representatives) in project works / customer involvement	4.0

The leading two positions are taken by factors connected with project manager, namely commitment and sense of responsibility of project manager. The two are followed by a factor connected directly with project – clearly defined project objectives – parallel to commitment of project team members, ability of project manager to react to changes and sense of responsibility of project team members for project results.

As evident from the presented data, the success of projects implemented in Polish enterprises depends to a considerable extent on people. It is the human potential, both of project management and project team members that is considered to be the main reason for improvement of effectiveness of all project management processes.

Conclusions

As the data presented in the article show, among the key self-assessment areas established according to the EFQM Model, the lowest results are achieved by Polish enterprises in the field of human resources management. At the same time, since Poland joined the EU, the importance of human factor as a key indicator of the achieved results has been growing in Polish companies. This is confirmed by the results of studies concerned with project success factors in Polish companies, according to which it is the factors connected with people that mainly determine effective project implementation. However, such project success factors as for example commitment of project team members and their sense of responsibility for project results as well as motivation of team members and atmosphere of cooperation can not be released without commitment and effective leadership of project managers. At the same time, if in a project human factors are managed efficiently better overall performance can be expected.

J.S. Oakland and S. Oakland emphasize that an effective human resources management more and more often becomes the area of management which is given considerable attention in the organizations which want to be successful (Oakland & Oakland, 1998). For this reason, the main challenge facing the managers of Polish companies on their way to perfection is an increased effectiveness of management of the most productive resource any organization can have, namely its personnel. It will also undoubtedly contribute to successful implementation of various undertakings such as projects.

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Exploring the Practical Implementation of Corporate Social Responsibility in the Mining Industry

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Paper categorization: Literature review

Introduction

Today corporate social responsibility (CSR) is discussed worldwide but the importance given to it may differ between countries (Idowu and Leal Filho, 2009). A transnational organization may be faced with differing aspects of CSR in different countries of operation. What is included in the concept in one country may perhaps be of little significance in another. Sustainable development is a widely accepted concept, often used interchangeably with the term CSR. However, in our view these concepts are closely linked but differ considerably with regard to their system level and scope. Sustainable development focuses on global issues while CSR has its focus on individual organizations. One of the industries in the fore front of CSR practice is the mining industry. Industries that utilize natural resources are more inclined to have formal written code of ethics and environmental policies, a social responsibility and practices (Reichert et al., 2000) and provide social and environmental disclosure (Jenkins and Yakovleva, 2006). Kapelus (2002) states that these industries are in the fore front as a response to significantly increased pressure in the last twenty years from non-government organizations (NGOs), social movement and indigenous peoples, which in turn is a result from the major impact that these industries have both on the environment and the society. Thus, CSR is particularly relevant in the mining sector (Hamann, 2003).

According to Dobers (2009) research should focus on the practical rather than the policy level of CSR. Kemp (2010) also wants scholars to pay closer attention to organizational arrangements and on-the-ground practice inside operations, rather than from an external standpoint. Jenkins and Yakovleva (2006) say that there is no measure of whether policy statements are applied in practice in any meaningful way and that further research is needed to develop such measures in order that performance against intention can be calculated.

Kotler and Lee (2005) divide CSR practice into six options for, as they say, doing good; cause promotions, cause-related marketing, corporate social marketing, corporate philanthropy, community volunteering and social responsible business. This study is only focused on the last option; social responsible business. CSR concerns the potential and actual impacts of the organization's activities and decisions, the ongoing, regular daily activities. Philanthropy, as giving to charitable causes, should not be used as a substitute (ISO, 2010). Despite that, much of the existing literature within CSR is focused on philanthropic activities of large companies (Whitehouse, 2006). The difference in view can partly be explained through national differences. Matten and Moon (2008) have studied why forms of CSR differ among countries by comparing The

United States with Europe and have identified differences like the power of the state, governments engagement in economic and social activity, financial sources and education and labour systems. Another national difference is environmental legislation (Hilson and Murck, 2000). A comprehensive environmental legislation has been in place for decades in large parts of North America, Europe and Australia, but in a number of South American, African, and Asian countries environmental legislation are still in their infancy.

Hence, there is a need to explore practical implementation of CSR in corporate core business within the frontrunner industries and find best practice that might form a basis for further development of CSR implementation. In response to this need the purpose of this study is to explore integrated CSR practice in mining corporations which is addressed by answering the following research questions;

Within which core subjects are CSR practice conducted?

What is CSR practice in each core subject?

How do organizations practice CSR?

Study design and data

According to Hart (1998) a literature review is important for acquiring an understanding of the topic, of what has already been done on it, how it has been researched, and what the key issues are. Since this study is the first part of a larger research project it was preferable to start with a literature review. The search for literature was conducted during the period from September 2010 to March 2011.

In order to find relevant academic data bases, a search with the keyword CSR, was conducted by a large amount of subjects and a number of data bases were identified. The search string used in these data bases was CSR OR corporate social responsibility AND mining AND specification area. The specification areas chosen for identifying the CSR practice were practice*, implement*, ISO 14001, ISO 26000 and management. The search resulted in five search strings for each database and the search was conducted in article titles, abstracts and keywords. The procedure resulted in 37 peer-reviewed studies (33 articles, three conference papers and two reports) published between 1998 and 2010. A majority of these were published from 2006 and onwards, as seen in Figure 1.

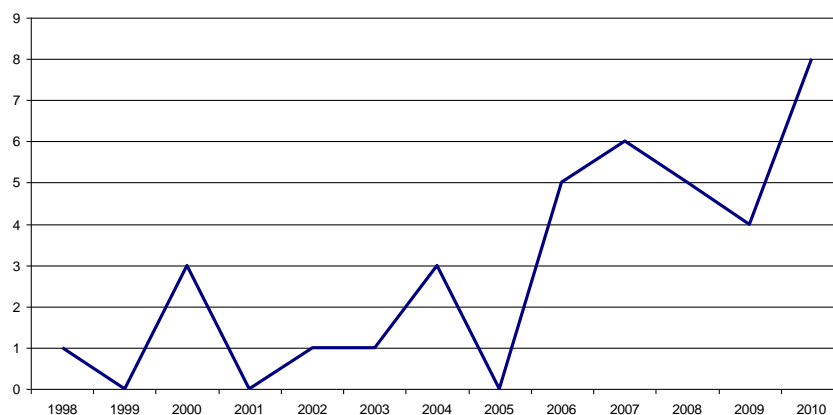


Figure 1

Selected studies and the year they were published.

The selected studies were published in 30 different journals. The majority of the authors are studying mining operations in Africa (mostly operations in South Africa and Ghana) and Oceania (where Australia is dominating). Three studies were found in South America as well as in North America, two in Asia and one in Europe, as seen in Table I.

Table I

Selected studies, country for mining operation and approaches.

Study	Country for mining operation	Research method
(Dashwood and Puplampu, 2010)	Ghana	Case study
(Kemp, 2010)	Australia, New Zealand	Survey, ethnographic research and industry interviews
(Cronjé and Chenga, 2009)	South Africa	Survey
(Welker, 2009)	Indonesia	Essay
(Rajak, 2008)	South Africa	Ethnographic research
(Parsons, 2008)	Australia	Case study
(Imbun, 2007)	Papua new guinea	Survey
(Whitehouse, 2006)	No specific	Survey
(Hamann, 2004)	South Africa	Case study
(Hamann and Kapelus, 2004)	South Africa and Zambia	Case studies
(Reichert et al., 2000)	No specific	Survey
(McPhail and Davy, 1998)	No specific	Review
(Carvalho et al., 2010)	Brazil	Case study
(Yankson, 2010)	Ghana	Case study
(Esteves, 2008a)	Australia, South Africa	Case study
(Hilson, 2006)	Ghana	Case study
(de Jesus Soares, 2004)	Indonesia	Case study
(Kapelus, 2002)	South Africa	Case study
(Hilson and Murck, 2000)	No specific	Case studies
(Campbell, 2008)	Canada, Africa	Conceptual
(Esteves, 2008b)	Australia, South Africa	Case study
(Aloi, 2007)	No specific	Conceptual
(Unknown, 2007)	No specific	Review
(Jones et al., 2007)	No specific	Case studies
(Lange, 2006)	Tanzania	Case studies
(Jul-Larsen et al., 2006)	Mali	Case studies
(Jenkins and Yakovleva, 2006)	No specific	Case study
(Towsey, 2003)	Australia, Europe, Africa and the Americas	Case studies
(Warhurst and	USA	Case study

Mitchell, 2000)		
(Vintró and Comajuncosa, 2010)	No specific	Conceptual
(Perez and Sanchez, 2009)	No specific	Content analysis
(Trebeck, 2007)	Australia	Case studies
(Kemp et al., 2010)	No specific	Discourse analysis
(Coronado and Fallon, 2010)	Australia	Discourse analysis
(Young et al., 2010)	No specific	Review
(Hutton et al., 2007)	Peru	Case study
(Garvin et al., 2009)	Ghana	Case study

Findings

The findings are divided into six core subjects that are of specific interest; organizational governance, human rights, labour practices, the environment, fair operating practices and community involvement and development.

Organizational Governance

Organizational governance is the system by which an organization makes and implements decisions in pursuit of its objectives (ISO, 2010). How CSR is organized, what partnerships with governments and other organizations the review has identified as well as CSR principles, standards and tools will now be presented.

Little information about how CSR issues are organized within the organization have been identified. A study by Reichert et al. (2000) indicates that a large part (66,7%) of the studied industries that utilize natural resources have a position that is handling ethical concerns. Imbun (2007) has examined two gold mining companies in Papua New Guinea and the mines have a community relations department which have more than thirty employees with prior experience in dealing with community affairs. One mine executive described this department as “the engine of the mine operation” and the employees provides a vital link between mining projects and the local communities.

A large portion of the literature is addressing partnerships with governments, business associations and other organizations. According to Hamann (2003) there is a growing interest amongst government organizations for partnership with business in order to create sustainable development and achieve mutual objectives. One important example is the United Nation’s Global Compact (Hamann, 2003; Jenkins and Yakovleva, 2006; Jones et al., 2007) which is a strategic policy initiative for businesses that are committed to aligning their operations and strategies in the areas of human rights, labour, environment and anti-corruption. The initiative has 8,000 participants, including over 5300 businesses in 130 countries around the world (UN, 2011). Other examples are presented in Table II.

Many companies are financially driven to achieve best CSR practices in order to access capital through different indexes and a number of business associations and other organizations that are focusing on sustainable development in the mining industry are also identified, listed in Table II. Numerous of CSR principles, standards and tools have

been identified to implement the values in the core business activities. The most referred to is the global reporting initiative (GRI) but many more are presented in Table II.

Sánchez (1998) observed in the 1990s that many major Canadian mining companies had integrated a number of environmental management tools and strategies into their operations. Hilson and Murck (2000) have studied two Canadian mining companies and the first had developed an environmental, health and safety management framework and the second had an environmental management system in place that followed ISO 14001.

Esteves (2008a) argues that social impact assessment (SIA) is widely accepted as a project planning tool amongst the largest mining companies. According to Aloi (2007) SIA is a methodology to review the social effects of infrastructure projects and other development interventions and should for example include profile of the operation and impacted communities, identification of stakeholders and key issues, detection of emerging social, cultural, technological, political and economic trends and demands, population statistics and analysis of education levels, skills and trades. Esteves (2008a) advocates that SIA needs to be expanded to embed concepts of social development and sustainability into core business strategies and that the SIA process should serve as a basis for building collaborative alliances with government and communities to address shared issues in the external environment. He has therefore, based on eight case studies, built a decision model called SIDAT for evaluating social projects in order to create value for both the company and the community.

Table II

The government partnership with business, financial drivers, business associations, organizations and CSR principles, standards and tools identified in this study.

Government partnership with business	Reference
The United Nation's Global Compact	(Hamann, 2003; Jenkins and Yakovleva, 2006; Jones et al., 2007)
ILO Declaration on Fundamental Principles and Rights at Work	(Jones et al., 2007; Dashwood and Puplampu, 2010)
The UN Declaration of Human Rights	(Jones et al., 2007)
The OECD Guidelines for Multinational Enterprises	(Jones et al., 2007; Dashwood and Puplampu, 2010)
The US/UK Voluntary Principles on Security and Human Rights	(Jones et al., 2007)
The European commission's and the United Kingdom's CSR initiative	(Hamann, 2003)
BEE Scorecard for the broad based socio-economic empowerment charter for the South African mining industry	(Hamann, 2004)
Financial drivers	Reference
Dow Jones Sustainability Index	(Aloi, 2007; Jones et al., 2007)
FTSE4Good Index	(Jones et al., 2007; Vintró and Comajuncosa, 2010)
The Citigroup Global Markets Sustainable Mining Index	(Aloi, 2007)

The Equator Principles	(Aloi, 2007)
Domini 400 Social Index	(Vintró and Comajuncosa, 2010)
KLD-Nasdaq Social Index	(Vintró and Comajuncosa, 2010)
The International Finance Corporation's (IFC) Policy and Performance Standards on Social and Environmental Sustainability	(Dashwood and Puplampu, 2010)
Business associations and other organizations	
World Business Council for Sustainable Development	(Kapelus, 2002; Hamann, 2003; Hutton et al., 2007)
Business for Social Responsibility	(Hamann, 2003)
The Global Mining Initiative (GMI)	(Jenkins and Yakovleva, 2006)
International Council on Mining & Metals (ICMM)	(Jenkins and Yakovleva, 2006; Hutton et al., 2007; Vintró and Comajuncosa, 2010)
The Extractive Industries Transparency Initiative (EITI)	(Jenkins and Yakovleva, 2006)
Australian Mineral Industry Code for Environmental Management	(Jenkins and Yakovleva, 2006)
The Minerals Council of Australia (MCA)	(Jenkins and Yakovleva, 2006)
The Prince of Wales Business leadership Forum (PWBLF)	(Kapelus, 2002)
The Centre for International Private Enterprise (CIPE)	(Kapelus, 2002)
International Association of Environment and Development (IIED)	(Kapelus, 2002)
Transparency International	(Kapelus, 2002)
CSR principles, standards and tools	
The Global reporting Initiative (GRI)	(Hamann, 2003; Jenkins and Yakovleva, 2006; Perez and Sanchez, 2009; Vintró and Comajuncosa, 2010)
GRI Mining & Metals Sector Supplement	(Perez and Sanchez, 2009; Vintró and Comajuncosa, 2010)
AA 1000	(Hamann, 2003; Jenkins and Yakovleva, 2006; Vintró and Comajuncosa, 2010)
SA 8000	(Jones et al., 2007; Vintró and Comajuncosa, 2010)
ISO 14000 environmental standards	(Hilson and Murck, 2000; Dashwood and Puplampu, 2010)
ISO 9000 quality standards	(Vintró and Comajuncosa, 2010)
ISO 26000 Guidance on social responsibility	(Vintró and Comajuncosa, 2010)
SGE-21	(Vintró and Comajuncosa, 2010)
UNE 22470 Sustainable mining management indicators	(Vintró and Comajuncosa, 2010)
Social impact assessment (SIA)	(Aloi, 2007; Esteves, 2008a)
Social Investment Decision Analysis Tool (SIDAT)	(Esteves, 2008a)

Models of work for community-company interaction (Kemp, 2010)

Kemp (2010) presents a framework with four models of work for community–company interaction in mining. Models 1 and 2 are traditional and have long been accepted as work that large mining companies do. Model 1 is focused on company information and that the information is accurate, accessible and understood. Model 2 is concerned with how messages are received and perceived, with the aim of reducing negative feedback and protecting company reputation and interaction with powerful and more influential stakeholders, such as the media, government and community representatives, including non-government organizations (NGOs). In Model 3, the company is focused on understanding community perspectives through dialogue, which is inclusive of disempowered groups. Personal interaction and relationships are essential. Model 4 is dependent on the identification of social risks and impacts and is focused on development priorities. It places local people at the centre of the interaction process where on the aim of the work is on their empowerment and betterment, rather than protecting company reputation.

An initial step of practicing CSR is to define, document and publicly communicate the organization's intentions and direction related to its CSR performance. This is sometimes called a sustainability policy or a CSR policy (Jenkins and Yakovleva, 2006; Whitehouse, 2006) and sometimes a code of conduct (Kapelus, 2002; Unknown, 2007). In the literature these concepts are used simultaneously but they can be different concepts. As Cooney (2000) explains, a sustainable mining policy is the first step to reconciling mining with sustainable development, as it helps align operations with governmental objectives, create a basis for dialogue, and clarify corporate sustainability objectives. According to Bondy et al. (2004) a code of conduct can be divided into two camps: normative and instrumental. A normative code is formalizing, encouraging, and guiding employee behavior (Bondy et al., 2004) while an instrumental is a part of an internal control system (Brereton, 2002).

As mentioned before Reichert et al. (2000) found in their study of 146 Fortune 500 companies that industries that utilize natural resources, such as mining, are more inclined to have a formal written code of ethics, environmental policies and practices. Also Kapelus (2002) describes transnational mining corporations increased interest for publicly communicating their values. Jenkins' and Yakovleva's (2006) study, based on the ten largest mining companies around the World, shows development from policies on health and safety, employee well-being and the environment, followed by community relations or social investment policies, to integrated policies. Several of the companies had moved further to develop overarching sustainability and CSR-policies.

Whitehouse's (2006) overview of CSR policy development within 16 UK companies points out two important factors when determining the policy. The first was identifying and responding to the demands and expectations of stakeholders and she states that many of the companies spent considerable time and expense communicating with their stakeholders in order to arrive at policies consistent with the companies' definition of CSR. The second factor was consistency with the core aspects of the business. This is also described by Newenham-Kahindi (2011). Whitehouse concludes that the companies' underlying objectives with these policies are to balance the interests of both shareholders and stakeholders.

Jenkins' and Yakovleva (2006) is exploring trends in the reporting of social and environmental impacts and issues between 1999 and 2003. They claim that stand-alone social and environmental reports are becoming more sophisticated and stylish. The elements of this increasing sophistication include:

- Reports covering a wider scope of issues. This is confirmed by Perez and Sanchez (2009) who have conducted a content analysis of 31 reports published between 2001 and 2006 by four major mining companies. The result shows a clear evolution in report's comprehensiveness and depth and to a greater maturity level in reporting;
- A trend towards producing sustainable development and CSR report, also argued by Hamann (2004) who has studied mining companies active in South Africa;
- Accordance with the Global Reporting Initiative (GRI) guidelines. Hamann (2004) has also seen that GRI plays an increasingly significant role in guiding these reporting efforts by the mining companies active in South Africa;
- Increasing levels of external verification of data contained in reports, even if Perez and Sanchez (2009) want to see an improvement of the third-party verification; and
- An increase of report publications on the web.

Human rights

Human rights are the basic rights to which all human beings are entitled and an organization has the responsibility to respect human rights (ISO, 2010). Only one article mentions CSR practice within this core subject. Kemp et al. (2010) are examining a multi-national mining company's efforts producing "The gender guide" which has the purpose to integrate gender considerations into its communities work. They argue that this is one of the first gender frameworks developed by a multi-national mining company but unfortunately they are not describing the guide further.

Labour practices

The labour practices of an organization encompass all policies and practices relating to work performed within, by or on behalf of the organization, including subcontracted work. (ISO, 2010). Jones et al. (2007) have studied two Canadian mining companies and their employment systems and practices and despite the fact that they have committed to a numerous amount of statements much of the practical work is focusing on policy principals instead of more specific programmes or actions. Towsey (2003) has studied the fatality prevention in the mining industry and states that the industry still has a long way to go. He suggests a change of the corporate culture by focusing on fatalities with the same intensity as profit, senior management should attend funerals of all fatalities, communication and focus on risk prevention.

The environment

The decisions and activities of organizations always have an impact on the environment no matter where the organizations are located (ISO, 2010). Mining causes irreversible damage to the environment and some common examples are acid mine drainage, heavy metals overloading, ecological impacts, effluent contaminations, impact upon water resources, air pollution, noise, dust and landform changes (Hilson and Murck, 2000; Yakovleva, 2005).

One of the mining companies studied by Hilson and Murck (2000) has developed a management framework for environmental issues. Another company has adopted a comprehensive environmental information management system that records data, displays trends, prescribes changes in waste and air and water management. Both mines have an environmental management system in place that follows the requirements in ISO 14001. The company scientists continually review alternative technologies, are involved with research consortiums, have chaired conferences and sponsored new standards for the industry. A regular assessment of environmental conditions is made at all stages of mining, from exploration to mine closure, and objectives and strategies have been developed for their management. Jul-Larsen et al. (2006) have studied the gold mining in Mali and the focus there has been on environmental protection, such as purification of the village, construction of garbage dump and building systems to regulate rain water. Reichert et al. (2000) gave the industries that utilizes natural resources the highest environmental index in their study. However, this study generated little information about how mining companies practice CSR within the environmental area.

Fair operating practices

Fair operation practices concern the ethical conduct when an organization is dealing with other organizations for example anti-corruption, fair competition and respect for property rights (ISO, 2010). Lange (2006) describes a case where corruption had taken a serious form that was devastating for the public image for a mining company operating in Tanzania. To avoid the problem to repeat itself the company took control over the implementation of the development projects themselves and used their own contractors. Young et al. (2010) have turned the issue and have developed principles that are important from a customer perspective. They suggest that the customers of the mining industry should recognize their responsibility through traceability of the metals, give priority to metals from mining companies that adhere the initiatives in the industry, conduct due diligence and reduce their consumption of metals from indigenous lands and environmentally sensitive areas.

Community involvement and development

Organizations have a relationship with the communities in which they operate. This relationship should be based on community involvement and to contribute to community development (ISO, 2010). This is particularly important for the mining industry due to the extensive impact on both the environmental and social environment. Examples of social impacts are disturbance to agricultural land and livelihoods, increased road traffic, encroachment on spiritual and burial sites, cultural disturbance and displacement of families or entire villages (Yakovleva, 2005). In response to the loss of land for farming problems like poverty and unemployment are aggravating (Yankson, 2010).

A growing public concern has been noted due to many environmental disasters and human rights incidents that took place in the mining industry over the last 40 years (Warhurst, 2001). As mining has become more technical and automated it provide fewer employments and reduced direct benefits for local communities, it has less support from local stakeholders (Warhurst and Mitchell, 2000). Hence, there is a growing demand

from society for the mining industry to be more socially and environmentally responsible.

Because of that, many companies are struggling to regain lost trust (Hutton et al., 2007) and one way described by Imbun (2007) and McPhail and Davy (1998) is the integration of government, business, and civil society also called tri-sector partnerships (McPhail and Davy, 1998; Warhurst, 2001). More and more companies are contributing to sustainable development in a way that adds value both to the firm and to the society. Kapelus (2002) has studied one mining company's steps to try and work more closely with authorities. But the efforts should go both ways and the community should also be engaged in the mining process as early as possible (Aloi, 2007).

Another important issue for the mining industry is to have strategies for minimizing problems after closure. Hilson and Murck (2000) suggests that to minimize such problems mines can implement re-skilling programs, establish small and medium sized enterprises and develop educational and training facilities.

Community involvement

Hilson and Murck (2000) describe one mining company's efforts to involve stakeholder parties in operations through public information for example meetings, visits to the surroundings and local hearings to receive stakeholders perspectives. Another way is to construct and fund development programmes and engage private, public, NGOs and community representatives in the programme design in order to have a high impact, result focused, sustainable, and integrated community involvement (de Jesus Soares, 2004; Imbun, 2007; Carvalho et al., 2010; Yankson, 2010). Hence, Rajak's (2008) view is that the mining companies involvement in community development is inspiring dependence instead of independence and empowerment. Hilson (2006) is critical to the development programmes and his study shows that rural communities are benefiting little from the achievements.

A NGOs partnership with companies, governments and communities is described by Carvalho et al.(2010) and the NGO has developed a methodology for capacity building and empowerment of community leaders to promote local sustainable development. Examples of the community expectations of the mine are health infrastructure, education, income facilities and road infrastructure and Imbun's (2007) study shows that it was wise for the mine company to invest in social and economic activities in particularly local communities as a social insurance to operate safe projects. Similar findings were reported by Trebeck (2007) which show that indigenous communities are most effective in bringing leverage over mining companies even though Coronado and Fallon (2010) state that the mining companies are motivated by profit imperatives.

Social investment

Social investment takes place when organizations invest their resources in initiatives and programs aimed at improving social aspects of community life. Types of social investments include projects related to education and culture, employment creation and skills development, technology development and access, wealth and income creation, health etc. to promote economic or social development (ISO, 2010).

Findings of the case studies made by Esteves (2008a) show current trends in social investment practice in the minerals industry;

- Depth rather than breadth; companies are becoming more strategic and proactive, investing in fewer, but more well-defined areas of focus, with long-term benefits, and opportunities for building of relationships and partner capacity
- Increasing use of strategic partnerships and volunteering; Partnerships are increasing in popularity, as are employee volunteering programs
- Treating the cause rather than the symptoms
- Building capacity and the importance is also discussed by Aloï (2007)
- Pushing decisions down to the ground
- Measurement
- Partnering takes effort
- Business drivers for social investment

Education and culture

Education and culture are foundations for social and economic development and part of community identity (ISO, 2010). Numerous education development projects have been identified in this review. Jul-Larsen et al. (2006) mention funded education development projects like construction of classrooms, latrines and managers' homes, payment of salary to teachers, purchase of school furniture and organization of school exams. Hilson and Murck (2000) describe a mining corporation's financing for improved educational facilities for surrounding communities. Kapelus' (2002) study shows support for projects in education such as assisting local schools, promoting, and teacher training. Yankson (2010) has studied gold mining in Ghana and the education development projects have included construction of schools and provision of books and furniture for staff and pupils. Hutton et al. (2007) have studied a mining company in Peru and the mine funded programs that are educating a large amount of children annually at several education centers and providing transportation for teachers to help future generations in the district. Lange's (2006) study identified donations for schools.

Employment creation and skills development

By creating employment, all organizations can make a contribution to reducing poverty and promoting economic and social development (ISO, 2010). How many local employments mining operations create varies from 25% (Hilson and Murck, 2000) to 90% (Jul-Larsen et al., 2006). According to Aloï (2007) community expectations for employment are not always realistic. They are often unaware of the numbers of employees required at different stages of development or the duration of the employment. The ability to announce phased local employment requirements, and to link training programs with direct employment, helps to manage local expectations and create a mutually beneficial situation of local capacity building. Labour capacity building begins with a local labour analysis that shows the extent of local skilled and unskilled labour potentially available to the project. The result identifies the types of skills training required and forms the foundation for a local employment and training time line. Training partnership can be developed with local and government sponsored institutes or can be provided directly from the mining project. Aloï (2007) describes a large mining project with a short time frame that created an increased need for existing skilled labour and this meant more external workers. It also meant that locals who received training would be unemployed in about seven years. The result of the

negotiations between the mining company, the local community, and the government was a smaller project that would last for at least 30 years.

Skills development is an essential component of employment promotion and of assisting people to secure decent and productive jobs, and is vital to economic and social development (ISO, 2010). Numerous of capacity building projects have been identified. Yankson (2010) describes a development program that focuses on empowerment through education and capacity building. One Australian example is a training program to supply the project with a local, trained mining force (Aloi, 2007). Hilson and Murck (2000) describe a technical support team that trains the local miners in mining methods. Another example is a development project that provide training of mine workers to get the skills required to conduct certain tasks at the mine (Jul-Larsen et al., 2006). Lange (2006) shows human resource development for about 2000 people a year.

Technology development and access

To help the economic and social development, communities and their members need full and safe access to modern technology. Organizations can contribute by applying specialized knowledge, skills and technology (ISO, 2010). One example of specialized knowledge and skills was given by Kapelus (2002) who has studied a major mining company operating in South Africa that supports projects in technical education. The other examples identified in this study have to do with technology for example drinking water projects (Jul-Larsen et al., 2006; Lange, 2006; Yankson, 2010), sanitation (Yankson, 2010), sewer systems (Hutton et al., 2007), electrification (Jul-Larsen et al., 2006; Lange, 2006; Hutton et al., 2007), and construction of roads (Lange, 2006; Hutton et al., 2007; Yankson, 2010), bridges (Jul-Larsen et al., 2006), administrative buildings (Jul-Larsen et al., 2006) and maintenance (Yankson, 2010).

Wealth and income creation

Competitive and diverse enterprises and co-operatives are crucial in creating wealth in any community. Organizations can help to create an environment in which entrepreneurship can thrive, bringing lasting benefits to communities (ISO, 2010). Aloi (2007) argues that indirect employment around large projects can be sources of sustainable livelihoods and describes one Canadian mining company's commitment to purchase 70 per cent of goods and services locally. Another example is described by Hutton et al. (2007) where over 85 percent of the mine's procured goods and services were purchased locally. Hilson and Murck (2000) have studied a mining company with operations worldwide and they make use of local services such as catering, laundry, air, engineering and consultation.

Jul-Larsen et al. (2006) describe projects that stimulate local business life. One environmental initiative was to help local people to plant and grow mango trees. The mining company provided information about the cultivation and the saplings. Another project was a micro-credit initiative that provided small loans to start a business or set up a small or medium-sized enterprise. Another mining company had implemented agricultural activities like vegetable gardens and paddy fields. Kapelus (2002) describes gardening and cooking clubs, support for small businesses, support for a development centre as a community development projects implemented by a major mining company operating in South Africa. Yankson's (2010) examples are vegetable cultivation, livestock rearing, batik production, bakeries, soap production and food processing.

Health

Health is essential and a recognized human right. Organizations should respect the right to health and should contribute to the promotion of health, to the prevention of health threats and diseases and to the mitigation of damage to the community (ISO, 2010). Health issues are described by Hilson and Murck (2000) as funding and construction of medical centers. Similar findings were reported by Kapelus (2002), Lange (2006) and Hutton et al. (2007) for health issues like malaria, filariasis, HIV/AIDS programs and diarrhea diseases. Jul-Larsen et al. (2006) and Yankson (2010) add purchase of medicine for the health centers. Yankson (2010) presents more examples of health issues like the training of volunteers as community health facilitators to provide first aid in the communities. The facilitators are supervised by community health nurses and have been given bicycles and medical kits to enable to offer basic services in remote areas, as well as radio sets for regular community education on serious health issues. The facilitators educate school pupils, community members and church congregations on hygiene and other health issues. Other examples are nurses' accommodation, and a hospital, with furniture and hospital equipment.

Discussion and Conclusions

This study is based on articles published between 1998 and 2010, of which a majority was from 2006 and onwards. This indicates that the interest for CSR practice has increased over time, and it is likely that it will continue to do so also in the near future. A majority of the selected studies were focusing on mining operations in Africa and Oceania. Notable is that only one study is focusing on mining operations in Europe indicating a need to study CSR practice from a European perspective.

Little information about how the CSR practice is organized was found in the review and therefore this is identified as an interesting area for further studies.

Partnership with governments, business associations and other organizations for sustainable development is common in the mining industry, as are CSR principles, standards and tools. However, how these initiatives are integrated and implemented in the core business activities remain unknown. According to Vintró and Comajuncosa (2010) the CSR practices would be more extensive if a management system is introduced rather than solely a code of conduct. Surprisingly, ISO 14001 only motioned a few times in this study even though the environment is an important part of sustainable development and CSR. So far more than 220,000 organizations worldwide have certified their environmental management system according to ISO requirements (ISO, 2011) and the research about environmental management in the mining industry is extensive. But still environmental management is a minor part of the CSR concept. This might be due to that environmental management, in itself, is a major area of research.

The mining industries are more inclined to have formal written codes or policies and are more interested in publicly communicating their values than many other industries. A development from policies on single issues, for example the environment, to integrated policies has been identified and a presumed expectation is that this development has progressed further. Two factors are important when determining the policy, identifying and responding to the demands and expectations of stakeholders and consistency with

the core aspects of the business. No measure of whether codes and policies are applied in practice was identified. Similar findings is reported by Jenkins and Yakovleva (2006) and Perez and Sanchez (2009). Further research is needed to develop such measures in order to calculate performance against intention. The reporting is becoming more sophisticated and stylish and is covering a wider scope of issues. The reports have more depth and a greater maturity level. Accordance to the GRI guidelines is important and an increasing level of external verification of data in the reports has been shown. The reports are increasingly communicated through the web and a trend towards producing sustainable development and CSR reports has been argued for. This study has identified data about the construction and development of the more visionary CSR policy/Code of conduct and the reporting of the CSR performance. Little is about the practice in between and this finding is supported by Utting (2007) and Cronjé and Chenga (2009). Jones et al. (2007) suggest that companies might be more committed to general principle and the level of disclosure, rather than a deeper level of actual workplace practice. Hence, there is a need to explore the practical implementation of CSR in corporate core business in order to generate knowledge of best practice that forms the basis for further development of CSR implementation.

Little information about the CSR practice within the core subjects; human rights, labour practices, the environment and fair operating practices have been identified. This is somewhat surprising, since many of the partnerships, agreements and initiatives identified include these core subjects. Labour practice was expected to be rather extensive subject partly because commitments to, for example the ILO Declaration on Fundamental Principles and Rights at Work (Jones et al., 2007) and the United Nation's Global Compact (Hamann, 2003; Jenkins and Yakovleva, 2006; Jones et al., 2007) have been identified and because the health and safety at the work place is an important issue in the mining industry. Perhaps this is due to that labour practice, in itself, is a major area of research.

The extensive data identified in this study concerning community involvement and development indicates that CSR in the mining industry today almost solely focus on community involvement and development. This conclusion is supported by both Hamann and Kapelus (2004) and Kapelus (2002). The integration of government, business and civil society is important and the mining companies are contributing to sustainable development in a way that adds value both to the firm and to the society. This is commonly resulting in development programmes for education, employment creation, skills development, technology development and access, wealth and income creation and health. Building education facilities seems to be common and the importance of educated and available teachers is mentioned. This is activities identified in studies made in the developing world. None of the studies focusing on the developed world have mentioned education as an important issue and culture is not mentioned at all. The question is how the communities perceive all these efforts? Garvin et al. (2009) have made an interesting study of the communities' perception of the mining companies impacts on the communities in Ghana. Positive impacts were perceived for trade and commerce, employment/job opportunities, income level, education, housing, population and health and negative for agriculture, cost of living, land issues, security, culture and the environment. Mines create employment, but how many of the workforce that are locals varies from 25% to 90% in this study. Maybe this can be explained through the degree of devotion to different kind of skill development programmes. Many projects within skills development and technology development have been identified. This

confirms that mining companies are contributing to sustainable development in a way that adds value both to the mine and to the society.

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Optimization of the requirement-oriented product development by a functions differentiation within a holistic system description

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Category: Research Paper

Introduction to system modelling

As quality and demand compliance require approaches how to develop technical products right-first-time, Systems Engineering is concerned with this task. One aspect of Systems Engineering is the requirement-oriented product development and possibilities of its improvement. Emphasized in numerous approaches is the concept of using models for showing cause and effects relationships within a technical system. Therefore a holistic system description must become an integral part of system modelling. Most system models use common domains, respectively views on a system e.g. components and functions (Haberfellner et al. 1999, Pahl et al. 2003, Sitte et al. 2005, Ponn et al. 2008). Though, the potential of system modelling is not yet exhausted. One main element for system modelling is the functions element. Functions “translate” requirements into solution neutral technical descriptions of the system performance while functions themselves are realized by components or processes. This approach prevents an overhasty limitation of the potential solution space (the direct requirement compliance by choosing concrete components without regarding functions) by using functions as an interface element between requirements and components (Riekhof 2011a). Being kind of a translation or link between a theoretical system description and its practical realization, functions become the centre of attention for system modelling approaches.

System modelling using the demand compliant design

Although functions are already an integral part of most system models like the Demand Compliant Design (DeCoDe), which had been developed at the University of Wuppertal (Sitte et al. 2005), the extended utilization of functions promises the ability to increase the reliability and the degree of innovation of a system by showing cause and effects relationships. This aim is supported by subdividing systems into the four basic views of DeCoDe: requirements, functions, components and processes. All views contain structured descriptions of the different system elements within the specific system matrices S_x . This facilitates, for example, the identification of conflicts of goals or the weighting of requirements (matrix S_R). Most important, mutual interdependencies are singled out using all possible combinations of these matrices, e.g. the system matrix for interdependencies between functions and components $S_{F,C}$ (Müller et al. 2010). Finally,

the demand compliance of a developed concept can be validated by correlating functions, components and processes to the requirements.

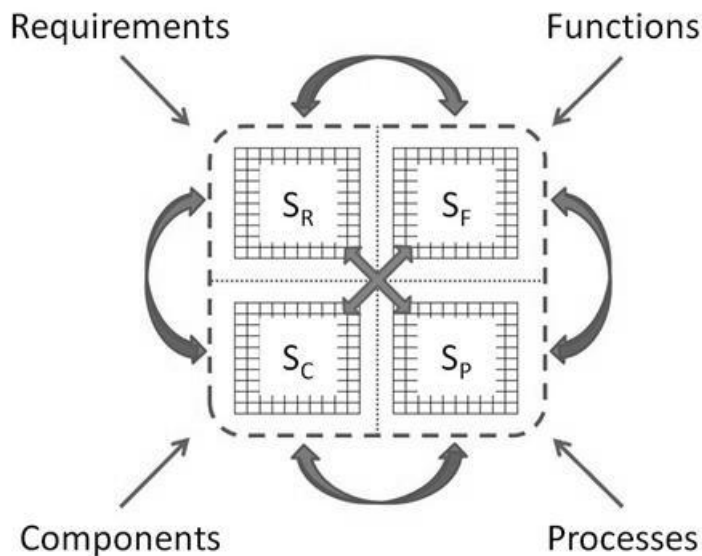


Figure 51: Views on the system and matrices of the DeCoDe model

As mentioned before, the impact of a precise functions differentiation on the product development can be revealed regarding interdependencies between requirements, functions and so-called function-realizing elements i.e. components and processes. A solution neutral system description and the realization of functions being regarded within a holistic system context may benefit a requirement-oriented product development as well as innovative solutions. A first step towards this is a further differentiation of functions, whose necessity was derived from reverse engineering experiences (Riekhof 2011b).

A precise functions differentiation

As an interface element between requirements and components respectively processes, functions must be further analyzed. Existing approaches partly differentiate functions into various kinds of functions like main function, auxiliary function or disturbance function and to some extent also integrate them into a system model (Steinmeier 1999, Ponn et al. 2008). As a further step, functions will be differentiated into three standardized types with and are integrated into a holistic system model, also showing consequences for demand compliance. Achieving the mentioned benefits requires a subdivision of functions into *target function*, *disturbance function* and *compensation function*, pointing out the links between all system elements. Advantages of this approach will be illustrated using the KitVes system.

A target function fulfils underlying requirements using function-realizing elements like components and/or processes. Besides their designated effect, these elements may have negative influences on the system, which are described using disturbance functions. These negative effects – for example an increase of temperature that negatively influences an electronic control unit – will negatively affect other system elements or the system performance. To prevent disturbance functions to entry into force, adequate requirements must be derived and implemented in answer to it. These requirements are in particular design constraints, as they limit the possible design and solution space and are only applicable for the occurrence of disturbance functions. Still, design constraints

are necessary to legitimate derived measures and to depict their contribution for demand compliance. Design constraints are fulfilled by compensation functions that in return may require new function-realizing elements. This way, adequate compensation functions and their technical realization are implemented and can inhibit or lower the impact of disturbance functions on the system.

This approach can be depicted in nine steps, as shown figure 2. Irrespective of an iterative product development process, a general procedure for finally translating requirements into function-realizing elements under the awareness of mutual interdependencies will be derived. This is due to the fact that specific paradigms of product development take place during the entire development process continually. The single steps are explained more detailed in the furthering.

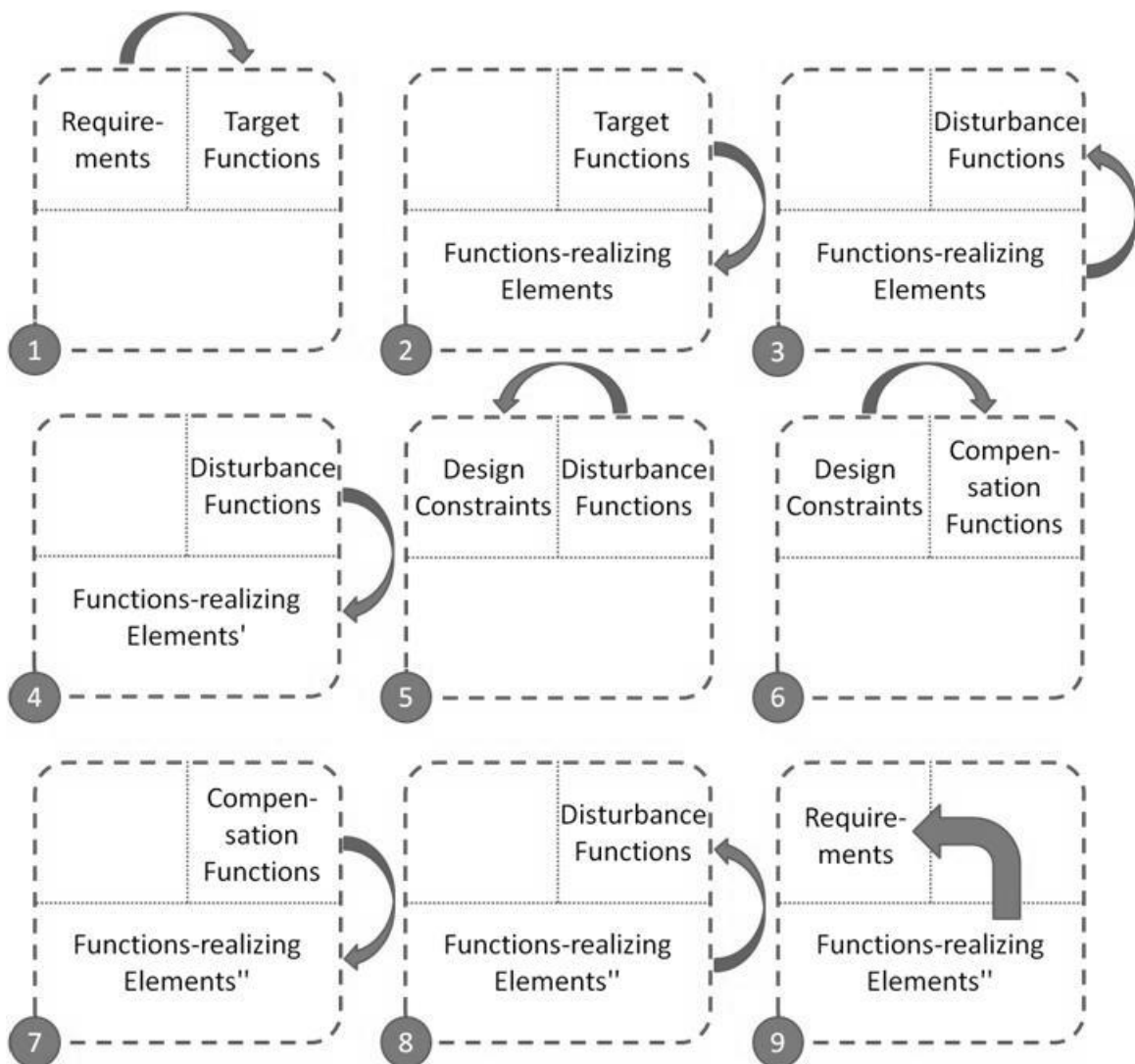


Figure 52: Principal steps for the implementation a functions differentiation (cf. Riekhof 2011a)

First, requirements are translated into target functions, which should be solution neutral (1). The solution neutral formulization of target functions benefits new or innovative realizations as no solution is excluded or anticipated. Then, realization possibilities are searched for (2). With appropriate function-realizing elements for target functions, most approaches of Systems Engineering end at this point. Being aware of possible negative

impacts on the system that function-realizing elements – mostly components, but also processes – might have, disturbance functions must be identified (3). As disturbance functions depend on chosen function-realizing elements, their occurrence must be determined due to the developed solution. This identification of disturbance functions requires knowledge on system performance or the use of simulation models. If disturbance functions exist, their impact on the system must be quantified (4), i.e. which elements are affected. As possibly other elements will be affected, these elements are marked with an apostrophe. Additionally, existing disturbance functions require the definition of design constraints (5). In terms of but not limited to traceability, the design constraints must become part of the product specification. Defining fitting compensation functions for the design constraints (6), the procedure is actually the same as to define target functions for requirements (cf. (1)). Function-realizing elements for the compensation functions will be searched for equally (7). As these might be again other function-realizing elements than those that realize target functions and those that are affected by disturbance function, they are marked with two apostrophes. In return, compensation functions affect the system performance respectively the function-realizing elements in a way that lowers or eliminates the impact disturbance functions had (8). Bearing in mind all described interdependencies within the process of product development, kind of a quality control loop was implemented in the entire process and demand compliance is assured (9).

The information on the elements and interdependencies required and those that were gained using this approach are integral part of the DeCoDe system model. This way, DeCoDe delivers input for the determination which elements might be affected by a disturbance function (cf. matrix $S_{C,F}$). On the same hand, new identified interdependencies have to be documented in the matrices, so the output of a functions differentiation can be integrated. Making available correlation matrices, all mentioned steps are feasible using DeCoDe. Additionally, design decisions – e.g. the choice of concrete components for realizing a function – are made traceable and well-founded. The functions differentiation therefore benefits a double-track approach: while a systematical identification of disturbance functions and the implementation of adequate compensation functions will probably increase reliability – as all possibly negative effects on the system were reacted on – a system design targeted on the avoidance of disturbance functions might benefit new and innovative solutions.

Exemplified utilization of the functions differentiation within a holistic system modelling

Advantages of systematically identifying interdependencies between system elements can also be shown on the development of the KitVes system. KitVes is a cooperative research project financed by the EU in the 7th framework programme. The KitVes system is a new product concept for harnessing high altitude winds using a kite which is mounted on top of a vessel. Contrarily to existing solutions, the kite is not used for traction purposes but for the generation of energy for auxiliary services onboard of the vessel. Starting at the deck of the vessel, the kite ascends in loops up to 1000 meters height. While ascending, two lines are pulled out powering an electric drive. When the kite reaches its maximum height, a so-called side-slip manoeuvre is performed, allowing to haul inboard the lines with using a minimum amount of energy. During this, the electric drives act as a motor. Figure 3 shows the general principle of the KitVes system.

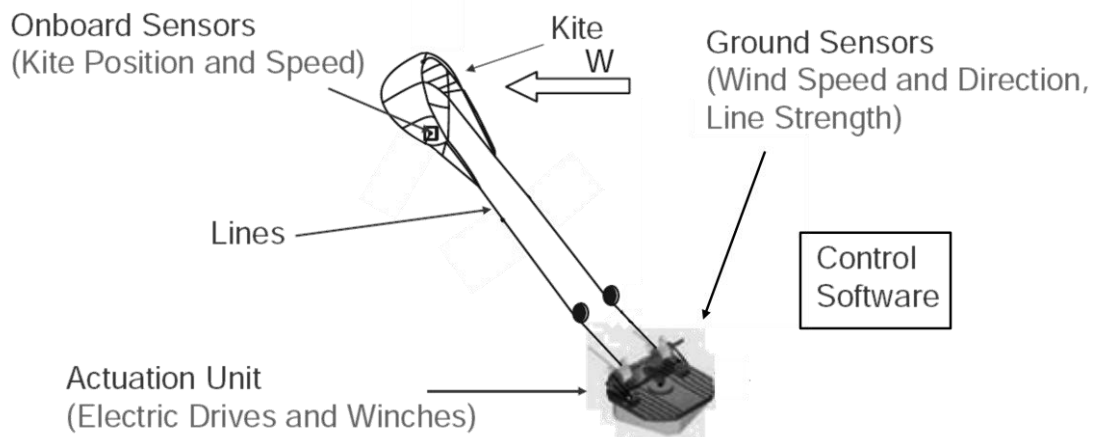


Figure 53: Fundamental construction of the KitVes system following (Canale et al. 2007)

Due to action radius and flying height of the kite, various safety equipment is installed onboard of the kite itself but also on the on-ground kite-steering unit. Furthermore, reliability calculations and a risk assessment of the KitVes system are being made, assuring the secure and reliable operability of the system. Part of the risk assessment and the demand compliant development is an analysis, whether function-realizing elements also implement unintended functions. The approach of a functions differentiation within the context of a holistic system model can therefore methodologically support the design of the KitVes system, as shown in the following.

Within the iterative development process of the KitVes system, different concepts have been developed, discarded or in part also been constructed and tested. This led to the insight that early concepts often lack a consideration of unintended effects being implemented by components themselves – namely disturbance functions. The problem was not that these effects were unknown before, but that developers were just not aware of it. The derived method of a precise functions differentiation within DeCoDe is exemplified on an early concept of the kite steering unit (KSU) and the comparison to its latest design changes.

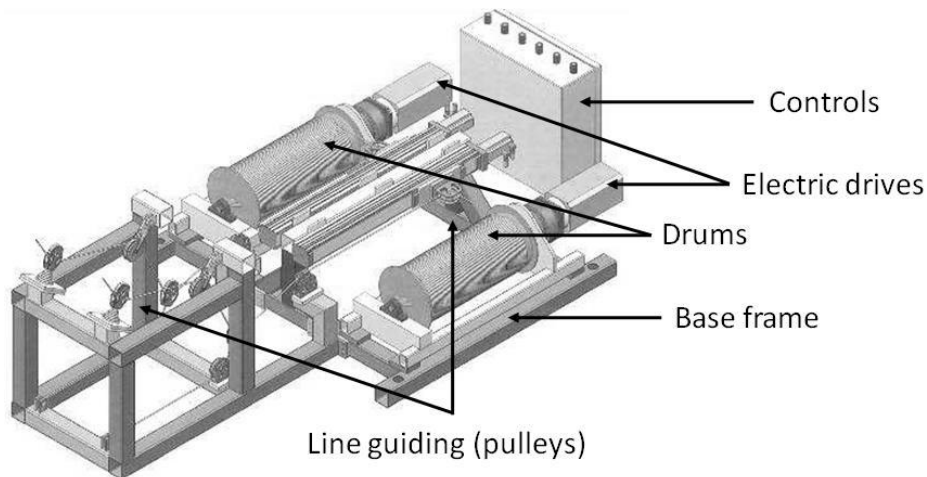


Figure 54: Early concept of the KSU (project internal illustration)

Figure 4 depicts the KSU with its main components base frame, drums, generators, pulleys and controls. The lines are rolled up on one drum each from where they are guided via several pulleys to the exit of the KSU and to the kite. One problem that occurred in the testing of this concept was the oscillating respectively swinging of the lines due to wind forces and movement of the kite that led to shocks of the whole KSU. Additionally, the kite had to be lifted manually from the ground. This problem is describable using disturbance functions and the system context of DeCoDe.

Regarding possibilities of solving the problem of shocks affecting the KSU, different solutions have been developed, e.g. a damping system using springs and shock absorbers. The solution finally realized is to mount a carbon-fibre stem with a length of 12 meters on the KSU. Besides line guiding and damping this solution is also able to support the process of kite take-off as the stem it brings the kite in a better starting height and position than it could be done manually. Figure 5 shows the KitVes system on a hexapod base frame with a top-mounted stem and horizontally slidable drums.

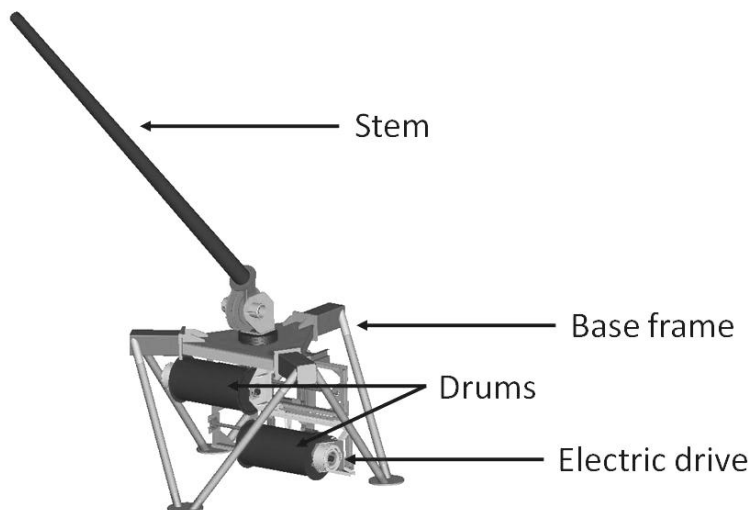
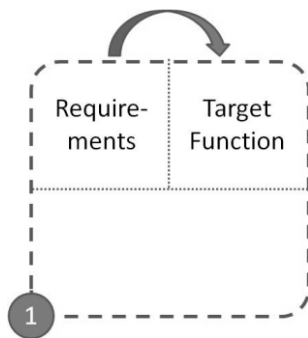


Figure 55: Latest version of the KSU with top-mounted stem (project internal illustration)

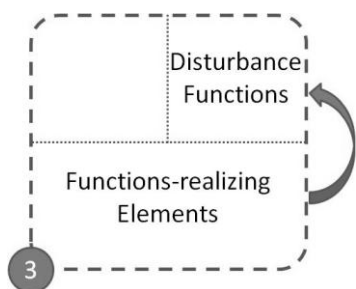
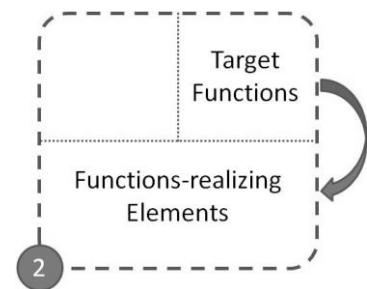
Regarding the improvements of the KitVes system in terms of Systems Engineering, benefits of a functions differentiation within a holistic system modelling can be shown. While requirements and solution neutral target functions stay the same for both concepts, the way they were realized significantly differs. The reason for a further

development of the first concept of the KSU was that problems occurred which had not been taken into consideration before. The underlying methodological development process can be depicted using the principal steps for functions differentiation (cf. figure 2). This approach finally led to an increase of the maturity level of the KitVes system.



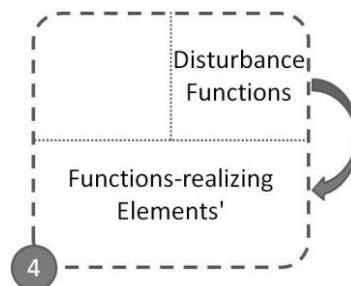
First of all, there are underlying requirements which determine the definition of an adequate target function. Requirements in this case refer to the energy generation using a kite. The broken-down requirement-fulfilling target function therefore is “transform linear to rotating movement” as a sub-function of “convert wind (mechanical) power into electrical power”.

The realization of these target functions has been implemented by the lines, the pulleys, guiding the lines to the drums, and the drums that are interconnected with the electric drives. Their joint interaction realizes necessary processes for the usage of the KitVes system.

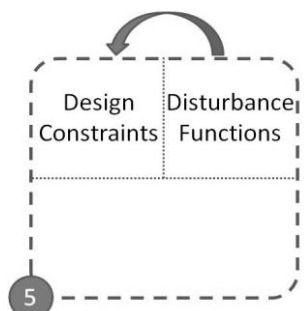


Using pulleys for line guiding in the described way, disturbance functions were unintentionally co-implemented. Due to kite moving and wind forces, lines were oscillating, resulting in the disturbance function “abrupt change of the line angle” and “increase of shock of the KSU”.

The disturbance functions pulleys and drums led to function is problematic as resulting from it cause components of the KSU and movements more

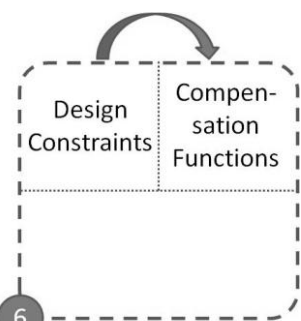


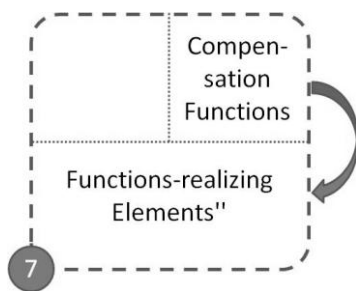
implemented by the lines, shocks of the KSU. This shocks and vibration increased wear of the makes controlling the kite complicated.



Being aware of the disturbance functions, a design constraint has to be defined. For the “shock of the KSU”, the design constraint is “keeping lines under control” and for “abrupt change of the line angle” it is “enable a smooth roll movement of the lines”.

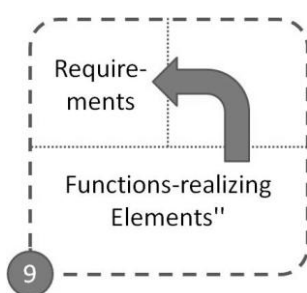
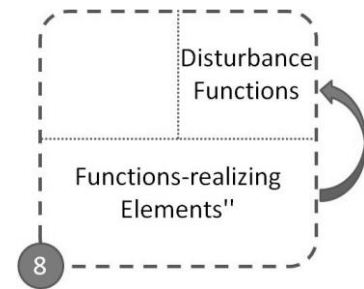
The fulfilling of the design constraint requires an adequate compensation function which should be defined – as well as the target function – solution neutral. Compensation functions for the described problems are “damping the lines” and “guiding the lines lengthwise to the pulleys”. This formulation does not indicate a solution but specifies what to do in order to bring the system under control.





Analogous to the realization of target functions, now function-realizing elements for the damping and guiding of the lines have to be developed. For the KitVes system, one innovative solution has been developed, also benefitting the former problem of manually lifting the kite for take-off. The component developed is a carbon-fibre, 12 meters long stem, being mounted on top of the KSU.

Using the stem for line damping and guiding, the influence on the system due to the disturbance functions “shock of the KSU” and “abrupt change of the line angle” can be lowered. Though, with the presented solution “stem”, the cause itself cannot be prevented. This would require another realization of the target function, while the stem is a measure to lower the impact of a disturbance function.



By ensuring the demand compliant operability of the KitVes system, underlying requirements have been fulfilled. Furthermore, the stem as a realization for the compensation functions “damping the lines” and “guiding the lines lengthwise to the pulleys” was also able to benefit the process of lift-off the kite by acting as a taking-off structure in a height of 12 meters. This way, the implemented measures were able to close the quality control loop.

Advantages of holistic system modeling

The described functions differentiation within a holistic system model points out the relevance of a methodological approach in terms of Systems Engineering. It is thus essential to systematically analyze implemented functions, function-realizing elements and the system performance for identifying interdependencies and possibly negative impacts on a product system. System engineers will therefore be supported by using the DeCoDe approach with a functions differentiation. Still, the data quality of information and interdependencies contained within the DeCoDe matrices is due to expert knowledge and therefore DeCoDe matrices must be filled accurately.

In general, the presented approach helps to perceive the necessity of components being added to a technical system in order to prevent disturbance functions to entry into force. The same way, it substantiates the decision if certain components may have become obsolete when new functions are integrated or others are excluded from a system during its further development. This is also important in terms of traceability. Additionally, the extended functions differentiation facilitates a system analysis basing on functionality instead of components.

The presented approach of a functions differentiation in connection with a holistic system description facilitates a more precise system modelling and assures a requirement-oriented product development process due to the identification of yet

unknown interdependencies of elements. The detailed functions differentiation extends previous definitions but yet has a common basis. It therefore shall become a first step towards a domain-comprehensive system modelling that depicts all interdependencies of different system elements and is able to contribute Systems Engineering.

Though advantages using this approach have been described and exemplified by the help of the KitVes system, several questions are arising from this it. Besides the verification of the presuppositions made, the interdependencies between elements of DeCoDe – especially the indirect ones – must be regarded to find out how interrelationships can be described. In addition it has to be analyzed, how an integral system modelling can positively effect the product development process and if the elements of DeCoDe are sufficient to do so.

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Assesment of PUBLIC Servants Performance: looking for the possibility

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Category: Research paper

Reducing the costs of public administration, restructuring and outright downsizing of the public service, outsourcing the part of the public functions to private sector, strengthening the service delivery capacity of the public service are among the key challenges the governments face all over the world striving to increase the value of public services to the citizens. In this context the assessment of quality, effectiveness and efficiency of public administration becomes the task of outmost importance.

Even though TQM is a new quality management system for the public sector, this does not imply that public administration was not quality oriented in the past. Quality has always played a role in the public administration, at least implicitly, but the meanings have changed over time.

There are could be distinguished three phases in the evolution of quality in the public sector (Beltrami,1992):

- quality in the sense of respect of norms and procedures;
- quality in the sense of effectiveness; and
- quality in the sense of customer satisfaction.

In the first case, quality means the absence of arbitrary, or to express it in a positive way, formal correctness. Of course, in this definition, the reference to the user or customer is missing. This understanding of quality in the public administration corresponds to the early notion of quality as technical conformance to specification in industry.

The meaning of quality in the public sector changed in the late 1960s when management by objectives gained popularity in public administration. Quality in the public sphere would still include the absence of errors but also starts to link the concept of quality with the purpose/a product/service would serve. This definition of quality has its equivalent in Juran's famous definition of quality as "fitness for use".

In the early eighties, the "total quality" concept of the private sector was transferred to the public sector in North America and Western Europe, making customer satisfaction or even customer delight the point of reference for the degree of quality achieved. Nevertheless, this does not imply that all Western countries apply the same concept of quality in the public sector. Even though most public agencies are familiar with the business concept of quality (in particular, its rhetoric) by now public administration in many countries still reduces quality to compliance with the law. This is particularly true in Continental European countries with an administrative law tradition (Loffler, 2001).

The assessment of public administration in the world is being implemented at the four major levels. At the global scale it allows to make cross-country comparisons with the regard to common objectives, methods and measures which are widely accepted at the time. At the national level it becomes more comprehensive taking into consideration the specific features of the country and its social and economic development. At the local level the public administration assessment is carried out by geographical regions. The less developed are the methods and instruments for assessment of quality and performance of public authority.

Most global evaluations are focused on three dimensions of governance that are isolated as essential: Efficiency, Transparency, and Participation (Mimicopoulos, 2006):

Efficiency should be understood as a government's ability to establish predictability in the institutional and policy environment. Efficiency is also a question of correctly prioritizing government services to correspond with citizen needs (Afonso, Schuknecht, Tanzi, 2006). This includes the provision of services such as security, healthcare, and education.

Transparency is the availability and clarity of information provided to the general public about government activity. A lack of transparency creates opportunities for government corruption and reduces public sector efficiency. Linked with transparency is the issue of Accountability. Accountability rests on the establishment of criteria for evaluating the performance of public sector institutions. This includes economic and financial accountability brought about by efficiency in resource use, expenditure control, and internal and external audits. Accountability improves a government's legitimacy.

Participation is an essential element for an engaged civil society. The public sector can promote participation by enacting legislation that strengthens the freedom and plurality of media, establishing an independent electoral management body, and encouraging public input into decision making on government plans and budgeting. Participation requires enhanced capacity and skills of stakeholders and sustainable policies supported by institutions of public administration (UN, 2007).

Key elements that need to be taken into account when measuring the performance of the public administration are presented below (UNDP, 2009):

- Civil service management: legal and ethical framework, human resource management policies and procedures, institutional framework;
- Public financial management: budget preparation and execution, accounting systems, audit and legislative scrutiny;
- Government policy making: processes, structures and capacity for analyzing problems, identifying and appraising options, consulting with stakeholders, decision-making, monitoring and evaluation;
- Leadership: selecting, rewarding, deploying and developing capacity of senior public servants;
- Service delivery: identifying client needs, developing service standards and targets, monitoring performance, building capacity to deliver.

At the global level there are 25 instruments which can be used to measure different components of public administration performance. They are all publicly accessible, although a few require a simple registration process before they can be used. Of the 25 instruments – 18 are assessment tools and only 7 are information sources.

These 25 instruments can be further categorized as follows:

- purpose-built tools which purport to measure a particular aspect of public administration performance;
- broader governance assessment tools and information sources which include a component on public administration;
- tools designed for a different purpose, but which measure the relevant processes.

When looking at both assessment tools and information sources, there could be found 13 instruments measuring public financial management and 15 instruments measuring human resource management. Both are critical reform areas. However, public financial management tools have attracted a greater interest than human resource management tools within the development community in the last few years. Traditionally also, these two sectors were seen as the main drivers of public sector efficiency (financial and human resources). Attention to leadership, service delivery, the quality of policy making and information and communication capacity have come at a later stage.

According to the approach adopted by the OECD in “Government at a Glance” the assessment of public administration performance should implement the indicators measuring:

- Inputs as units of labour, capital, goods and services sacrificed for the production of services (e.g. for health services, inputs can be defined as the time of the medical staff, the drugs, the electricity, etc.);
- Public sector processes as structures, procedures and management arrangements with a broad application within the public sector (e.g. social and financial audit of local clinics);
- Outputs as the services that are delivered to the end user by a public sector organization (e.g. number of babies delivered safely, number of pupils completing primary education);
- Outcomes as the impact of these services on the end user (e.g. reduced maternal mortality, improved income).

Most tools and sources assess processes and not the outputs and outcomes.

According to the User's guide for measuring public administration performance by UNDP, 2009, objectives of public administration performance have been classified into five categories:

– Diagnosis & planning: where the information generated constitutes a formal review of strengths and weaknesses feeding into a planning exercise in which decisions are made on reform priorities. Many tools claim to be useful for diagnostic purposes. The reality, however, is that the majority provide data on high level indicators corresponding to the immediate objectives of reform which need to be analyzed further. Such tools can identify the weak areas for further investigation as part of a more intensive diagnostic process.

– Monitoring and accountability: in which information paints a picture of how well government is performing in a particular thematic area. Monitoring is useful to establish the current situation in relation to an established standard against which future improvements can be measured. Many tools can be used for monitoring purposes. But if the user wishes to monitor progress of an ongoing reform program, the measures selected will need to be customized to reflect its strategic objectives;

– Cross-comparison and benchmarking: in which information is used to compare one country with another, usually by calculating a score for the phenomena being measured. Benchmarking is a further development which involves a measurement against a standard, or “good practice.” This is a common objective, particularly for those sources and tools which originate in the donor community;

– Dialogue and joint decision-making: where information can be used to initiate a dialogue about changes and improvements. Dialogue is a modest objective which is particularly relevant where donor-government partnerships are being promoted in line with the Paris Declaration.

Dialogue can form the first step in a more in-depth diagnosis

– Resource allocation: in which the outcome of the exercise is linked to the allocation of aid. This is not an explicit objective of any of our tools or sources, but it is included because it may be a perceived objective by national governments

International agencies are interested in measurement for a variety of purposes – dialogue, diagnostic, monitoring and international benchmarking. In contrast, national governments are mainly interested in measuring public administration for diagnostic and monitoring purposes, as well as for priority setting, and to a lesser extent for dialogue and joint decision making. Middle income countries aspiring to become developed nations are often interested in international benchmarking, but most developing countries less so.

Many of the sources and tools are serving multiple objectives. In general, where a single tool has many objectives it tends to be difficult to meet them all satisfactorily. Some objectives are complementary. For instance, international comparisons and benchmarking can form part of a locally applied diagnostic tool or monitoring exercise. And information for dialogue can be useful for diagnostic purposes. However, information for dialogue is not the same as a diagnostic, which examines causes as well as symptoms. If the user has multiple objectives, it will be necessary to “mix and match” different tools.

Thus we conclude that the instruments for public administration assessment accepted worldwide do not allow to evaluate the contribution of certain public servant to achieving the overall goals of public authority he/she works for and to assess his/hers performance. This constrains the applicability of these instruments for the human resource management and performance improvement of public authorities. This is the reason why governments all over the world are seeking the most effective approaches to public administration quality planning, assurance and improvement.

In accordance with concept of public service system reform in Russian Federation the following laws was passed: on 27th of May 2003 the Federal Law № 58-FZ «On the public service system in the Russian Federation» and on the 27th of July 2004 the Federal Law №79-FZ «On civil service in Russian Federation». These laws formed the basis of unified public service system, established legal, organizational and economic principals of it's functioning. It helped to create the legal basis of public servants performance improvement.

The principal approaches to public authorities performance improvement and the relevant criteria of it's assessment were determined by Presidential Decree of June 28, 2007 № 825 "On evaluating the effectiveness of executive authorities of subjects of the Russian Federation" and by Federal Program "The reform and development of public service system of Russian Federation (2009 – 2013)" approved by Presidential Decree of 10 March 2009 № 261.

At the same time formed to date regulatory framework of the effectiveness and efficiency of public bodies assessment is not fully aligned with the assessment of public servants performance.

The salaries of public servants do not depend on the outcome of their work, and evaluation of their performance is not always focus on achieving the key priorities of government. At the same time, the solution of these problems is an important factor in increasing the motivation of public servants and the efficiency of public administration in general.

In the subjects of the Russian Federation has been accumulated certain experience in assessing the effectiveness and efficiency of public servants work. The analysis revealed that firstly, this assessment is implemented primarily for the public servants material motivation decision making; secondly, effectiveness and efficiency indicators for assessment of public servants performance included in their job descriptions are related only to the performance of official duties; thirdly, the major part of these indicators are generalized and do not provide a quantitative measurable results of their work.

In the Republic of Mordovia, the incentive system for public servants has been applied since 1996 in the framework of improving intergovernmental relations. The indicators to evaluate the results of public authorities and local governments work were established.

In the year 2004 in the Republic of Mordovia the criteria for assessment of effectiveness and efficiency of public authorities' performance were developed. Since 2005 the efficiency indicators for public authorities are implemented monthly, quarterly and annually. The assessment results influence the calculation of payroll for every public

authority in the republic as well as the results of implementation of critical and complex tasks for each public authority.

The assessment of municipal authorities performance in the Republic of Mordovia is being implemented in the framework of cross-budget relations as the integral part of development of new wage system for municipal authorities employees.

A new stage of work in this direction became the experiment "Development and implementation of the public servants performance indicators system, differentiated by area of activity of public authorities " launched in the second half of 2010.

The aim of the experiment was to raise the efficiency and effectiveness of public servants work in order to improve the quality of public service, contribute to the development of civil society and innovative economy.

Achieving this goal led to the following tasks:

- the improvement of mechanisms for professional activities of public servants aiming at public service quality improvement;
- updating the public servants job descriptions by ordering and specification of powers and responsibilities of public servants;
- regulation of issues concerning the development and introduction of motivation component of public servants salary;
- the introduction of modern mechanisms and technologies of public servants motivation aiming at their professional competence development and performance improvement;
- the development of material incentives for the public servants related to the amount and results of the work done by them;
- formation of system for registration and monitoring of public opinion concerning the public service performance and public servants effectiveness and efficiency;

The experiment was held in the form of pilot study. The following methods were used:

- research and description of the objects and subjects of the experiment;
- identification and classification of public servants performance indicators;
- modeling of public servants performance assessment process;
- approbation of indicators and assessment process developed;
- comparison of the results obtained by different participants of the experiment.

There were identified three stages of the experiment: preparatory, implementation and summarizing.

At the first stage on the basis of analysis and generalization of regional and international experience the necessary regulatory framework in the field of development and introduction of public servants wage system in the Republic of Mordovia was created including the local acts of public authorities participating in the experiment.

The implementation phase of the experiment included the development and introduction of individual performance indicators of public servants as well as methods and evaluation procedures.

In the third stage of the experiment the results were summed up and proposals for improving the system of indicators to measure the effectiveness of public servants work were developed.

Participants in the experiment were: the Administration Office of Head of Republic of Mordovia, the Ministry of Industry of Republic of Mordovia, the State Committee of Justice of Republic of Mordovia, the Ministry of natural resources and ecology of Republic of Mordovia. In general, in the experiment participated 11% of the total number of public servants of the Republic of Mordovia.

One of the main problems on the way of development of public servants performance indicators system is the lack of clear delineation of the concepts of efficiency and effectiveness in public administration. In regulatory documents this terms are often used as synonyms.

According to the International standard ISO 9000-2005 “Quality Management Systems – Fundamentals and Vocabulary” effectiveness refers to the degree to which a planned effect is achieved. Planned activities are effective if these activities are realized. In turn the efficiency is a relationship between results achieved (outputs) and resources used (inputs).

Based on these definitions we accept that the term “efficiency” reflects the public authority performance in total integrating the economic, social, budgetary and other effects that could be quantitatively measured by the progress of development indicators of the country, region, territory, taking into account the costs involved.

Unlike efficiency the effectiveness includes an assessment of the degree of achievement of targets over a specified planning period.

Comparing various approaches to effectiveness and efficiency measurement there were two levels of assessment identified during the experiment.

The first level presupposes the evaluation of public authority efficiency indicators. The selected indicators of the first level are presented in the table I.

Table I – Selected indicators of Republic of Mordovia public authorities efficiency

Indicator name	Target value, %
1	2
The Ministry of Industry of Republic of Mordovia	
1.Performing revenue forecasts: consolidated budget of the Republic of Mordovia; Republican Budget of the Republic of Mordovia.	100
2.Growth rate of the amount of shipped goods, works and services at constant prices to the corresponding month of previous year	114
3. Growth rate of average monthly nominal wages to the corresponding	113,9
1	2
month of previous year	
The State Committee of Justice of the Republic of Mordovia	
1. The absence of unsatisfied complaints on acts or omissions of the State Committee of Justice of the Republic of Mordovia	100

2. Timely response to requests of citizens and organizations by the apparatus of magistrates	100
3. Implementation of measures to prevent crime committed by juveniles	100

Achieved values of the indicators are the basis for determining the amount of fund incentive of certain public authority for the month, quarter and year.

The second level involves the assessment of public servants performance indicators. The second level system of indicators includes the following types of these: indicators of the volume of work; quality indicators; compliance indicators; indicators of work organization; development indicators. Examples of indicators are presented in table II.

Table II – Examples of public servants performance indicators

Types of indicators	Examples of indicators
Indicators of the volume of work	Number of municipal regulations, information on which are recorded in the federal register in electronic form on the basis of common requirements established by the Government of the Russian Federation
Quality indicators	Qualitative performance of official duties and the degree of achievement of the anticipated results of operations during the reporting period
Compliance indicators	The duration of the legal review of draft federal laws, directed by the State Duma of the Russian Federation to the Government of the Republic of Mordovia for giving an opinion
Indicators of work organization	Compliance with the regulations of the work
Development indicators	Reducing the time for processing applications for granting of water objects in use, decision-making or contracting water

During the experiment two approaches to indicators development were defined: differential and standardized.

The first one demands the development of the individual target map for every public servant.

The individual target map of public servant is the organizational and methodological instrument that allows not only to plan and organize the work of every public servant but also to analyze, monitor and assess his/hers performance in comparison with strategic priorities of regions development in a whole and the tasks assigned to the public authority. The advantages of target map are the flexibility, informational content, ensuring the traceability of the employee' work and the openness of decision-making concerning the stimulation of labor.

The table III gives an example of quarterly individual target map of public servant employed at Ministry of natural resources and ecology of the Republic of Mordovia.

The map indicates the name of indicator, it's target value and weight. Assessment scale is 100-point scale. The decision concerning the indicators weight and it's maximum score is being made depending on the nature and importance of the target.

Evaluation of indicator depends on the degree of achievement of it's target value, taking into account an incomplete implementation or over-fulfillment. For this scale were adopted criteria, corresponding to the three levels of performance: A – done on time, B – made out of time; C – not made.

It was decided that the individual target map should be developed for the quarter, which was adopted as the basic evaluation period, since it is the minimum time necessary to perform the actions and decisions.

Table III – The example of individual target map of the public servant employed at Ministry of natural resources and ecology of the Republic of Mordovia

Name and short description of the indicator	Criteria of execution	Maximum score in points	The actual score in points	Note
Reducing the time for processing applications for granting of water objects in use, decision-making or contracting water	Reduction of time not less than for the three days	25	25	Number of applications – 3, the actual time reduction – 4 days for every application
Compliance with the terms of the government contracts and agreements	Compliance with the terms of the government contracts and agreements	25	20	Government contracts NN and NX performed in violation of the terms
Timely review and preparation of information requested by government and executive authorities, local governments, organizations and citizens	Time for review – 20 days; request fulfillment– 100%	25	25	Requests satisfied – 12 in compliance with terms
Execution of orders of the Head of the Republic of Mordovia, the leadership of the Ministry, the planned activities of the Office	Running orders in full on time	25	25	Orders (3 unit) run on time

At the end of the quarter the Commissions of every public authority summarize the work of each employee, determine the degree of achievement of performance targets and exposes the integrated assessment scores. Specific amounts of individual payments from the incentive fund for each employee are made on the basis of proposals by the Commission in accordance with the integrated assessment of target map.

The standardized approach could be implemented for the public authorities performing the coordination functions in different spheres of activity. This approach implies that at the first place the indicators to assess the structural divisions of public authorities should be developed, depending on the general targets of the public authority. Then the head of the structural unit forms differentiated indicators for their subordinates.

This approach was implemented at Administration Office of the Head of the Republic of Mordovia, where for all structural units the system of indicators was developed. The form for assessment of structural unit indicators is shown in the table IV.

Thus, the targets set for the structural units are also used to assess the performance of each employee, taking into account his individual contribution to achieving the target values of indicators. If the employee does not complete the task or has violated terms of its implementation, the total score may be reduced. The aggregate indicator is determined by the sum of individual indicators.

In 2011, the experiment was continued to improve the system of indicators of public servants performance. In particular, the system was supplemented with indicators for the Administration Office of the Head of the Republic of Mordovia in relation to the activities of the Ombudsman for Children, also with indicators for the Office of Special Programs and the Office of Economic Policy. At the State Committee of Justice of Republic of Mordovia criteria for indicators assessment were clarified and specified with a justification of situations when they are exceeded and the plan is over-fulfilled. Other public authorities updated list of indicators to reflect changes in the priorities of their activities.

Thus, the experiment made it possible to solve some of the methodological problems of public servants performance assessment: first of all, the concepts of "efficiency" and "effectiveness" in relation to governance have been delineated; second, assessment levels have been identified and established the relationship between them; third, two methodological approaches to development of system of indicators for public servants performance assessment were identified based on two types of organization of their activities – standardized (for employees who perform routine tasks) and differential (for employees who perform diversified tasks);–fourth, a classification of indicators to measure the performance of public servants was proposed, which ensures comparability of the work results of public servants who perform various types of work.

From the standpoint of achieving the goals the positive results of the experiment were:

- 1) the planning process improvement by deployment of the public authorities goals at the level of departments and public servants. Development and implementation of individual target maps as a management tool;
- 2) involvement of every public servant to the process of indicator's system development for the public servants performance assessment;

- 3) transparency and equity of the bonus fund distribution, taking into account the contribution of each employee in achieving general goals;
- 4) improvement of the public servants monitoring system on the basis of increasing the objectivity of their work assessment;
- 5) focus on continuous improvement activities through the establishment of incentive values of performance indicators for employees;
- 6) improvement of the quality of the employees work by reducing the number of errors; shortening tasks; growth of creative activity of employees.

Table IV – The example of the form for assessment of structural unit indicators

№ п/п	Name and short description of the indicator	Term of execution	Criteria of execution	Maximum score in points	
				III quarter	IV quarter
1	Providing special admission of applicants to universities of Republic of Mordovia originating from the Russian Federation regions with compact living of Mordvin nation	According to the admission plan	Formation of entrance contingent (X people)	20	10
2	Implementation of projects of the 1000 anniversary of the unification of the Mordovian and Russian nations	Quarterly according to operation plan	The execution of X projects	30	20
3	Provision of public boards and commissions work under the Head of the Republic of Mordovia, the Public Chamber of the Republic of Mordovia	-//-	Execution the plan of public boards and commissions under the Head of the Republic of Mordovia, the Public Chamber of the Republic of Mordovia	20	15
4	Analysis of applications of citizens and making suggestions for their solution	Quarterly	Consideration of all applications	20	15
5	Implementation of the plan of measures to improve the legal status of public institutions supervised by the executive authorities of the Republic of Mordovia	Quarterly	Implementation of the plan of measured (100 %)	10	10
6	Preparation of Head's Address to the Republic of Mordovia State Assembly	IV quarter	Address draft	-	30

At the same time the experiment revealed the shortcomings of the existing system:

- 1) increase of the time and cost of planning, organization and monitoring the activities of employees based on the monthly bonus payments;
- 2) the absence of a special bonus fund allocated for the experiment and as a consequence, insufficient amount of payments and incomplete implementation of the potential effects of the experiment;
- 3) poor differentiation of the indicators reflecting the routine activities of the employee and those reflecting the development activities. This is primarily due to the fact that the contents of the public servant work is defined by the official and administrative regulations;
- 4) the difficulty of identifying indicators for public servants, which determine the individual contribution to the achievement of general goals.

As a result of the experiment, it was decided by the leadership of the Republic of Mordovia to continue it in order to complete a full management cycle: plan → act → assessment → improvement. It is necessary to adapt the system to the peculiarities of the various government bodies, departments and services.

As a prolongation of the experiment the development of a system of public servants performance indicators should be continued as well as the methodology for their evaluation in the following areas:

- 1) development of typology of public authorities, departments and government employees according to their occupation and nature of its results that is necessary to refine the classification of effectiveness and efficiency indicators. The most difficult issue is to explore the possibility of measuring the effectiveness of work of support and service units, such as accounting and office;
- 2) expanding the range of implementation areas of public servants performance assessment. In addition to incentive fund distribution there could be identified the following goals: 1. diagnosis and planning, when the results of assessment identify strengths and weaknesses of public authorities and is used in planning and setting reform priorities; 2. monitoring and reporting, when the information obtained allows to evaluate compliance with established standards and identify key areas for improvement; 3. benchmarking, where the information is used to compare the effectiveness of the various public authorities through the scoring in points of separate objects under comparison; 4. dialogue and joint decision-making, which requires the provision of open and objective information on government operations and public servants to all interested parties. The expanding of areas of implementation should result in changes of public servants performance indicators system and relevant assessment methodology as well as guidelines to its implementation in different situations;
- 3) elaboration of performance indicators assessment scale, taking into account different types of indicators – both positive and negative, restrictive and evaluative, suggesting the possibility of over-fulfillment and under-fulfillment, subject to external factors and not;
- 4) establishment of weighting coefficients of indicators that would allow to graduated scale of assessments depending on changes in value of certain targets and indicators in different time periods, as well as various public authorities, their departments and employees.

Solving these problems will break new methodological and practical level of performance assessment of public servants when on the basis of its standardization will be ensured

comparability, reproducibility and verifiability of data on the activities of public servants and public authorities in general.

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A benefit based segmentation as a management tool to improve services' quality in shopping centres

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Introduction

In the perspective of a market-oriented company, fulfilling consumers' expectations is a necessary condition to obtain competitive success. Company performance is the result of its ability to attract demand shares depending on the possibility of its output to satisfy functional and symbolic needs expressed by demand.

Demand and supply relation is constantly influenced by some relevant factors causing different developments. Among the most important evolutionary trends influencing competitive intensity, we remind the following: the pervasiveness of new technology, especially information technology, which makes sector borders less noticeable; the increasing flexibility of production processes that, non considering the importance of the economies of scale as a result of strategic decisions, allows to optimize company's ability to offer different outputs to suit consumers' needs; the international development of firms and the increasing globalization of markets, contributing to the variation of the competitive context of firms (Calvelli, 1998; Valdani, 1988; Valdani and Adams, 1998; Varaldo, 1987; Vicari, 1989; Busacca, 1994). All these factors helped develop some methods for the continuous management of strategic positioning of firms, in order to guarantee replies anticipating environmental changes (Golinelli, 1994).

At the same time, demand shows an evolutionary trend aiming at going over the satisfaction of primary needs and directed to the advantage of other more sophisticated needs. This trend is explained by the combined effect of different factors, among which: the speed-up/acceleration of changes and social heterogeneity; the consumer trend to define their needs in a individualistic way; the ability of people to control a complex symbolic universe (Busacca, 1994; Ferrero, 1990; Cozzi and Ferrero, 2004; Quintano 2006).

For these reasons, consumer behaviour represents with no doubts one of the most deepened subject by marketing researchers. Understanding the reasons of consumers' choices and defining

the articulation of the making-decision process and of the individual behaviour to fulfill his needs, are among the main goals of marketing studies (Castaldo and Botti, 1999).

The configuration of consumers' buying process, especially the correspondent level of complexity, is the result of the interaction of multiple factors. In addition to environmental factors and goods' characteristics, the specification of expectations is influenced by policies enforced by companies, too (Quintano, 2006).

Consumers tend to choose a product or a service that offers them the maximum value, taking their degree of information, the cost for finding new information, their mobility and their income into account. They assess which offer presents the higher perceived value and then behave in consequence. The ratio between expectations and real value of supply affects customer satisfaction and the likelihood of a repeated purchase.

Customer perceived value is the difference between the assessment of all advantages and costs of a specific offer and the perceived options. (Kotler and Keller, 2007).

The key factor for increasing customer loyalty is just the development of a high value for costumers.

Within this context, the objective of this study is to analyze the different types of customers of a shopping centre trying, through a socio-demographic segmentation, to understand the different benefits that encourage consumers to attend the same centre as well as the different functional and recreational reasons behind their purchases. The first part of the paper is therefore dedicated to the contextualisation of theories related to customers' behaviours, then we will briefly illustrate the methodology, to end with the result discussion and some final conclusions.

Theoretical framework

In the past, the studies about consumer's behavior seldom considered that some consumer choices comprise not only the decision about the type of product or brand to buy, but also the point of sale where they acquire some useful information and physically make a purchase. Indeed, a common critique asserts that studies about the choice of a point of sale occupied a marginal position, compared to those dedicated to brand choice, not considering that in an advanced economy customer satisfaction oblige to solve both problems related to brand choice and aspects referred to the selection of a point of sale.

Thus, by analyzing literature we notice a cognitive gap between real consumer behaviour and models aiming at understanding it. This gap is more critical if we consider that point of sale choice often precedes product choice, influencing the decision-making process of goods. In parallel with demand for products, there is a demand for services offered by specialized intermediaries, who make goods available when, where and how consumers prefer them. In the past, intermediaries' offer was firstly analyzed from a logistic point of view, emphasizing its function of spatio-temporal connection between production and consumption.

In accordance with this vision, a point of sale choice and shopping behaviour have been deemed mainly as rational activities, aiming primarily at satisfying functional needs. Only recently there

have been some attempts to deepen the recreational dimension of shopping, whose aim is not only to lay in supply of goods and information in order to optimize the decision-making process, but it also extends to seeking sensorial stimulus that allow to go through an involving and fulfilling experience.

One of the principal conclusion emerging from the analysis of different buyer profiles is the acknowledgement that there are different reasons driving to shopping, underlying in this way that it's reductive to consider the supplying cost minimization as the only buyers' goal. About that, the existence of two well-defined types of attitude towards purchase activity has been acknowledged, that is functional and recreational attitudes: in the former case, shopping is considered merely functional to supplies; in the latter case, a person attributes an independent worthiness to shopping, since it guarantees the possibility of amusement and entertainment.

In extreme situations, shopping may even become a way of spending free time, an end in itself and aside from the purchasing act. The mentioned orientations have been used as psychological segmentation criteria, distinguishing the "recreational" buyer by the "economical" (Bellenger, Robertson and Greenberg, 1977; Bellenger and Korgaonkar, 1980) or "functional" one (Roy, 1994). Both of them take their purchasing decision according to convenience assessments, observing the classic cost-benefit pattern.

Shopping cost is expressed in terms of dedicated time and resources, while benefits consist essentially in potentially achievable saving for functional buyers and in pleasure arising from the recreational dimension related to browsing activity and information acquisition.

Understanding the phenomenon of experiential shopping depends not only on socio-demographic characteristics of people, rather on pursued benefits from time to time. In fact, purchasing and consuming behaviour are expressed by the understanding of needs, that define individuals' motivational system (Busacca, 1990; Mauri, 1995). Starting from the work of Tauber (1972), Westbrook and Black (1985) classify pursued shopping benefits in three categories: product oriented, experiential and a combination of both.

In the first case, people go shopping in order to get useful information for future purchases, while in the second case people simply go shopping in order to spend time within stores. Shifting attention from consumer typology to motivational typology, it is possible to notice a continuum which links recreational value of shopping to utilitarian one (Babin, Darden and Griffin, 1994), where recreational value - meant as the research of a subjective, emotional benefit related to the need for entertainment - is in contrast to functional value, which aims at reaching a specific result, that is purchasing a product or getting some information. As a consequence, single purchasing experience can be explained by both aspects, that is by a mix of pleasure and utility that may be affected by both general aptitude and situational and environmental characteristics.

The phenomenon of experiential shopping develops together with another important and interesting phenomenon that concerns the shopping centres that offer consumers all services that fulfill their needs.

Compared to other typologies of modern retailing, shopping centres are characterized by a wide range of people that manage businesses within the shopping centre and by the coexistence of large-retailers and traditional specialized operators.

These are the two complementary essences that form the core foundation of every shopping centre: one or more large-surface shops with a de-specialized assortment (supermarket or hypermarket) and other, smaller, specialized retail stores, which offer an assortment that completes the one offered by the retailing and distribution industry. Using a widespread term, the GD structure is referred as the “locomotive” of the centre, to highlight its propulsion role. What occurs in the malls is the phenomenon of so-called cumulative attraction, hence a synergic effect whereby the demand of the centre as a whole exceeds the sum of the single retail shop demands. This occurs because consumers prefer to buy in areas where it is easy to compare with commercial offers from different operators, rather than looking at isolated shops.

Another important element of shopping centres is represented by non-commercial activities, which can significantly enhance the attractiveness. Indeed, the presence, in addition to stores, of public services (bars, restaurants, etc.) and of other activities and services (banks, cinemas, conference halls, etc.) contributes to the artificial reproduction, within the shopping centre, of the characteristics of the natural shopping centre, which is the core of each city. The typical customer of the retail mall has different characteristics than the customer of a supermarket, he will not hardly ever goes to the mall only to purchase, but he lives the shopping expedition as a way to pleasantly spend his free time as an alternative to other recreational activities. So in this context, it is essential to have non-commercial structures that would be incompatible with other types of business, against which the attitudes and expectations of consumers are completely different (Gandolfo and Sbrana, 2007).

Within this context, the environment can also have a significant impact on the individual emotional state of the consumer, and thus on purchasing behaviour and level of post-purchase satisfaction. Donovan and Rossiter (1982) and Donovan et al. (1994) have demonstrated the existence of a significant positive correlation between the degree of pleasure, the time spent inside the store and the level of expenditure. The environment, therefore, should be able to satisfy not only the purely functional needs that drive the potential customer to visit the mall, that is purchase or information searching, but also the emotional needs, related to feelings and sensory aspects. (Castaldo and Botti, 1999). Based on this logic, inside a shopping centre is given adequate space to common areas for meeting and gathering of customers, usually referred to as mall. The mall has the function to recreate the ambience and atmosphere of the old town squares and to promoting the continued presence of people within the centre for a period longer than the one necessary to make purchases. It must therefore possess the whole set of elements of attraction and animation typical of a vital town square (Aguiari, 1993, Gandolfo and Sbrana, 2007).

Methodology

The research presented in this paper is part of a broader survey planned by the management of the shopping centre “Tuscia” in the town of Viterbo (central Italy) in collaboration with the University of Tuscia. The mall includes 42 shops, a hypermarket and some fast foods and bars. It is typically structured in order to benefit of cumulative attraction from different types of stores: one large-surface food store, specialized retail shops and public services.

The general objective of the survey is to study the profile and motivations of the mall's customers. To this purpose, a questionnaire has been administered to the customers in the shopping mall's premises. Six interviewers have been involved in the survey. They stood at three different entrances of the mall – one for pedestrians, one from the underground parking lot, one side entrance - asking customers to take part in the survey. As it was very difficult to identify the size of the customer population of the shopping centre, a non-probabilistic sampling was adopted, namely an accidental sampling as it is widely accepted in marketing research. The survey was carried out within one week in November 2010 in order to ensure homogeneity of the data, which may be affected when the data collection extends over a long period of time. In order to get the best representation of different types of customers visiting the mall a variation of the days and the time slots was also respected in the interviews. A total of 500 consumers has been interviewed in the survey.

The questionnaire prepared for the survey is made up of three sections. The first is focused on the customers motivations to visit the shopping centre. In the second section customers' satisfaction for the services offered within the mall is investigated. The final section of the questionnaire is devoted to collect socio-demographic and behavioural information about respondents.

Out of the 34 questions included in the questionnaire, 8 are considered in this paper. This is because in the construction of the database for our research we only take into account the questions whose answers are more relevant for the analysis of motivations and habits of customers. In the following table the selected questions are listed.

Table I – Selected questions from the questionnaire used in the survey.

Question code	Question type *	Question text	List of answers
Q3	MC	In which days of the week do you usually visit the shopping centre “Tuscia”?	Monday; Tuesday; Wednesday; Thursday; Friday Saturday; Sunday; no preference.
Q15	LS	How important are the following reasons for you to visit the shopping centre “Tuscia”?	Purchases in the hypermarket; Purchases in the shops; Meeting place; Leisure; Eating in the restaurants.
Q18	MC	Why do you visit the shopping centre “Tuscia” instead of going somewhere else?	Close to home; Linked by public transportation; Big and covered parking; No-breaks day; Leisure; Well-know brands.
Q29	MC	Gender	Male; Female
Q30	MC	Age	Younger than 18; 18-25; 26-33; 34-41; 42-49; 50-57; 58-64; 64-70; Older than 70.
Q31	MC	Occupation	Student; Housewife; Employed; Self-employment; Unemployed.
Q32	MC	Area of origin	Town of Viterbo; Province of Viterbo; Outside the province.
Q33	MC	Household	1; 2; 3; 4; more than 4.

* *MC: multiple choice question; LS: Likert scale from 0 (not important/very bad) to 6 (very important/very good)*

Looking at the list of the selected questions it is evident that the first three refer to the habits (Q3) and the motivations (Q15, Q18) that drive people to visit the mall. While the last five questions (Q29, Q30, Q31, Q32, Q33) refer to demographic characteristics of the respondents, such as gender, age, occupation, household and area of origin.

Both Q15 and Q18 refer to the motivations for visiting the shopping centre “Tuscia”, therefore before selecting all of them to run our elaborations, a correlation analysis has been carried out. The two last answers to Q18 (leisure and well-known brands) are strongly correlated with two answers to Q15 (leisure and purchases in the shops), thus they have not been taken into account. Furthermore, we have decided to also exclude the first two answers to Q18 (close to home and linked by public transportation), since they are not related to services that directly depend on the mall management.

As it regards Q3 we have considered only the answer “Sunday”, creating a dummy variable, since we believe that the habit of going to the mall on Sundays can be a specific characteristic on which target the shopping centre services.

As a result, in order to identify different segments of customers of the shopping centre “Tuscia”, we have considered as variables on which characterize such segments the ones summarized in table II.

Before clustering the sample using the selected parameters together with demographic data, a principal component analysis (PCA) has been carried out in order to determine the main drivers and thus reducing the number of variables to be used for the cluster analysis.

Table II. Variables used for the PCA.

Variable code	Scale	Description
Q3G	0-1	Customer’s preference for visiting the mall on Sundays.
Q15A	0 – 6	Customer’s evaluation of the motivation “purchases in the hypermarket”.
Q15B	0 – 6	Customer’s evaluation of the motivations “purchases in the shops”.
Q15C	0 – 6	Customer’s evaluation of the motivation “meeting place”.
Q15D	0 – 6	Customer’s evaluation of the motivation “leisure”.
Q15E	0 – 6	Average of customer’s evaluation of the motivation “eating in the restaurants”.
Q18C	0 – 1	Customer’s motivation “big and covered parking”.
Q18D	0 – 1	Customer’s motivation “no-breaks day”.

To run both PCA and Cluster Analysis we have used the XLSTAT software.

Results and discussion

The PCA has been carried out using the 500 observations for the eight selected variables. Table III shows the eigenvalues and the contribution of each factor to the total variability. According with these results we choose to consider the first five factors that together explain more than 80% of variability.

Table III. PCA - factors’ eigenvalues.

	F1	F2	F3	F4	F5	F6	F7	F8
Eigenvalue	2,432	1,217	1,056	0,919	0,797	0,672	0,521	0,386
variability (%)	30,40	15,21	13,20	11,48	9,97	8,40	6,51	4,83
% cumulated	30,40	45,61	58,81	70,29	80,26	88,66	95,17	100

To properly name the five resulting components, thus making more readable the results, the values of the eigenvectors have been considered (table IV).

The first factor (F1), which explains the 30,40% of variability, is positively determined by the variables Q15B, Q15C, Q15D and Q15E and thus it can be called “shopping for leisure”. Indeed, the reasons to go to the mall express by this component are purchasing in shops together with spending free time, meeting persons and eating in restaurants or fast foods.

The second factor (F2), which adds another 15,20% of variability, it is clearly settle on variables Q15A, Q18C and Q18D. So, it can be called “purchasing in the hypermarket”. The presence of a big and covered parking place and a no-stop schedule go together with the motivation of going to the mall to do the groceries shopping.

The third factor (F3), counting for an additional 13,20% variability, is strongly determined by the customer’s preference for Sunday’s visits together with the appreciation for the parking place and the no-stop schedule. Thus, we have named this factor “convenient shopping on Sunday”.

Customer’s preference for Sunday’s visits is the predominant variable also for factor 4 (F4), but in this case it is joint with the purchase on the hypermarket; F4 clearly represents “Sunday’s food purchase”.

The last considered factor (F5), which brings the cumulated variability to 80,26%, has been called “parking addiction”, since the variable related to the parking place appreciation seems to be the only one that strongly determine this component.

Table IV. PCA - eigenvectors.

Variables	Principal components				
	F1	F2	F3	F4	F5
Q15A	-0,149	0,536	-0,454	0,534	-0,267
Q15B	0,406	0,189	0,037	-0,227	-0,290
Q15C	0,500	0,153	-0,032	0,008	0,128
Q15D	0,534	0,009	0,134	-0,084	0,149
Q15E	0,453	0,274	-0,165	0,170	-0,017
Q18C	-0,178	0,559	0,316	0,028	0,714
Q18D	-0,164	0,470	0,510	-0,327	-0,526
Q3G	0,122	-0,211	0,622	0,721	-0,139

Being the purpose of this study to provide a segmentation of the clients of a shopping centre, the five factors individuated through the PCA has been used as the variables for clustering the sample of our survey.

Table V shows the results of the cluster analysis given by the XLSTAT software, k-means method. The optimal classification explain 62,20% of variability and returns three clusters.

Table V. Cluster Analysis – cluster’s centroids.

Cluster	F1 shopping for leisure	F2 purchasing the hypermarket	F3 in convenient shopping Sunday	F4 on food purchase	F5 parking addiction	Observations
1	1,072	0,004	-0,423	-0,456	0,036	213

2	-1,520	0,210	-0,146	-0,074	0,031	202
3	0,925	-0,509	1,408	1,317	-0,165	85

The first group contains 213 observations; these persons mainly go the shopping centre to spend their leisure time while doing shopping. The second cluster is made of 202 people that almost exclusively visit the mall because of the hypermarket. The last group (85 observations) includes the Sunday's shoppers.

These three resulting clusters represent three segments on which apply eventual marketing strategies. To easily understand the common characteristics of the groups, we have named them as follow: shoppers for leisure; food buyers; Sunday's shoppers.

The last step of our analysis is to characterize the three segments according to the socio-demographic variables. As shown in table I the demographic variables utilized to this purpose are five: gender, age, occupation, area of origin and household. Indeed, we found out that the differences about gender and household are not significant, while age, occupation and area of origin result all significant ($p < 0,01$) in distinguishing the 3 clusters.

More specifically, as it regards age, shoppers for leisure and Sunday's shoppers show a very high percentage, respectively 70% and 68%, of young people (<33 years old), while the food buyers are equally distributed among the age-classes.

Concerning occupation, figure 1 shows the different distribution in the three clusters. Shoppers for leisure is the most unbalanced group, having the 42% of students, the 33% of employed and very low percentages of the other three categories. On the contrary, the second cluster - food buyers - is the most balanced one: housewives, students, self-employed and unemployed are almost equally represented; while employed persons cover the higher quota (36%). Sunday's shoppers are basically represented by employed, which is the predominant category in all three clusters, students and unemployed persons.

To be more accurate, it is important to say that employed persons and students together cover more than the 50% of the whole sample. But, while employed are equally distributed among the three clusters, students definitely characterize the shopper for leisure group.

Figure 1. Occupation in the 3 clusters.



Analysing the variable related to the area of origin, thus the distance from the shopping centre, the first evidence is that only the 12% of the interviewed customers comes from outside the province of Viterbo and that this percentage is almost the same in the three clusters. The interesting difference is between people coming from the city and people living in the province. Indeed, in the first and third group the majority of persons comes from the province of Viterbo (56% and 47% respectively), while the second group is composed for the 52% by citizens of Viterbo. This result is quite reasonable, since food purchase is often a daily activity and therefore people tend to do it close to their homes. On the other hand, shopping for leisure or shopping done on Sundays is something done with more relax and thus people do not mind to travel to reach the shopping centre.

To conclude our analysis we have summarized the main features of each cluster in table VI.

Table VI. Cluster's main features.

Cluster	Name	Main characteristics
1	Shoppers for leisure	Young students living in the province
2	Food buyers	Self-employed adults living in the city
3	Sunday's shoppers	Young unemployed living in the province

Conclusion

The research has confirmed that segmentation is a useful tool for firm management in order to develop a target analysis as well as a convenient marketing strategy. The segmentation performed on the case study may help the managers of the shopping centre making strategic and tactical

marketing decisions. The results might be used to target the shopping centre services in accordance with customer needs and desires rather than treating everyone as a single group with similar needs and preferences. In this way managers create an empathy with the customer encouraging higher customer retention.

The research shows how shopping malls can act as centres of interests in which different expectations related to the individual needs converge.

The data analysis reveals three segments of customers, that synthesize the different drivers of customer purchases, namely functional needs, leisure and recreational activities. Shopping centres are able to satisfy all these dimensions of the shopping experience.

Improving and enhancing the services offered to customers within a shopping centre is then a key element for the development of the economy both at a local and wider level.

The attention of the research should be focused on the customers, particularly on the analysis of their needs with the objective of translating their expectations into concrete answers. To this purpose it is necessary to take advantage of the attractive capacity of the shopping centres, particularly of the leading role that the large food retailers can play as “locomotive” for the whole centre. This is well known in most shopping centres where cumulative attraction takes place. The offer of public services within the mall is also often used to improve the attractiveness of the shopping centre.

Consistently with other findings in the literature this research has shown that customers motivations to go to the shopping centre are related to the sort of services they can find there.

The main objective of shopping centre managers should therefore be to further develop the offer of services in order to make them closer to the needs of the community. It means to provide places where people are encouraged to shopping which, at the same time, can act as meeting places for the member of the community.

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Using E-S-QUAL to measure Internet Service Quality of E-Commerce Websites in Greece

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Introduction

The use of Internet as a mean of shopping goods and services has been growing over the past few years. The number of internet stores, which through e-commerce are able to conduct transactions over the internet, has been steadily increasing (Liang and Lai, 2002), while revenues from online shopping exposed considerable growth (Rohm and Swaminathan, 2004). Companies increasingly rely more on internet services because they are more convenient, interactive, have lower costs and offer a high degree of customization and personalization to their customers (Park and Baek, 2007). Moreover, the number of customers who choose to purchase goods and services online is continuously rising, since they are usually able to find better prices in a more convenient manner (Chen and Chang, 2003).

Many companies have realized that due to technological advances, establishing a website does not pose significant problems any more. However, operating without errors and managing all the associated processes can be proved complicated and difficult. Internet retailers have also realized that their customers care about how a service delivered as well as the outcome of the service (Katz, 2001). Successful businesses in the e-commerce sector realize that the key factors for avoiding such problems are not limited to the existence of a website and low prices but must also include high standards of electronic service quality (Zeithaml, 2002). According to Smith and Chaffey (2005, p.94) online customers have some non-negotiable standards in their demands from an online store, with quality of the product, quality of the service and quality of the sites be at the first place.

Electronic service quality (e-service quality) has been in the focus of researchers for the past decade or so. However, it is generally acknowledged that research is still at a relatively early stage. A noticeable effort to develop a measurement instrument is E-S-QUAL, which has been proposed by Parasuraman et al. (2005). This team of researchers also developed SERVQUAL (Parasurman et al., 1988), an instrument which played a pivotal role in measuring conventional service quality. The present study, replicates the research of Parasuraman et al. (2005) in order to

examine the applicability of E-S-QUAL on e-commerce sites in Greece and investigate its effects on customer perceived overall quality, value and loyalty. More specifically, the study objectives are:

1. The determination of the E-S-QUAL dimensions and their effect on customer perceived overall service quality.
2. The investigation of the relationship between the E-S-QUAL dimensions and customer perceived value.
3. The investigation of the relationship between the E-S-QUAL dimensions and customer loyalty.

Literature Review

Service Quality in Traditional and Internet Settings

Service quality in traditional service contexts has been the focus of research since the 1980s. The roots of service quality occur in expectancy disconfirmation theory (Collier and Bienstock, 2006). Many studies adopted this theory as the base for measuring service quality. Service quality is usually understood as a measure of how well the level of the delivered services, matches customer's expectations (Santos, 2003). As an example, the definition of Gronroos (1984) outlines perceived service quality, as "the outcome of an evaluation process, where the consumer compares his expectations with the service he perceives he has received". Parasuraman et al. (1985) stated that service quality is the degree and direction of discordance between perceptions and expectations of customers, in terms of different but relevant dimensions of the service quality that can affect their behavior in the future. Three years later, the same authors, defined service quality as "the overall evaluation of a specific service firm that results from comparing that firm's performance with the customers general expectations of how firms in that industry should perform" (Parasuraman et al., 1988).

Colby and Parasuraman (2003) defined e-services as "all services delivered via an electronic medium (usually the Internet) and comprising transactions initiated and largely controlled by the customer". E-services differ from traditional services, in a sense that customers interact with the organization usually through a website, relying on sight and sound, in comparison to traditional services, where they use all their senses (Rowley, 2006). The way that people apprehend service quality in internet based settings differs from service quality in traditional settings, because they tend to have different beliefs about technology, a fact that makes them accept and use technologies in a different manner (Parasuraman et al., 2005).

In recent years, the well acknowledged relationship between service quality and business performance has also increased the interest in e-service quality (Rowley, 2006). E-service quality has been defined by Zeithaml (2002) as "the extent to which a Web site facilitates the efficient and effective shopping, purchasing and delivery".

Measuring E-Service Quality

A stream of research on measuring e-service quality focused on the interaction between customer and the website. These studies considered website quality as an assessment of website design and system function. Representative examples of results of such studies are the WebQualTM (Loiacono et al., 2002) and SITEQUAL (Yoo and Donthu, 2001) scales.

- *WebQualTM*: This scale focuses on the interface of a website and includes 36 items and 12 dimensions, which are: information fit to task, interaction, trust, response time, design, intuitiveness, visual appeal, innovativeness, flow, integrated communication, business process, and substitutability. The basic idea behind *WebQualTM* is that it is possible to predict the behavior of a web user when he/she re-visits a web site according to their perceptions of overall website quality.
- *SITEQUAL*: The development of this scale was based on the SERVQUAL scale for measuring traditional service quality (Parasuraman et al., 1988). The model has four dimensions, namely ease of use, aesthetic design, processing speed and interactive responsiveness.

The above two scales measured the interactivity of a website, without looking at the view of e-service quality as something beyond an interaction between the customer and the website (Collier and Bienstock, 2006). Furthermore, both these research efforts underline the system attribute of e-service quality and not its service attribute (Yen and Lu, 2008). For instance, *WebQualTM* focused only on the technical quality of a website, instead of the entire service quality that is provided to customers through the website (Zeithaml et al., 2002). Likewise, *SITEQUAL* does not apprehend all aspects of the buying process and does not provide a comprehensive assessment of a website (Parasuraman et al., 2005).

Other studies aimed to extend e-service quality so that the system and service attributes are of the same importance and measure the entire online buying experience. Wolfenbarger and Gilly (2003) developed the *eTailQ* scale, which includes four dimensions: website design, reliability/fulfillment, privacy/security and customer service. Despite the fact that during the development process the authors carried out a wide multi-group study, criticism has questioned the scale's dimensionality (Parasuraman et al., 2005). In the same line, Bauer et al. (2006) developed *eTransQual*, a transaction process-based scale including the dimensions responsiveness, reliability, process, functionality/design and enjoyment.

The E-S-QUAL scale developed by Parasuraman et al. (2005), which comprises the base of this study, provides a comprehensive approach, since it supports the measurement of both pre- and post- e-service quality aspects. Furthermore, E-S-QUAL dimensions were developed by processing data provided by qualified respondents, who had effectual experience on internet shopping. Therefore, when compared to other studies that used convenience samples of students, E-S-QUAL provides more representative information in terms of e-service quality (Kim et al., 2006). E-S-QUAL includes the following 4 dimensions:

- **Efficiency**: The ease and speed of accessing and using the site. Efficiency is considered very important in e-commerce, since convenience and saving of time are generally considered as the main reasons for shopping online (Renganathan and Ganapathy, 2002).
- **Fulfillment**: The extent to which the site's promises about order delivery and item availability are fulfilled. Fulfillment is one of the most vital factors for the judgment of the quality of an online shop, since keeping service promises and accurate order fulfillment are elements of service quality that lead to customer satisfaction or dissatisfaction (Yang and Fang, 2004).
- **System Availability**: The correct technical functioning of the site. When consumers purchase from an online shop or they are just surfing, function problems like non-working buttons or

missing links, disappoint customers and can lead to exiting. As a result, the retailer loses the opportunity to enhance customer loyalty (Wachter, 2002).

- **Privacy:** The degree to which the site is safe and protects customer information. Many people are still not willing to purchase products from the Internet because of the risk that is related to maltreat of personal information. Online retailers are becoming more acquainted of the importance of providing consumer privacy (Ranganathan and Ganapathy, 2002). Privacy has been shown to have a strong effect on intention to purchase (Loiacono et al., 2002), customer satisfaction (Szymanski and Hise, 2000) and overall site quality (Yoo and Donthu, 2001).

Parasuraman et al. (2005) also developed a complementary scale, called E-RecS-QUAL, aiming to capture the effects of problems encountered during an online transaction on customers' perception of e-service quality. The dimensions of E-RecS-QUAL are responsiveness, compensation and contact. This scale is only applied in cases of customers have questions or encounter problems and was not included in the research presented in this study.

Customer Perceived Value

The concept of customer perceived value has gained much attention from researchers, since it plays an important role in predicting purchasing behavior and at the same time can lead to the creation of competitive advantage. According to Day (1990) perceived value represents the difference between customer's perceived benefits and costs. Zeithaml (1988) defined perceived value as "the consumer's overall assessment of the utility of a product based on perceptions of what is received and what is given". Perceived value in this definition is measured at the product-level. It refers to the "value for money" that consumers receive, or otherwise "what you get for what you pay" (Sirohi et al., 1998). Service quality researchers like Parasuraman et al. (1985; 1988) point out that beyond from what is delivered, the way that a service is delivered is also important.

Customer Loyalty

Oliver (1999) defined customer loyalty from a behavioural point of view as "a deeply held commitment to rebuy or repatronize a preferred product/service consistently in the future, thereby causing repetitive same-brand purchasing, despite situational influences and marketing efforts having the potential to cause switching behaviour". Another stream of research examines customer loyalty under the attitudinal lens and argues that it can be derived from psychological involvement, favoritism and a sense of goodwill towards a particular product or service (Oh, 1995 cited by Kim et al., 2004). A more comprehensive approach combines both behavioural and attitudinal facets of customer loyalty and describes it as the repeated purchase of a service or good over time and the maintenance of favourable attitudes towards this service or good and towards the company supplying it (Wong and Sohal, 2003).

Loyal customers are important for every company because they contribute significantly to profitability (Anderson and Mittal, 2000), and even more so in e-commerce (Reichheld and Schefter, 2000). Loyal customers purchase more than new customers (Baldinger and Rubinson, 1996), can be served with lower operating costs, give positive word of mouth, and are more likely to pay normal prices (van Riel et al., 2001). Reichheld and Schefter (2000) have observed in their study, that in the Web, trust is more important than prices. However, researchers point out

that the achievement of customer loyalty over the Internet is difficult and costly (van Riel et al., 2001) and demands a service of high quality that satisfies the customer (Cristobal et al., 2007).

Research Methodology

Research Instrument

The field research was conducted using a structured questionnaire, by utilizing the E-S-QUAL model and replicating the work of Parasuraman *et al.* (2005). The conceptual framework of the present study is illustrated in figure 1.

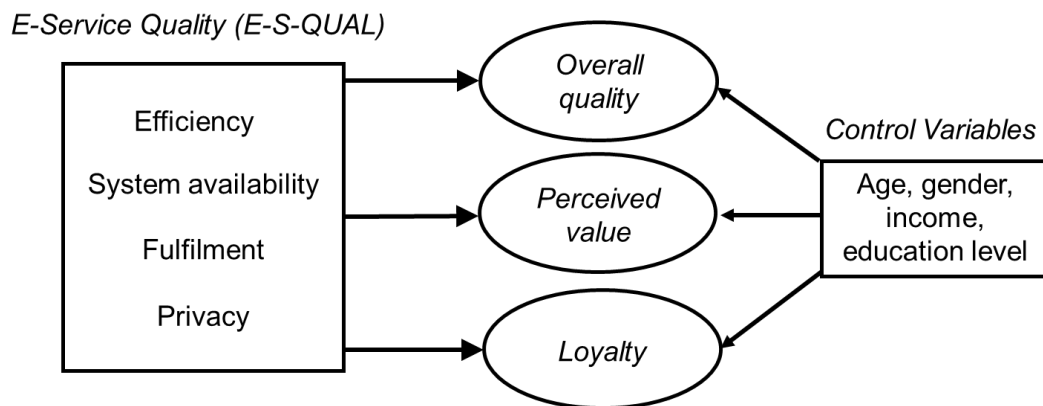


Figure 1 Research conceptual framework

The questionnaire that was used for the field research consisted of the following 3 distinct sections:

- 1 *Customer demographics.* The questions in this section aimed to capture the gender, age, educational level and monthly income of respondents.
- 2 *E-service quality measurement.* This section comprised the 22 items of the E-S-QUAL scale, measuring the following dimensions:
 - *Efficiency:* 8 items
 - *System availability:* 4 items
 - *Fulfilment:* 7 items
 - *Privacy:* 3 items
- 3 *Customer perceived value, loyalty and overall quality measurement.* This section aimed to measure customer perceived value by adopting the scale of Parasuraman et al. (2005) and customer behavioural loyalty based on the work of Zeithaml et al. (1996):
 - *Perceived value:* 4 items
 - *Loyalty:* 5 items

Finally, there was a single question aiming to capture the overall perception of respondents about e-service quality.

Sampling

The survey target sample consisted of people living in Greece, who had successfully completed at least one transaction (i.e. product/s purchase) with any of the 4 most popular Greek internet shops, in the period of 3 months before the survey date. In that way it was ensured that all respondents had sufficient experience in online shopping. The resulting sample comprised of 227 valid questionnaires. It must be noted that only 44% of the Greek population connected to internet in 2010, while 20% of users completed an online purchase (Observatory for the Greek Information Society, 2010). Therefore, given the relatively low penetration rate of internet shopping in Greece, the sample size can be considered satisfactory.

Data Analysis and Results

Sample Profile

Table I below presents the sample's demographic characteristics. The majority of respondents are male, relatively young and highly educated, while they have a relatively low monthly income. This profile is close to the Greek internet shopper profile, as described by surveys about internet usage in Greece (e.g. Observatory for the Greek Information Society, 2010). This fact makes the research sample sufficiently representative in order to draw generalized conclusions, regarding the Greek population.

Table I. Survey respondents' demographic frequencies

MEASURE	ITEM	FREQUENCY	PERCENTAGE
Sex	Male	135	59.5
	Female	92	40.5
Age	Less than 24	91	40.2
	25-34	81	35.6
	35-44	40	17.6
	45-54	13	5.7
	More than 54	2	0.9
Education	Secondary school	26	11.5
	University or TEI	157	69.1
	Postgraduate	44	19.4
Monthly Income (Euro)	Less than 600 €	50	22
	601-1000 €	70	30.8
	1001-1500 €	51	22.5
	1501-2500 €	31	13.7
	More than 2500 €	25	11

Factor Structure of Service Quality

Principal Component Analysis (PCA) was performed to verify the reliability and validity of the emerging dimensions of E-S-QUAL. Moreover, multiple regression analyses were conducted to assess the unique contribution of each predictor (e-S-QUAL dimensions) in explaining criterion variance (quality, value, loyalty).

Principal component analysis

PCA was conducted to identify latent factors within the E-S-QUAL dimensions. Four factors with eigenvalues greater than one (Kaizer, 1960; 1974) were extracted from the data, as shown in table II. These principal components accounted for over 63% of the total variation. A cut-off of 0.50 was used for item scale selection and a normalized varimax rotation was adopted to bring about simple and interpretable structure. Following an inspection of the items' loadings on each factor, four distinct principal components were identified, corresponding to: *efficiency*, *fulfilment*, *system availability* and *privacy*. Preceding PCA, the Bartlett sphericity testing on the degree of correlation between the variables ($p < 0.001$) and the appropriateness of the sample according to Kaiser–Meyer–Olkin (KMO) verified the appropriateness of the sample for all scales (Norusis, 1990).

Table II. Principal Component Analysis of E-S-QUAL

	<i>Efficiency</i>	<i>Fulfillment</i>	<i>System Availability</i>	<i>Privacy</i>
1. It is easy to find what I want in this site.	0.674	-	-	-
2. It is easy to get anywhere on the site.	0.684	-	-	-
3. The website enables me to complete a transaction very quick.	0.592	-	-	-
4. All the information at this website is organized well.	0.616	-	-	-
5. The pages of the website load fast.	0.647	-	-	-
6. This website is simple to use.	0.808	-	-	-
7. This website enables me to get on to it very quick.	0.755	-	-	-
8. This website is well organized.	0.732	-	-	-
9. This website is always available.	-	-	0.683	-
10. This website loads and runs in no time.	-	-	0.754	-
11. This website does not crash.	-	-	0.725	-
12. Pages of the website do not freeze after I enter	-	-	0.755	-

information about my order.				
13. This website delivers orders when promised.	-	0.696	-	-
14. Items through the website are available for delivery within a suitable time frame.	-	0.825	-	-
15. This website delivers quickly what I order.	-	0.739	-	-
16. This website sends out the items I ordered.	-	0.539	-	-
17. This website has in stock the items the company claims to have.	-	0.678	-	-
18. This website has truthful offerings.	-	0.585	-	-
19. This website makes exact promises about delivery of products.	-	0.773	-	-
20. This website protects all the information about my web-shopping behavior.	-	-	-	0.832
21. This website does not share my personal information with others.	-	-	-	0.902
22. This website protects information about my credit card.	-	-	-	0.869

<i>Eigenvalues</i>	8.294	3.108	1.424	1.196
<i>Percent of total variation</i>	37.70	14.13	6.47	5.44
<i>Cumulative Percent of total variation</i>	37.70	51.83	58.30	63.74

Inter-item analysis was then used (Table III) to verify the E-S-QUAL, perceived value, and loyalty scales for internal consistency or reliability (Nunnally and Bernstein, 1994). More specifically, Cronbach's coefficient alpha (Cronbach, 1960) was calculated for each scale, as recommended by Flynn et al. (1990). The values ranged approximately between 0.86 and 0.92. Therefore, all sub-scales exhibited well over the minimum acceptable reliability level of 0.7 (Nunnally, 1967).

Table III. Descriptive statistics and internal reliability analysis of all scales

	mean	Std. dev.	items	Cronbach alpha	KMO*
E-S-QUAL					0.889
<i>Efficiency</i>	4.21	0.570	8	0.889	

<i>System Availability</i>	4.30	0.627	4	0.862	
<i>Fulfillment</i>	4.03	0.579	7	0.858	
<i>Privacy</i>	3.90	0.940	3	0.911	
Quality	4.21	0.697	1	-	
Perceived Value	8.34	1.378	4	0.919	0.834
Loyalty	4.16	0.653	5	0.903	0.833

*The Kaiser–Meyer–Olkin (KMO) indicator was calculated to assess sample size adequacy. The minimum acceptable level is 0.5. Bartlett's test of sphericity is significant at $p < 0.001$ for all scales. Valid $N = 227$.

Multiple regression analyses

In order to determine the extent to which each E-S-QUAL dimension contributes to overall quality, perceived values and loyalty, we conducted three multiple regression analyses in which the independent variables were the mean scores on the four dimensions (table IV).

Interestingly enough, only *efficiency* exerts a significant positive relationship with all dependent variables (std. beta=.302, $p < .001$, std. beta=.284, $p < .001$ and std. beta=.304, $p < .001$ respectively), whereas *privacy* is associated with overall quality and perceived value (std. beta=.251, $p < .001$ and std. beta=.290, $p < .001$ respectively). *Fulfilment* is related to overall quality (std. beta=.183, $p < .01$) and *system availability* to perceived value (std. beta=.374, $p < .001$).

Following the rationale of Parasuraman et al. (2005), the selective lack of significance of some E-S-QUAL dimensions was surprising. Thus, we examined for multicollinearity effects among the mean-score measures of the four E-S-QUAL dimensions. For this reason, we calculated the variance inflation factor (VIF) for each independent variable in regression equations. The mean VIF value across the four independent variables was 1.79, while the maximum value was 2.65. According to Allison (1999), these values may be interpreted as indicators of a moderate degree of multicollinearity, since this exceeds the cut-off value of 2.50.

Table IV. Regression analyses of overall quality, perceived value and loyalty on mean scores for the E-S-QUAL Dimensions

<i>Independent variables</i>	Overall quality		Perceived value		Loyalty	
	<i>Std. beta</i>	<i>Sig.</i>	<i>Std. beta</i>	<i>Sig.</i>	<i>Std. beta</i>	<i>Sig.</i>
Gender	.038	.490	-.034	.466	.068	.245
Age	.042	.597	-.049	.475	-.193	.024
Level Of Education	.055	.390	.054	.324	-.066	.336
Personal Income	.047	.577	.007	.919	.094	.297
Efficiency	.302	.000	.284	.000	.304	.000
Fulfilment	.183	.009	.011	.851	.117	.115

System availability	.101	.184	.374	.000	.154	.059
Privacy	.251	.000	.290	.000	.080	.231
Adjusted R-square	.397	.000	.552	.000	.311	.000

In order to circumvent the problem of multicollinearity, the approach of Parasuraman et al. (2005) was followed and we extracted the orthogonal factor-scores resulted from principal component analysis on E-S-QUAL. Each factor score is a weighted combination of the relevant items, reflecting the corresponding E-S-QUAL dimension. Hence, multiple regression analyses using the orthogonal factor-score measures, rather than the mean-score ones, as independent variables will present a clearer pattern of the relative contributions of the four E-S-QUAL dimensions in explaining the variance in the dependent variables (table V). The results revealed that all 4 factor-score measures have significant positive effects on the 3 dependent variables.

Table V. Regression analyses of overall quality, perceived value and loyalty on factor scores for the E-S-QUAL Dimensions

<i>Independent variables</i>	Overall quality		Perceived value		Loyalty	
	<i>Std. beta</i>	<i>Sig.</i>	<i>Std. beta</i>	<i>Sig.</i>	<i>Std. beta</i>	<i>Sig.</i>
Gender	.042	.441	-.034	.458	.071	.220
Age	.046	.567	-.066	.329	-.195	.022
Level Of Education	.052	.416	.041	.454	-.072	.291
Monthly Personal Income	.046	.591	.032	.656	.100	.268
Efficiency	.359	.000	.414	.000	.346	.000
Fulfilment	.306	.000	.183	.000	.206	.000
System availability	.291	.000	.503	.000	.315	.000
Privacy	.296	.000	.340	.000	.129	.025
Adjusted R-square	.393	.000	.571	.000	.313	.000

Conclusions

The rapid proliferation of services being provided over the internet has led many researchers in efforts to develop instruments measuring the quality of such services. Despite the fact that this stream of research is at a relatively early stage, several such instruments have been proposed in literature. Among these, E-S-QUAL plays a central role, since its focus is on measuring the quality of the core service attributes rather than the technical quality of websites measured by other models, such as SITEQUAL and WebQualTM.

The aim of the research presented here was to replicate the research of Parasuraman et al. (2005), in order to examine the applicability of E-S-QUAL on e-commerce sites in Greece and investigate its effects on customer perceived overall quality, value and loyalty. The analysis of the research data confirmed the four factor structure of E-S-QUAL in the context of e-commerce in Greece and produced similar results to those of the initial research. Our results are in partial disagreement with those produced by Boshoff (2007), who investigated the factor structure of E-

S-QUAL in the context of e-commerce in South Africa. He found that E-S-QUAL exhibits a six factor structure, namely efficiency, delivery, privacy, speed, system availability and reliability. Since, the application of E-S-QUAL in measuring e-service quality is at its very early stages it is obvious that further research is required to determine the dimensionality of the instrument.

Regarding the relative importance of the E-S-QUAL dimensions, *efficiency* was proved to be the highest ranked one since it has a significant positive effect on all three dependent variables, namely perceived overall quality, value and loyalty. This is in full accordance with the results obtained by Parasuraman et al. (2005) and means that customers value very high the ease and speed of accessing and using a website, so that they take full advantage of the convenience that e-commerce offers. The next most important dimension was *privacy*, since it has a positive significant effect on both perceived overall quality and value. This is in contrast with what Parasuraman et al. (2005) found, since in their research privacy was not found to have a significant effect on any of the dependent variables. It can be attributed to the relatively low experience of Greek users on e-commerce, a fact that can make them unaware of the technological advances made in information systems security and therefore cautious and concerned when it comes to safety of their personal data. *Fulfillment* was found to have a significant positive effect only on perceived overall quality, which again is at disagreement with the results of Parasuraman et al. (2005), who found this dimension to have a significant effect on all 3 dependent variables. Finally, *service availability* affects positively only perceived value. This was largely expected since the correct technical functioning of e-commerce websites are common place in nowadays.

Overall, providing a high level of e-service quality is a target that managers of e-commerce companies must constantly strive to achieve. The results of the research presented here show that in the relatively immature environment of e-commerce in Greece, efficiency and privacy are the dimensions that customers value very high. Hence, managers must ensure that the e-commerce websites of their companies deal efficiently with issues such as the good organization and easy location of information, the quick completion of transactions and simplicity. Furthermore, care must be taken so that customers are informed about the security measures and policies relevant to the protection of customer personal, credit card, and shopping data.

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Sustainable and innovative Public Transit - *Bus Rapid Transit (BRT) system thinking in social context*

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Introduction

Sustainability is argued to be a key driver for innovations. To really fulfil the ambitious goals for sustainability; innovations should aim to re-invent the way value is created. Re-inventing value creation relates to the underlying foundation of value-creating process through the service-dominant logic (Vargo and Lusch, 2008). Value creation occurs when a potential resource is turned into a specific use or integrated. This means that value creation relies on resource integration across a value network consisting of firm, network, partners, and customers (Ibid; Edvardsson, Gruber & Tronvoll, 2011). The networks form service systems that survive, adapt, and evolve through exchange and application of resources. BRT as an integrated system that combines many of the features with flexibility can be developed incrementally, with each stage keyed to demand characteristics and the availability of resources and networks. A value network development departs from existing *sustainable and innovative public transport*. It would enable to elaborate transformations in the way customers, operators and authorities integrate their resources. Sustainable public transport at least has a harmonizing role to the economic, social, and environmental needs of the communities they serve, based on sustainable systems and thinking. Advancing a particular condition of public transport services could be achieved by solving the challenges by integrating resources and service systems of increasing mobility, improving service, satisfying customer needs, solving road congestion, and innovate new services.

Despite the importance of sustainable public transit services, existing research takes not full advantages of exploring how innovation alters value creation; and exploring how sustainability drives innovation. Literature suggests that value creation and value network are highly embedded in social forces (e.g., signification, legitimization and dominance). In both situations, public transit services are embedded in societal and infrastructural problems and offer solutions to cope with rapid population growth, urban expansion, traffic congestion, and green house emissions. On the other hand the intangible socio economic values of services, such as, transport, living space are also requiring greater understandings. To find solutions for the present and upcoming traffic and transportation challenges research can either focus on advancing single provision of sustainable public transport services, or it could use a value network perspective. Of course, networks are complex phenomena; however the structure, governance and managerial issues are associated with present-day business networks.

We applied value creation and value network perspective to bus transit services in both industrialized and newly industrialized countries. Our empirical evidence includes the case of

Jakarta, Indonesia, Bus Rapid Transit (BRT) and Fryksdalen (Värmlandstrafik), Sweden in comparison with contextual illustration of the innovative service practices of value networks in public transit and BRT systems through value-configuration spaces: through value creation and value network (Gebauer et al., 2010; Johnson et al., 2010). More specifically, regions vary in the way they address value creation elements (e.g. customer engagement; self-service; customer experience; problem-solving; and co-designing) and value network elements (the goal of the network, structure of the networks along its vertical and horizontal dimension, value activities of the business networks, and the capabilities of the actors). The variation in maturity allows us to BRT system that assesses social force.

To further embrace the ideas this paper lays the foundation for enriching the BRT thinking and conceptualization through empirical evidences from the public transit services. The paper continues the research around understanding BRT thinking in a social context. The remainder of the article is organized as follows. The next section presents our conceptual framework. This consists of sub-sections describing value creation, value network, and BRT systems generally as well as in the context of public transit services. Section 3 describes the research methodology, and Section 4 presents our discussions.

Conceptual Framework

Innovation Sustainability, Value creation and BRT systems

Innovation is essential for sustainable achievement. The concept of innovation is multifaceted. A service innovation may not only involve new services, but also require new technology, new networks and new procedures. Moreover, such innovations can be radical or incremental, and can be based on utilitarian principles or be experience-based. And Service systems are promote both excellence and innovation (Rubalcaba *et.al.*, 2010).

Service innovations are based on customer-focused S-D logic - whereby value is co-created with customers who are resource integrators (Baron and Harris, 2008). The process consists of actors who are using its resources for the benefit of the other party. This implies that both the service provider and the customer are part of the value creation; they together integrate resources in order to co-create value (Gummesson, 2008). Value is being co-created through this resource integration (Vargo and Lusch, 2008). These integrated resources can be of private (e.g. self, friends, family), market (from other entities, through economic exchange), or public (collective access from communal and government sources) (Vargo &Lusch, 2011). When integrating these resources new opportunities for the creation of new potential resources are provided. There are many potential sources of such service innovations. In this regard, Sundbo (2010, p. 281) noted that the complex character of service means that many actors and trajectories can be involved, which is include new values and priorities in society. Service systems are promote both excellence and innovation (Rubalcaba *et.al.*, 2010). Service systems are complex systems that dynamically configure access to resources (people, organizations, technology and information) to interact with other service systems and mutually create and capture value (Spohrer et al., 2007). Service systems interact via types of value propositions (internal and external business models) that connect them into vast service networks.

The role of is to improve services and the provision of mobility, which is safe, integrated, orderly, smooth, comfortable, economical, efficient, effective and affordable by the community (Gebaur et al., 2010). It can be described as a flexible and rapid transit mode that combines stations, vehicles, services, running way, and Intelligent Transportation System (ITS) into an integrated system. Sustainable Public transit as the goal of sustainable transportation is also to ensure that environment; social and economic considerations are factored into decisions affecting transportation activity (MOST, 1999). Public transit services take sustainable challenges for integrating environmental “*Eco-Efficiency*” and social sustainability with inclusion of all stakeholders, to provide better service, and efficiency. The society and humanity stands for big challenges regarding climate and environmental crisis (Leggewie and Welzer, 2009). Friedman (2008) argues that we do not regulate us out of the environmental crisis, we only innovate us out of it. A touchstone for sustainable innovation is not been a burden on bottom lines (Nidumolu et.al, 2009). A sustainable way of thinking is also important to create a value network by engaging local stakeholders (Hart, 2007).

BRT system contributes to both safer and more environmentally friendly traffic. In common with other forms of mass transit, BRT systems have potential to offer significant impacts on urban economic, social and environmental development, although less attention to date has been given to the economic impact of BRT (Deng and Nelson, 2011). The designation of separate bus lanes reduces the degree of risk that exists when buses and other vehicles, as well as pedestrians, are forced to coexist in dense city traffic. BRT has dedicated running ways, attractive stations and bus stops, distinctive easy-to-board vehicles, off-vehicle fare collection, use of ITS technologies, and frequent all-day service.” ITS stands for “intelligent transportation systems” and refers to applications of computers and wireless communications. The most common ITS applications are transit signal priority (TSP), automatic vehicle location (AVL), automated scheduling and dispatch, and electronic displays of real-time information about bus locations at stations and aboard the coaches (Ibid; Levinson et. al., 2002). This creates resource integration and systems to high-efficiency bus-based transport systems that make it far more attractive to travel by public transport. BRT systems offer an innovative approach to providing a high-quality transport service, which also ealy integrated with other modes of transit. The systems are flexible and can be built economically and incrementally compared with other forms of mass transit (Hook, 2006). Some BRT systems integrate resources to create value, for instance, operating infrastructure with LRT systems (with no loss of performance to either), whilst others allow conventional bus services access to certain key sections of BRT infrastructure to facilitate interconnection and performance enhancement (Deng and Nelson, 2011; Wright 2005).

Value creation, value networks, and value-configuration-space

The literature increasingly devotes attention to value-configuration spaces, which lays the foundation for the co-creation of value (Vargo and Lusch 2008), and each value configuration is distinctive in accordance with its own value-creation logic of transforming resources into products and services. Value-network logic links these value configurations in a network relationship that enhances resource integration among various social and economic actors, thus increasing the potential for synergistic value co-creation (Vargo and Lusch 2008). Consequently, value-configuration spaces combine two important elements, namely, value creation and value network. Arguably, the value configuration space consists of two parties (“customer” and “provider”), who are both resource integrators and beneficiaries in the value configuration space

(Edvardsson *et al.* 2011). Both parties are involved in networks of actors (or service systems) contributing to the value configuration spaces.

According to the service science literature, the ‘service systems’ constitute the value co-creation configuration of firms, institutions, and customers (Maglio and Spohrer 2008). Value networks form service systems that “survive, adapt, and evolve through exchange and application of resources” (Vargo *et al.* 2008, p. 146). The network is the basic locus of innovation and the principal unit of analysis in business and marketing (Vargo *et al.*, 2008). In the value network, value is co-created by different actors, and each actor contributes to the overall offering (Vargo and Lusch, 2011). Membership of a value network offers collective benefits that surpass those available to an individual entity because the synergistic application of specialised competencies in the value-creation process leads to increased efficiency (Möller and Svahn 2003).

Value creation emphasizes value-in-use, instead of value-in-exchange. Value is an exchange of goods and money (Vargo *et al.* 2008). Value-in-exchange distinguishes between producers and consumers. Value creation results from a series of activities performed by the firm. Value-in-use suggests the roles of producers and consumers are not distinct. Value is always jointly and reciprocally co-created. It results not from a series of activities, but rather from interactions among service providers and beneficiaries. These interactions require the integration of resources and application of competences (Edvardsson *et al.* 2011; Vargo and Lusch 2004).

Grönroos (2008) describes value-in-use from a supplier perspective as value facilitation and value fulfillment model. As a value facilitator, the service provider provides customers with a foundation for their value creation in the form of resources and beneficiaries. In terms of value fulfillment, the service provider act as value co-creator in a way of direct engagement in interactions with customers during their value-generating processes.

Empirical study

Research design and methodology

The construct of this case study is “designed with purpose” (Harrison and Freeman, 1999) to analyze and conduct an in-depth study of the role of sustainable public transport and its effects on sustainability and innovation in Jakarta Bus Rapid Transit System in Indonesia and Fryksdalen, Sweden. The case study method was chosen in order to assess and reveal the strength and extremity (Yin, 1994) of the organizational change for creating sustainability and value and its role on value creation. The study focuses on narrating (Pentland, 1999) the cases of Jakarta, Indonesia, and Fryksdalen, Sweden, rapid bus transit (BRT) system and draws some findings. We have been studying the different public transport cases for several years. This has involved: (i) the extensive perusal of documents; the collection of narratives about BRT and Jakarta from the media, the Internet, and books; and (iii) supervision of several masters’ theses in the case of Indonesia and on related subjects (iv) oversee the project. This extensive research involvement has provided us with a solid basis for selecting representative empirical data for this article.

The selection of Jakarta, Indonesia as a case study for this paper, assess the environmental and social challenges of public transport in developing countries. Jakarta will be the fifth-largest city in the world by 2015. The city is facing growing challenges in the traffic congestion and harmful

pollution that result from the increasing use of cars and motorcycles. The case of Fryksdalen selected to assess the new way of engagement for doubling public transport.

Jakarta public transport

Jakarta is capital city of Indonesia and one of the fast growing cities in East Asia. The city has that has about nine million inhabitants and total about twenty one million people, if we combine population from the surrounding municipalities. The fast growing economy and tourism makes Jakarta a destination and a business capital. However, this has a counter effect in the increasing number of cars in the street and congestion with the need for increasing mobility as seen in any cities and megacities of developing countries. In 2007, the number of vehicles that operated in the Jakarta roads was counted totaling 7,773,957 that consists of motorcycle vehicle 5,136,619 units, cars 1,816,702, buses 316,896, and other vehicles 503,740; motor vehicles mean growth reached around 10% per year in average, which is for car 12.51% and motorbike 7.75%. Public transport only shared 2% from all vehicles in Jakarta. It is also influencing by the satellite cities of Jakarta, namely Bogor, Depok, Tangerang and Bekasi. These cities are contributing to the congestion, as around 700,000 persons/ day traveling to Jakarta. In general, it estimated, there are more than 17 million trips every day in Jakarta. Besides the fast growing number of cars the road construction in Jakarta grows at around 0.01 percent a year. Private car users complain due to severe congestion. Public transport users in Jakarta also do not have a lot of choices and convenience.

The congestion and increasing demand have also affecting environment and health negatively - air pollution, crowd, accident, crime..., etc. Based on these factors Jakarta Provincial Government has formulated the Transportation System and developed directives and strategies to reduce traffic congestion in Jakarta. Bus Rapid Transit (BRT) is started since 2004, as one strategy of Macro Transportation Pattern (MTP) to improve services and the provision of transportation services that are safe, integrated, orderly, smooth, comfortable, economical, efficient, effective and affordable to the citizens.

Jakarta Transportation Pattern is covered in the Region Regulation (PERDA) No.12/2003 and then Governor Regulation (PERGUB) No.103/2007. The aim is to:

- Optimize the use of public transport as the backbone of the system and implement demand management policies (Transport Demand Management / TDM) and supporting the provision of road network
- Improve accessibility and mobility, and rearranging the integrated transportation modes
- Socialize mass public transport system
- Improve the road Network
- Promote the use of public transport
- Reduce use of private vehicles

Jakarta public transport is administered under Dinas *Perhubungan (Dishub)* or Jakarta Transportation Authority. Dishub has the task to organize, development, management, control and coordination of activities in the fields of land, sea and air transportation in Jakarta. Dishub vision is to “*make a city which has integrated transport system and equal with other big cities in developed countries*”.

The Development objective of *Dishub* is to create sustainable mass public transports system in Jakarta. This will also allow, as a primary target, the switch of some private transport users to public transport; thereby it can reduce the operation of private vehicles. This policy is also supported by private vehicle operation reduction policies such as policy of "three in one", road pricing, and others. Meanwhile based on PERGUB No.103/2007 the planning development transport system is focusing on developing the public transport system between the years 2004-2020. This is based on development of mass transport system; bus transport system; road network system; rail Transport systems – river way *by utilizing canal / river in to 2020; and* development of supporting policy. This includes the regulation of using new environmental friendly busses on the route.

The main part of this study is focused on the ***Development of mass public transport system***. Mass rapid transit system is a network of priority bus or Bus way, monorail and the Mass Rapid Transit with the duration target 2004 to 2020.

- a. ***Bus Priority Network (Bus way)***: Based on the planning of Macro Transportation Patterns (PTM) in Jakarta, one of strategies is optimizing the mass public transport buses which using Bus Priority or Bus Rapid Transit (BRT). BRT already established since 2004, based on PERGUB No.103/2007, development of corridor 1 to 7 had been planned and be constructed in 2004 to 2007. , the construction of the corridor 8 to 15 has planned for 2007 to 2010. However, because there were some problems, development corridors 8-15 is delayed from the original scheduled. The bus way of the BRT currently has 8 corridors (or lines) in operation with a total length of 123.35 km. BLU ***TransJakarta*** is also established by the government of Jakarta to provide BRT system on January 15, 2004. TransJakarta's BRT was designed to provide the citizens of Jakarta fast public transport system to help reduce rush hour traffic. The Indonesian Government provided TransJakarta buses with their own private lanes and TransJakarta's ticket prices are subsidized by the state government.
- b. ***Light Rapid Transit (LRT)***: Light Rapid Transit is designed to be developed in as Monorail, which is currently going under construction in Jakarta. It will consist around 61- 85 kms. The construction of pylons for the elevated track started in 2004, financial problems and legal disputes soon stalled the project, and in March 2008 developers PT Jakarta Monorail officially abandoned the project.
- c. ***Mass Rapid Transit (MRT)***: Jakarta MRT network of rail-based according to plans will be established in approximately 100 kms. on the South – North route (Lebak Bulus to Kampung Bandan) along approximately 22 km and route of East - West along approximately 80 km. The first Corridor has targeted to start operation in late 2016. Jakarta MRT project was signed in Jakarta March 25, 2009 with the first stage 4 underground stations and 8 station overpasses. MRT project fund is coming from JICA (Japan International Corporation Agency) and financed with loans. It is guarantees by central government. In other words, the MRT project is a national project organized by the Provincial Government of Jakarta. The support of central government in funding is agreed as the on-granting to the Jakarta Government. Although loan payments might be shared by the Government and the Provincial Government of DKI Jakarta, in the deal emphasized that to ensure sustainability of the project.
This rail-based MRT Jakarta is expected to overcome Jakarta congestion (bottlenecks).

Integration of all the three rapid transit systems is happened with the construction of roads to the station and other facilities including stations, shelters, sideways and parks.

In *analyzing the case of TransJakarta BRT*- based on performance during operation, TransJakarta increase in passenger numbers and revenue earned. This can be seen in terms of increase in No. of passengers' and revenue below:

<i>Year</i>	<i>2004</i>	<i>2008</i>
No. of Passengers:	15.942.423	74.619.995
Revenue:	39.063.108.475	248.339.552.000 rupiah

TransJakarta is also introducing *JakCard TransJakarta* an electronic payment card system since 11 April 2010 and Internet based *Halte cam* of the different corridors and Bus ways. JakCard is now using in four corridors and 32 bus ways, which creating convenience and security. The card is issued by Bank and can used for as a shopping card at certain merchants (Indomaret). The main purpose Halte cam is to provide more complete information of overcrowding, so that customers can know the actual situation of each bus stop. The Halte cam service can be used by passengers who want to see the current condition in the shelter by using internet through www.transjakarta.co.id. This service is now available on six corridors.

Even though, Dishub has been implemented Bus Rapid Transit as the new system to provide better services and sustainable solutions still there are some major *challenges* including congestion, safety and quality of services. This is beside the environmental cost caused by traffic jam, which traffic delays alone cost Jakarta \$3.5 billion a year in lost productivity and extra fuel costs. The number of vehicles on the road in Jakarta doubled in the preceding 10 years while roads only grew 10%, according Yayasan Pelangi, an environmental NGO. If nothing is done to improve things, the study predicts, traffic will reach to a complete halt by 2014. World Bank also places Jakarta as one of the cities with high levels solute particle after Beijing, New Delhi and Mexico City. The biggest contributor of pollution is transport reach 70%.

The strategy of Dishub, to the least, is to establish sustainable and integrated Mass public transport in the long term, and improving service quality through Mass Rapid Transit (MRT), Bus Rapid Transit (BRT) Light Rapid Transit (LRT) and other alternative transit methods.

Fryksdalen, Sweden

An attractive public transit system is a prerequisite to get more people to use common public transport such as trains and buses but also “special” forms of public transport such as school bus systems, mobility service (for disabled people), commuter services (complementary dial-and-ride traffic) in Sweden. To make public transit more attractive, it is about increasing the number of train or buses departures or straightens the way buses travels in order to reduce travel time. But how can a Public Transport Authority manage to do the same in sparsely settled areas with a small and decreasing population? Less people and poor municipalities need attractive PT as well.

The Public Transport Authority in Värmland (Värmlandstrafik) has made a remarkable expansion over the past decade including increasing the grant for public transit in the county of Värmland with 130 percent. By purchasing new trains and build a bus-network, a BRT system has been built up in Värmland region. Of course, more can be done to straighten up the passenger travelling time in the city of Karlstad, with more than 80, 000 populations, for effective hubs, effective integration with the city traffic and separate bus lanes where the traffic congestion is the worst. In the municipality of Sunne, with more than 14, 000 inhabitants, a project is running to utilize the railway system with new trains as well as other vehicle like taxi cars, small buses, larger buses coordinated by the PTAs call-center. The idea is that the traveler shall have an influence on building a “service public transport system”. The aim is to serve the BRT system with new travelers that can’t make their way to a hub with their own car and park at commuter’s parking lots. The local PT system will also serve the travelers who need transport to the local town for public services use and shopping.

The new “feeder public transport system” is not only utilized already excised school and taxi vehicles by the PTA between when the children are in the schools, but also coordinated in time with the BRT system to get coordinated time schedules for minimum traveler waiting time.

Discussion and Conclusion

We use insights from the study of other public transport agencies in Sweden (Enquist and Johnson, 2010) and Switzerland (Gebauer, et. Al., 2010) together with a conceptual analysis create a framework of sustainable public transport in developing countries. Gebauer et. al, (2010) indicate a framework for *Designing the public transit service* to extend value creation from *value-in-use* to the wider concept of *value-in-context*. This is based on five activities in value co-creation, which will be used to discussing the above case. Five activities in value co-creation:

1. **Customer engagement:** the engagement of customers for Dishub should be based on value co-creating with the operators. This can be done through open and fair contract and competitive tendering, and indispensable relationship built on commitment and trust for providing better service. As part of long term strategy both Värmlandstrafik and Dishub is planning to engage customers by using public transport system. This can be started by providing fast and affordable public transport based on BRT. The objective also includes the reduction of private cars to reduce traffic jam, congestion, pollution and accident, which are major threats.
2. **Self-service:** Public transit services could also offer a variety of self-service opportunities. The introduction of JakCard TransJakarta an electronic payment card is one of the efforts made to increase self service. In addition the operator TransJakarta launched Halte cam service for users of TransJakarta. Self-services do not stop after buying and paying tickets, but appear also by using public transit service. Customers, for example, are confronted with self-controlling mechanisms or observe overcrowding and safety, which could motivate them to use safe mode. Värmlandstrafik has more advanced and developed self service systems, for instance integrated ticketing system with other modes of transport.

3. **Customer experience:** Customer experience starts with an integrated public and individual transport network. The public transport service integration involves different means of public transport (buses, trains, and shelters), time schedules, ticket offering and geographical aspect (local, regional, national and international). The integration of individual means of public transport refers to park and drive services, car sharing, bike and sideways for walk and so on. The integration should also offer value creation opportunities of individual and business matters.
4. **Problem solving:** Value creation opportunities also emerge around problem solving. Problem solving can, on one hand, imply that public transit organizations offer customers the opportunity to navigate autonomously through information services and to solve problems themselves. In this case the introduction of Halte cam and electronic card are positive developments for solving passengers' problems. On the other hand, instead of leaving customers themselves in solving the problems, operators can take over responsibilities for solving the problem, "feeder public transport system" in Värmland.
5. **Co-designing:** This is one of the major challenges facing in developing the mass transit in Jakarta. However, for successful, development of sustainable public transport co-designing and the engagement of customers is essential. Value creation opportunities evolve when public transit companies co-design services together with customers. Co-design implies either to use customer's better align services and customer needs during the market introduction, or involving customer already in the creation of new service ideas.

Public transport has to improve services and the provision of mobility, which is safe, integrated, orderly, smooth, comfortable, economical, efficient, effective and affordable by the community. BRT is adding value in the transport system. It can be described as a flexible and rapid transit mode that combines stations, vehicles, services, running way, and Intelligent Transportation System (ITS) into an integrated system. Sustainable public transport has shown to be an effective catalyst to help transform cities into more livable and human-friendly environments. The appeal of BRT, in the case of Jakarta and Fryksdalen, is the ability to deliver a high-quality mass transit system. BRT has thus proven that the barriers to effective transit are not costly or high technology.

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Innovating Value-configuration spaces: Insight from Public Transport Services

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Introduction

Public transportation represents a complex service system, which is based on “value-co-production” configuration. In general, value-co-production configuration involves “ ... people, technology, other internal and external service systems, and shared information” (Spohrer et al., 2007, p. 2). Generally, the value configuration space consists of two parties (“customer” and “provider”), who are both resource integrators and beneficiaries in the value configuration space. Both parties are involved in networks of actors (or service systems) (Vargo, Maglio & Akaka, 2008). The networks form service systems that survive, adapt, and evolve through exchange and application of resources. The term service system is related to value networks. That means that value creation relies on resource integration across a value network consisting of firm, network, partners, and customers (Vargo & Lusch, 2008; Edvardsson, Gruber & Tronvoll, 2011).

Despite the importance of sustainable public transit services, existing research takes not full advantages of exploring how innovation alters value-configuration-spaces. Research rather concentrates on travel comfort, punctuality, reliability, pricing, or capacity management. This research rather substantiates the existing value-configuration-space, when looking for innovating value-configuration spaces (Gebauer, Johnson & Enquist, 2010; Johnson, Gebauer & Enquist, 2010). Thus, in this paper, we broaden-up the perspective on public transit services; we apply the conceptualization of value-configuration spaces. Public transit services in urban regions in China, Germany, Indonesia, Sweden, Switzerland, and South Africa form our empirical background. The urban regions include cities such as Freiburg, Hamburg, Guangzhou, Harbin, Jakarta, Johannesburg, Lanzhou, Stockholm, and Zurich. As an important side effect, innovating value configuration spaces also opens up a potential pathway towards increasing the sustainability of public transit services. To really fulfill the ambitious goals for a sustainable public transit, innovations should aim to re-invent the way value is created.

To further embrace the ideas this paper lays the foundation for enriching the logic on value-configuration spaces theories through empirical evidences from the public transit services. The article continues the research around understanding value-configuration spaces. The remainder of the article is organized as follows. The next section presents our conceptual framework. This consists of sub-sections describing value creation, value network, and value configuration spaces generally as well as in the context of public transit services. Section 3 describes the research methodology, Section 4 presents our findings, and Section 5 concludes with discussion.

Value creation, value networks, and value configuration space

Terminology and nature of the key concepts

As highlighted in the introduction, we rely on three key concepts, namely, value creation, value networks, and value-configuration spaces. Value creation emphasizes value-in-use, instead of value-in-exchange. According to the latter, value is an exchange of goods and money (Vargo et al. 2008). Value-in-exchange distinguishes between producers and consumers. Value creation results from a series of activities performed by the firm. Value-in-use suggests the roles of producers and consumers are not distinct. Value is always jointly and reciprocally co-created. It results not from a series of activities, but rather from interactions among service providers and beneficiaries. These interactions require the integration of resources and application of competences (Edvardsson et al. 2011; Vargo and Lusch 2004). Grönroos (2008) describes value-in-use from a supplier perspective as value facilitation and value fulfillment model. As a value facilitator, the service provider provides customers with a foundation for their value creation in the form of resources and beneficiaries. In terms of value fulfillment, the service provider act as value co-creator in a way of direct engagement in interactions with customers during their value-generating processes.

According to the service science literature, the ‘service systems’ constitute the value co-creation configuration of firms, institutions, and customers (Maglio & Spohrer 2008). Value networks form service systems that “survive, adapt, and evolve through exchange and application of resources” (Vargo et al. 2008, p. 146). The network is the basic locus of innovation and the principal unit of analysis in business and marketing (Vargo et al., 2008). In the value network, value is co-created by different actors, and each actor contributes to the overall offering (Vargo & Lusch, 2011). Membership of a value network offers collective benefits that surpass those available to an individual entity because the synergistic application of specialized competencies in the value-creation process leads to increased efficiency (Möller & Svahn 2003).

In this context, the literature increasingly devotes attention to value-configuration spaces, which lays the foundation for the co-creation of value (Vargo & Lusch, 2008), and each value configuration is distinctive in accordance with its own value-creation logic of transforming resources into products and services. Value-network logic links these value configurations in a network relationship that enhances resource integration among various social and economic actors, thus increasing the potential for synergistic value co-creation (Vargo & Lusch, 2008). Consequently, value-configuration spaces combine value creation and value network. Arguably, the value configuration space consists of two parties (“customer” and “provider”), who are both resource integrators and beneficiaries in the value configuration space (Edvardsson et al., 2011).

Both parties are involved in networks of actors (or service systems) contributing to the value configuration spaces.

Application of key concepts to the public transit services

Gebauer et al. (2010) demonstrate that value creation in public transit services can be altered along five elements (Gebauer et al., 2010; Prahalad, 2004), namely, (i) customer engagement; (ii) self-service; (iii) customer experience; (iv) problem-solving; (v) co-designing. Generally, customer engagement refers to providers seeking to persuade customers through advertising and promotions that involve and activate the recipients of the promotional message (Prahalad, 2004). Self-services (e.g. internet, mobile phones, computer terminals, or ticketing machines) enable customers to order, buy, and exchange resources without any direct interaction with the employees of the provider (Meuter et al., 2000). Customer experience means that services can create memorable experiences and events for customers (Prahalad, 2004). Problem-solving is related to the literature on service recovery, which related co-repairing value (i.e., service recovery) (Andreassen, 1999). In the context of public transit services, alterations in customer engagements involve persuading customers through environmental-friendliness or an open dialogue on latent risks by using public transit services. Illustrations of self-services cover using transit service, or buying and paying tickets such as self-controlling, automatic ticketing via ticket machines, mobile phones, or internet. Customer experiences involve direct incidents by using transportation modes, as well as, supplementary experiences around shopping and entertainment besides transporting people. Problem-solving can be either addressed by the actual passengers or public transit operator. Co-design of services covers aspects such as creating new value creation ideas in collaboration with customer's or engaging customers into the market launch of new service, tickets, and travel cards (Johnson et al., 2010).

Whereas these five elements of value creation have been previously transferred to the context of public transit services, value networks have been rarely used in conceptualizing collaboration among public transit operators and/or auxiliary service providers (Velde, 1999). The conceptualization of value networks draws on four elements, which have been previously used in other industries. The four elements contain (i) value activities of the business networks, (ii) the goal of the network and the focal (or hub) firm of the network, (iii) structure of the networks along its vertical and horizontal dimension, and (iv) the capabilities of the actors (Möller et al. 2005). Value creation activities are related to the five elements contributing to value creation (customer engagement, self-service, customer experience, problem-solving, and co-designing). These five elements bridge the value creation and value network. The goal of the network and the focal (or hub) firm of the network capture the actual value proposition offered by the network actors. Vertical dimension describes the network structures according to network actors positioned upstream and downstream in one specific value chain. Horizontal dimension captures network actors and activities across multiple value chains. Capabilities refer to network actors' capacity to deploy its resources to achieve a desired end (Amit & Schoemaker, 1993). Capabilities are twofold: operational and dynamic. Operational capabilities enable companies to earn a living under the condition of a specific business environment (Winter, 2003). Dynamic capabilities enable companies to respond to changes in the business environment (Teece 2007).

Research method

Against this background, those elements describing the value creation and value network sets the reference points for developing a process-model for innovating value-configuration spaces. Our empirical setting includes Zurich Region in Switzerland, Hamburg and Freiburg in Germany, Stockholm in Sweden, and Jakarta in Indonesia, Johannesburg in South Africa and Guangzhou, Harbin, and Lanzhou in China. These urban regions have achieved different maturity in innovating value-configuration spaces.

Consistent with grounded theory development, we aim at developing a process model of value-configuration spaces (value creation and value network) based on the attempts of public transit service providers to increase the usage of public transit services. Data was obtained between 2007 and 2011. Our sampling of urban regions and public transit service providers was discriminate. We sampled cases on public transit operators until recurring patterns on the process model of value-configuration spaces (value creation and value network) emerged (Strauss & Corbin, 1990). Following Bowen's (2008) argument that it is insufficient to state that sampling was concluded once saturation was reached, we employ following guidelines. The emerging process-model was considered saturated because they were upheld in all case studies; this was confirmed by interviewee feedback on the analyzed data and made sense on the basis of prior research (Bowen, 2008).

More specifically, different maturity means that regions vary in the way they address value creation elements (e.g. customer engagement; self-service; customer experience; problem-solving; and co-designing) and value network elements (the goal of the network, structure of the networks along its vertical and horizontal dimension, value activities of the business networks, and the capabilities of the actors). The variation in maturity allows us to develop a process model of value configuration spaces.

A qualitative, longitudinal study was used to explore the value network and value-configuration space in these urban regions. The data were collected through primary and secondary data sources. Primary data include interviews and workshops with key executives from the public transit operators. The interviews lasted between 90 and 120 minutes and were guided by a semi-structured interview protocol, which allowed going beyond the boundaries of the predefined interview contents. Follow-up questions consistent with the narrative approach were further used to explore the interviewee contents (Mishler 1986). Systematic notes were taken during the interviews, and transcripts were completed shortly after the interview. The transcribed interviews were combined with secondary data such as annual reports, official public transit developing programs, and letters to stakeholders.

The various data were combined to case studies on network formation for each urban region. The case studies were organized by chronological description of value network formations around public transit services. Assessing the value creation and value network elements conceptualized in the research framework substantiated the chronological description. Tables and illustrations were developed to track triggers, goals, and actions for distinct stages in value network formation. The obtained data was analyzed through a within and cross-case analysis (Eisenhardt, 1989).

A process model for innovating value-configuration spaces

Consistent across all case studies from industrialized and newly-industrializing countries, innovating value-configuration spaces occurs through five stages, namely, (1) ‘establishing reliability of single transportation modes’, (2) ‘integration of the means of transport’; (3) ‘regional integration’; (4) ‘service extension’; and (5) ‘individual mobility’. This process model is also important to newly-industrialized countries to integrate in their service systems and strategies:

1. The first stage aims at establishing reliability of single transportation modes. Reliability includes punctuality, travel comfort, and equally important safety issues related with using public transit services.
2. The second stage entails the integration of the different means of transportation—such as trains, buses, ferries, inter-urban trains, and trams—by coordinating timetables, destinations, and pricing systems. These changes ensured enhanced connections for commuters among the different modes of transportation. For example, trains leave regularly every half hour, and these departures are synchronized with buses and other trains.
3. The third stage involves regional integration, sought to integrate the level of urban, local to the regional level, including city busses, regional trains, or international high-speed trains connecting major cities.
4. The fourth stage refers to the extension of services by embedding transportation services into a wide range of value-added services in order to create comprehensive customer experiences for socializing, shopping, and entertainment.
5. The fifth stage changes the traditional public-transport focus on collective mobility towards a view to enhancing individual mobility. This included the provision of ‘park & rail’ services, car and bicycle hire, and mobility services.

Of course, these stages overlap and public transit operators might proceed to a further stage by still simultaneously optimizing previous stages. Empirical evidences from our cases are used to substantiate the summaries.

Discussion and summary

Our findings replicate and extend previous theoretical contribution. Theoretical replications are evident in Möller et al.’s (2005) suggestion for conceptualizing value networks, and in Prahalad’s (2004) recommendations around elements for value co-creation. Theoretical extensions refer to the value-configuration spaces. Value-configuration spaces for public transit services in urban regions evolve through five distinct stages. Each stage provides different value creation opportunities and requires specific value network activities. Whereas literature is relatively silent on conceptualizing value-configuration spaces, our findings offer a complementary perspective to bridge value-configuration spaces through value creation and value network.

The conceptualization of value creation through the five elements (customer engagement, self-services, customer experience, problem solving and co-designing) as well as value networks the

four elements (network goal, focal firm of the network, value creation activities, and capabilities) lead to a valid conceptualization of value-configuration spaces, which can be used for further research. Future qualitative research trying to describe value configuration in accordance with its own value-creation logics of transforming resources into products and services could draw on our comprehensive conceptualization. All these elements around value creation and value network are an integral part of value-configuration spaces. By describing the value network and value creation, the value configuration can be described to be distinctive in accordance with its own value-creation logic of transforming resources into products and services. Deepening the understanding of value creation and value network in the context of value-configuration space offers a guideline to describing the resource integration.

THE PAPER WILL BE DEVELOPING FURTHER

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Integrating Management Systems: A dynamic study of Spanish firms

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Introduction

Management systems standards (MSSs) have developed in an unprecedented manner in the last few years. The impact generated by quality, environmental and other MSSs is demonstrated by the importance of such standards worldwide, ISO 9001 and ISO 14001 (ISO, 2010). In particular, ISO 9001 accounts for 1,064,785 registered companies in more than 170 countries and ISO 14001 for 223,149 in about 150 countries (ISO, 2010). From 2006 to the end of 2009, the number of certifications has increased with 167856 ISO 9001 certificates and 94938 ISO 14001 certificates.

Traditionally, organizations have focused on establishing MSs that comply with each MSS requirements individually, often in isolation from each other and sometimes even in conflict (Karapetrovic & Willborn, 1998; Zeng et al., 2007). However, Integrated Management Systems (IMS) that address organizations' objectives jointly are becoming more and more popular as they aim to satisfy the needs of several MSs while running a business (Beckmerhagen et al., 2003). Achieving this can be beneficial to the organization's efficiency and effectiveness, as well as reducing the cost of managing each system individually (Tari et al. 2010).

The purpose of this paper is to understand how the integration of MSs changes within a period of time and to relate it to the difficulties perceived by companies of having an IMS. Moreover, it aims to analyse the implementation and integration of different MSs in Spanish firms. The overall aim is to analyse the impact of integration on companies. This is, as far as we know, the first study reported in literature that analyses the evolution of MS integration over a period of time.

First, a review of the literature on the evolution of perceived benefits and challenges of MSS implementation is presented. As we have not been able to find any studies on the evolution of integration benefits and difficulties, we review existing research on the extent of integration and integration tools used by organizations. We follow with an analysis of the impact of integration, namely the benefits and difficulties of MSs integration in organizations. We subsequently

develop the methodology used in this study, which involves a quantitative analysis of the implementation of MSs, the extent of their integration, as well as the difficulties of integration. The last part of the article includes empirical results of the investigation and a concluding section.

Literature review

As we have previously mentioned, only a few studies have been found on the evolution of the impact of MSS implementation over time.

For example, there are studies proving that firms which have been working for a longer time with certified systems perceive higher benefits than those that have just been certified (Brecka, 1994; Ferguson et al., 1996; Tang & Kam, 1999; Singels et al., 2001; Terziovski et al., 2003; Dowlatshahi & Urias, 2004; McGuire & Dilts, 2008). Other studies prove that a high number of certified firms do not perceive benefiting significantly from the certification process, and this situation does not improve over time (Leung et al., 1999; Jones et al., 1997; Leung et al., 1999; Casadesús et al. 2005; Karapetrovic et al., 2006). Some of the benefits mentioned by the authors defending the positive impact of MSS implementation over time include lower operating costs, reduced wastage, and improved efficiency and productivity compared to the companies that had just completed the certification (Brecka, 1994; Terziovski et al., 2003; Casadesús et al., 2005a, 2010).

Thus, it is very difficult to determine which benefits MSS implementation brings over time and it is even more difficult to assess the impact of the evolution of MS integration, as there is no existing literature on that topic. Therefore, in order to understand the impact that IMS have on organizations, it is vital to review the existing studies on the integration of MSs, especially on the benefits and challenges firms encounter during the process.

Regarding MS integration, Karapetrovic & Willborn (1998b) define three main elements of a standardized MS which can be integrated at different levels, namely goals, processes, and resources. Karapetrovic et al. (2006) and Bernardo et al. (2009) conducted two empirical studies in order to study the extent of integration of these elements. The authors found a high level of integration regarding the extent of the integration of the human resources, the company policy, objectives, the management system manual, and the processes of document control, record control, auditing, and management review. However, the authors found that aspects such as the use of integrated records, instructions or procedures, found at tactical organizational levels, or the planning, determination of requirements, product realization and other internal business processes, seemed to be integrated at a lesser extent.

At the same time, there has been a growing recognition of the value that IMSs can bring to the business (Karapetrovic & Willborn, 1998; Wassenaar & Grocott, 1999; Wilkinson & Dale, 1999; Douglas & Glen, 2000; Renzi & Cappelli, 2000; Zutshi & Sohal, 2005; Salomone, 2008; Asif et al., 2009; Griffith and Bhutto, 2009; Khanna, 2010 and Asif et al., 2010). Today, many organisations are implementing MSs not just to fulfil the requirements of individual standards, but to operate in a more combined, efficient and effective way (Asif et al., 2010). And in doing so, organisations can look to achieve significant internal benefits as well as meeting any external demands (Asif et al., 2010).

In order to avoid the failure of MS integration, it is important that firms manage the difficulties associated with the implementation and maintenance of an IMS (López-Fresno, 2010). These challenges are numerous and involve aspects such as the lack of human resources, the lack of government support, departmentalization of functions and individual concerns of the people involved (Karapetrovic & Willborn, 1998a; Karapetrovic, 2003; Zutshi & Sohal, 2005; Karapetrovic et al., 2006; Asif et al., 2009; Wassenaar & Grocott, 1999; Matias & Coelho, 2002; Zutshi & Sohal, 2005; Zeng et al., 2007 and Asif et al., 2009).

In the next sections of this paper, we present the first empirical study on evolution of the integration of MSs over time. In the following section, the methodology applied will be described. Finally, the empirical analysis and the conclusions are presented.

Methodology

The purpose of this study is to investigate the evolution of IMSs experienced by ISO 9001 and ISO 14001 registered companies in Catalonia over time. Additionally, the paper aims to evaluate the impact of integration, namely the extent of integration and the difficulties experienced by firms, during the integration of MSs in companies with more than one MS.

Two empirical studies, carried out in 2006 and 2010 respectively, were used in order to study the evolution of integration in companies. In 2006, the first study was conducted by sending questionnaires to 535 of the 1,191 certified Catalonian companies, addressed to the person responsible for quality and/or environmental management in the company. The companies were randomly selected using the Spanish Industrial Codes for stratification (Karapetrovic & Casadesús, 2010). A total of 176 valid answers were obtained. The survey therefore had a 33% response rate with a 93% level of confidence. The results of this study can be found in Karapetrovic et al. (2006).

In order to continue this study on the integration of MSs in Catalonia, a new empirical study was carried out from February to July 2010, using a questionnaire addressed to the 176 firms that answered the survey in 2006 (Karapetrovic & Casadesús, 2009). The questionnaire comprised a combination of semi-open and Likert-type questions with a 1 to 5 scale. The survey instrument was refined using a pre-test process.

In order to be able to compare the answers of the companies in both samples, the questionnaire used in 2010 was a new version of the one used in Karapetrovic et al. (2006). The surveys in 2006 and 2010 included questions regarding the implementation of MSs, the integration level, the integration difficulties and the integration of audits.

In 2010, the empirical study was conducted by means of a mail survey addressed to the person responsible for the QMS and/or EMS of the organization, and was subsequently followed up with a telephone call and an additional e-mail communication with the firms.

From the 176 companies that answered in 2006, with a subsequent follow-up by telephone, 76 valid answers were obtained. The survey therefore had a 43% response rate and a 93% reliability, with a 95% confidence.

For enhanced consistency, this work was carried out with the same methodology, using the same firms as in 2006 and in the same region of Spain, Catalonia. Catalonia is one of the regions of Spain with the highest rate of ISO 9001 registrations in the country and experiencing a growth in

the number of certificates which is very similar to the average rate of growth in Spain (Heras & Casadesús, 2006).

Table 1 compares the features of this empirical work to that of the previous study. The survey profiles are presented in Table 1.

Table I. Profile of the 2006 and 2010 surveys

Study factor	Year 2006	Year 2010
Location	Catalonia (Spain)	Catalonia (Spain)
Time	2006	2010
Population	1191	535
Sample size	535	176
Received responses	176	76
Response rate	33%	43%
Level of confidence	93%	93%
p=q=0.5		

Source: own elaboration

An empirical analysis on the evolution of the implementation and integration of MSs is provided in the next section. The results are presented with the following structure. First, results regarding the implementation of standards among firms in the 2006 and 2010 samples and the integration level of firms. Second, we illustrate the degree of integration of the human resources, documentation, goals and procedures of the IMS. Finally, we provide data regarding the difficulties of integration, as well as their evolution. For each of these aspects, we first provide a descriptive analysis comparing the 2006 and 2010 samples. Moreover, Wilcoxon tests to compare the means of the variables and a logistic regression are used to analyse the significant differences of the integration variables over time.

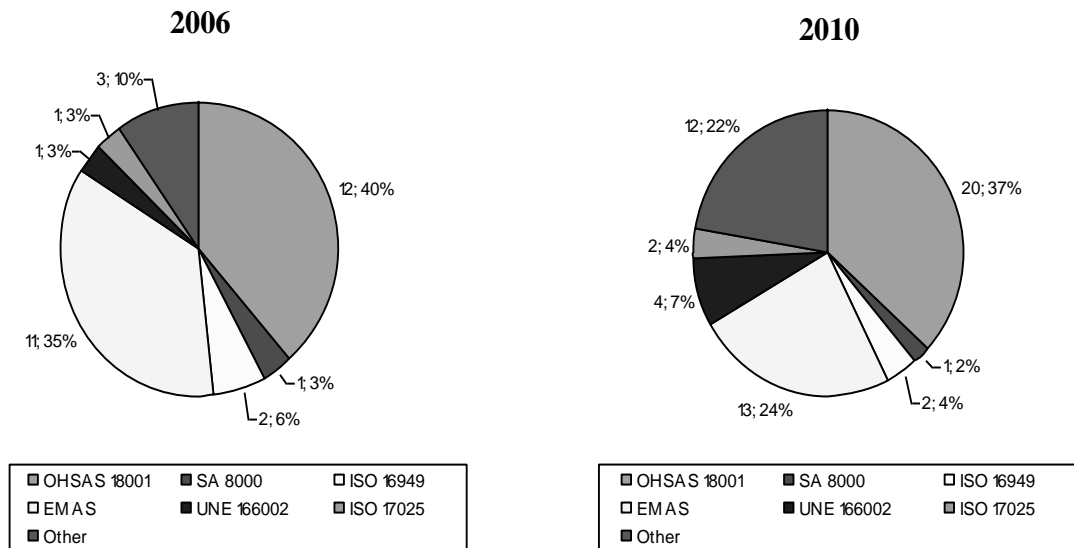
Findings

Evolution of implemented standards 2006-2010

Due to the survey design, all of the respondents were registered to both ISO 9001 and ISO 14001. Apart from these two standards, the most implemented one among firms is OHSAS 18001 for occupational health and safety with a 10.52% increase from 2006 to 2010 (see Figure 1). The proportions for the implementation of other function or stakeholder specific standards like SA 8000 for Corporate Social Responsibility or UNE 166002 for Research and Development are much lower. Implementations of sector-specific standards such as ISO 16949 for the automotive sector or ISO 17025 for calibrations in laboratories have experienced no increase or a moderate increase (1.31%) respectively. Enhanced-requirement standards focused on a single organizational area, such as EMAS for the environment reported a level of implementation of 14.47% and 17.10% in 2006 and 2010 respectively, representing a 2.63% increase. The other major increase is a group named “other standards” with a 11.84 % change, which includes standards such as ISO 22000 for food safety, ISO 13485 for medical devices, ISO 3834-2 quality

requirements for fusion welding of metallic materials or UNE 216301 certification for energy efficiency.

Figure 1. Evolution of the implementation of standards 2006-2010



Source: own elaboration

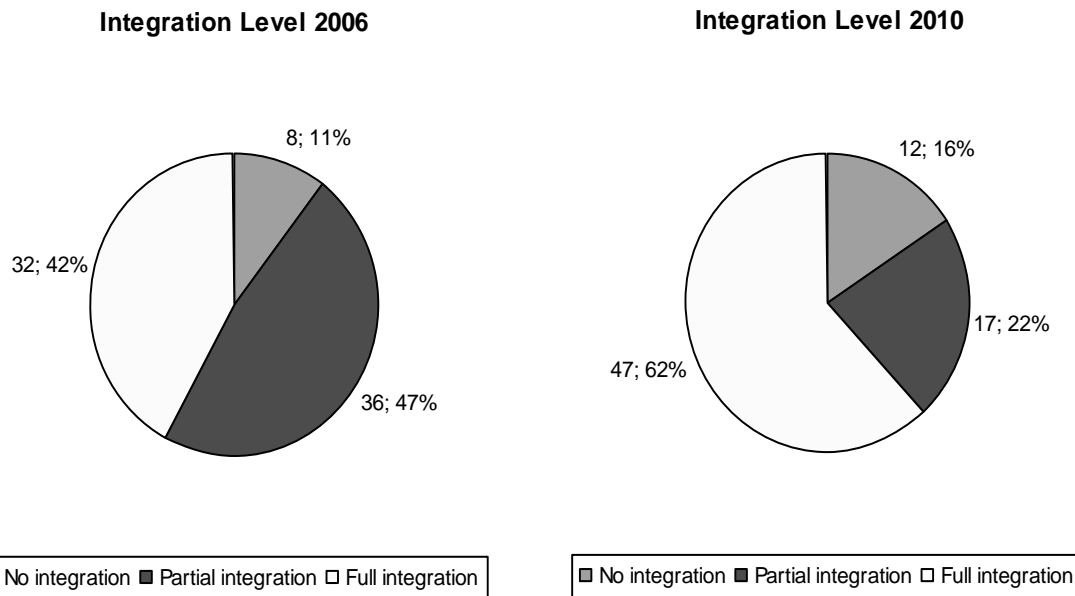
Level of integration

As discussed in the literature, from the 2006 survey, Bernardo et al. (2009) find three levels of integration: “no integration”, “partial integration” and “full integration”. Comparing the level of integration of 2006 and 2010, Figure 2 indicates that the levels of “no integration” (11% to 16%) and “full integration” have increased (42% to 62%) while the level of “partial integration” has decreased (47% to 22%).

One significant conclusion which can be drawn from these findings is that a great majority of organizations compliant with multiple standards have integrated the systems that these standards represent (Karapetrovic et al. 2006), and, as expected (e.g. Karapetrovic, 2002), that the scope of integration includes the most popular standardized MSs, i.e. quality, environment and health and safety, as shown in the previous section.

Moreover, these findings are especially relevant because they seem to indicate that firms tend to polarize in one of the two extremes: either they integrate all their MSs or they chose not to integrate any of them. Thus, firms perceiving the benefits of integration mentioned above in the literature prefer full integration, while firms who have probably faced or anticipated the difficulties of integration have opted to keep their MSs separated. The rest of the firms, which stay in a medium position with a partial level of integration, have decreased in number.

Figure 2. Integration level 2006-2010



Source: own elaboration

In order to compare the two surveys regarding the level of integration, the difference degree between the two samples was analyzed, using a Wilcoxon test for dependent samples (Novales, 1997). The Wilcoxon signed-rank test is a [non-parametric statistical hypothesis test](#) for the case of two related samples or repeated measurements on a single sample. It can be used as an alternative to the [paired Student's t-test](#) when the population cannot be assumed to be [normally distributed](#) like in our samples.

The Wilcoxon test provides the statistic (Z) and the related bilateral significance. The significance level for the integration degree (0.003) is lower than 0.005, therefore we can reject the null hypothesis of equality of means and conclude that the compared variables (level of integration in 2006 and 2010) are significantly different. The Wilcoxon test subtracts one variable from another, giving positive and negative ranks as a result. In this case, the significance level is based on the positive ranks, that is, the integration level in 2010 is higher than in 2006. Therefore, we can say, with 95% confidence, that the integration level showed a statistically-significant higher level of integration in 2010 compared to 2006. This result makes sense, as firms with more than one MS prefer integration over disintegration (Bernardo et al. 2009; Douglas & Glen 2000; Karapetrovic et al. 2006; Zeng et al., 2007).

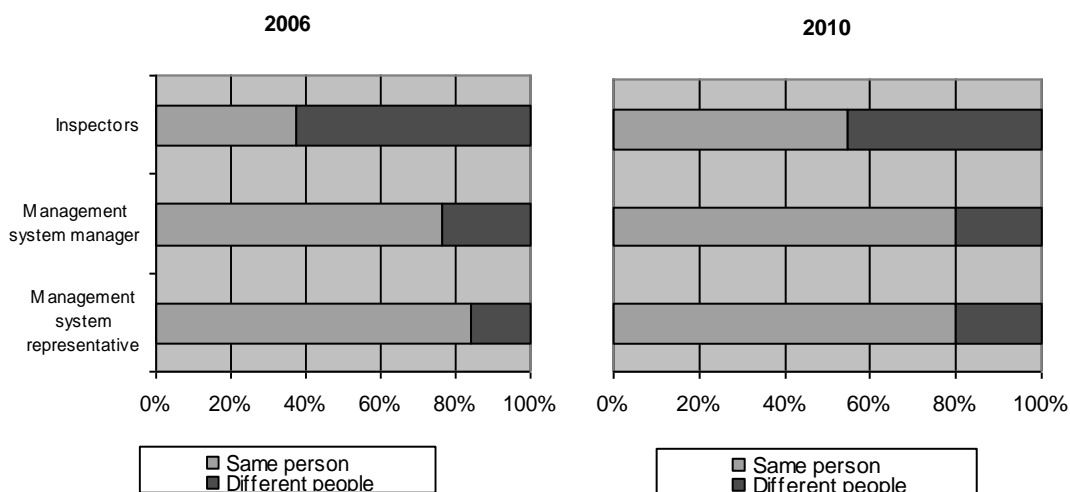
Resources involved in the different management systems

As Karapetrovic and Willborn (1998b) state, an IMS can be conceptualized as a set of three elements that can be integrated, namely resources, goals and processes. Therefore, the survey included questions related to the degrees of integration specific to each of these MSs elements.

Human resources

In terms of the human resources involved in the different MSs, Figure 4 illustrates that both in 2006 and 2010, the level of integration is much higher at the top level management than at the shop floor level. However, the results also show a 5% increase from 2006 to 2010 at the functional level (management system managers), as well as a 20% increase at shop floor level (inspectors), which means that the level of integration of these two types of human resources is approaching to the level of management integration.

Figure 3. Integration of human resources involved in the different



MSs

Source: own elaboration

In order to compare the two surveys regarding the level of integration of the human resources, the degree of difference between the 2006 and 2010 samples was analyzed, using the Wilcoxon test. The table below shows the Wilcoxon statistic (Z) and the related bilateral significance for each group of human resources. Only the MSs managers and the inspectors show significant differences between years. Therefore, we conclude that the level of integration of these two groups of human resources is higher in 2010 than in 2006.

Table II. Wilcoxon test for human resources integration level (2010-2006)

		Z	Sig. (p)
Management System Representative		-.447	.655
Management System Manager		-2.502	.012*
Inspector		-5.997	.000*

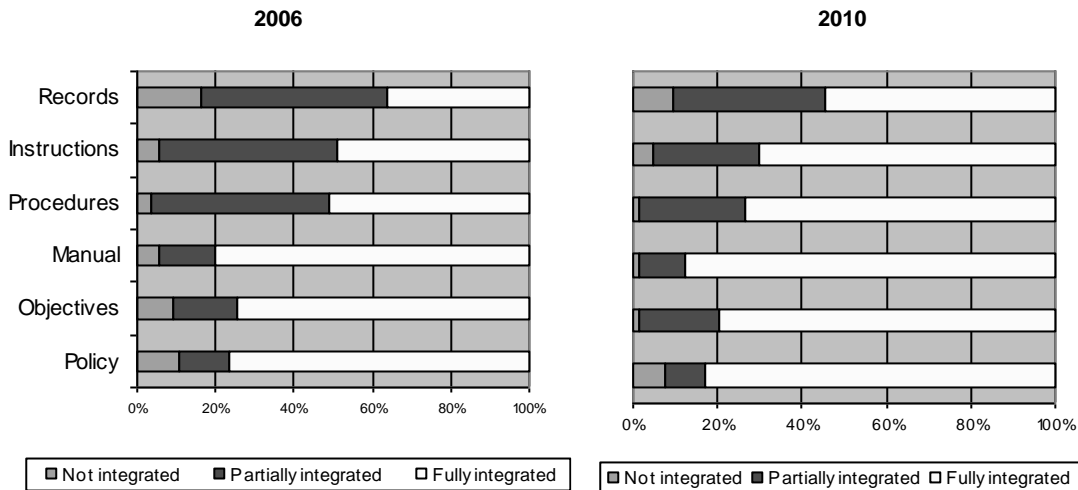
* Statistically significant based on positive ranks

Documentation and goals

Following Karapetrovic et al. (2006), “the integration of the documentation resources, including the management system objectives, was examined at the policy, objective, manual, procedure, instruction and record levels”. The results show that most firms have both in 2006 and 2010 a

single policy, set of objectives and the MS manual (Figure 5). However, in line with the results found by Karapetrovic et al. (2006), the integration level diminishes as we move towards the operational and tactical organizational levels. However, the use of integrated records, instructions or procedures significantly increases from 2006, when less than half of the firms had fully integrated these elements, to the year 2010, when between half and three quarters of the respondents had already integrated them fully (Figure 5).

Figure 4. Integration of documentation and goals 2006-2010



Source: own elaboration

Table III. Wilcoxon test for documentation and goals integration level (2010-2006)

	Z	Sig (p)
Policy	-1.919	.055
Objectives	-2.372	.018*
Manual	-.034	.973
Procedures	-1.966	.049*
Instructions	-.500	.617
Records	-3.126	.002*

* Statistically significant based on positive ranks

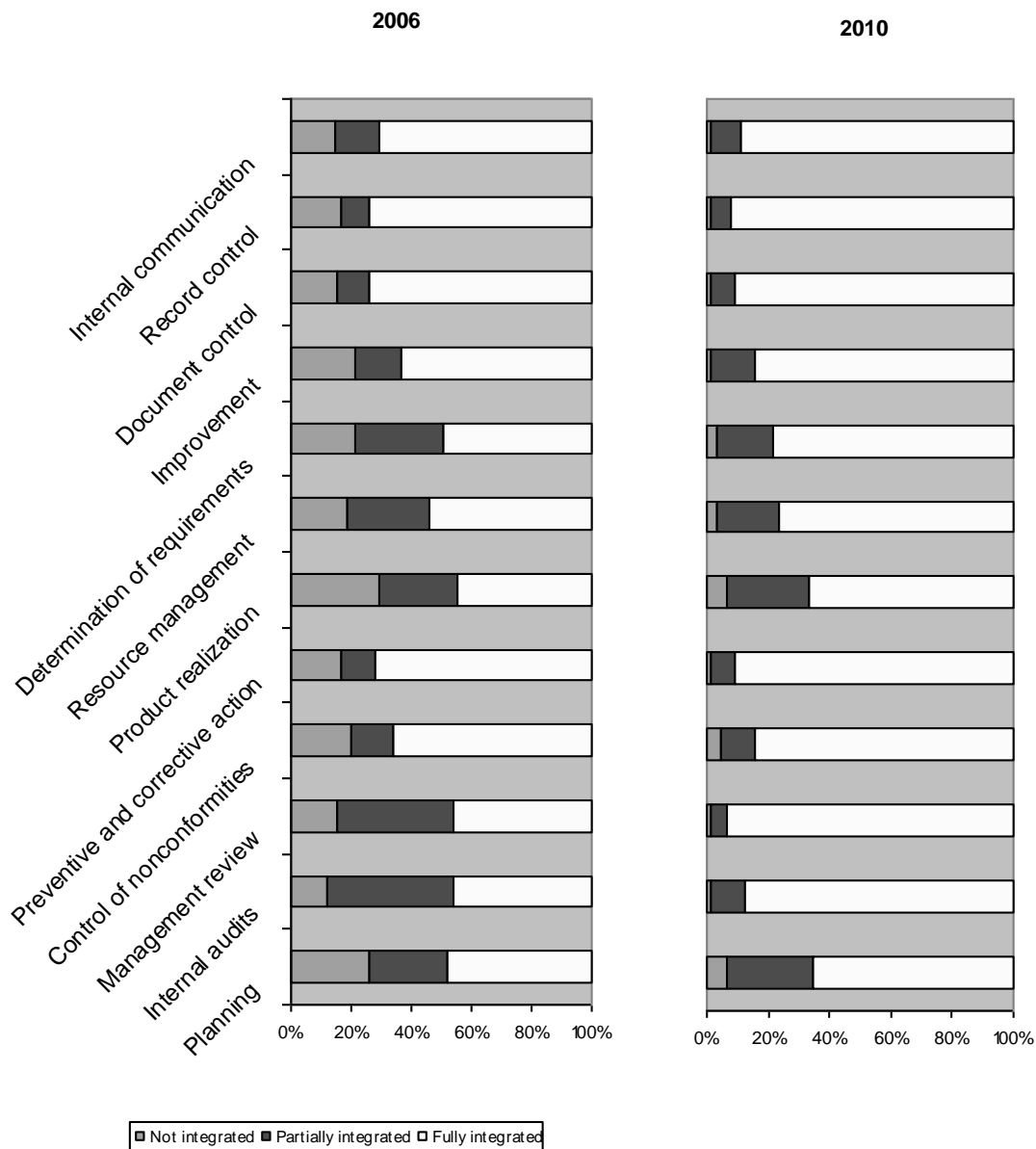
Comparing the 2006 and 2010 samples, the table above shows the Wilcoxon statistic (Z) and the related bilateral significance for each group of goals and documentation. Significant differences between years are shown in the objectives ($p=0.018$), procedures ($p=0.049$) and records ($p=0.002$). Therefore, we can conclude that the level of integration of these three elements is higher in 2010 than in 2006. One of the most important aspects of this analysis is that the significant variables are the ones related to the operational and tactical levels of the organization (objectives, procedures and records). Therefore, these are the elements that have experienced a major increase over this period of time, whereas strategic variables such as the policy or the manual have not experienced such an increase in the level of integration.

Procedures

As in Karapetrovic et al. (2006), we examined the integration of different procedures covering activities, such as document and record control, determination of stakeholder requirements and auditing (Figure 6).

High levels of integration were exhibited both in 2006 and 2010 in MS procedures, such as record and document control or preventive and corrective actions, while the elements integrated to a lesser extent were product realization and audits. In general, the overall level of integration of the procedures involved in the different MSs has increased and, in 2010, all the procedures have been fully integrated by at least 60% of the firms. However, in 2006, less than half of the firms had fully integrated most of the procedures. However, it is important to notice the increase of the integration level of one particular element, internal audits, which was the second least-integrated element in 2006. However, it became one of the most integrated procedures in 2010, with a level of full integration in more than 80% of the firms. This finding reveals the importance of internal audits and their integration, because many benefits and efficiencies are related to the integration of audits. For instance, the optimised use of resources is mentioned by Karapetrovic & Willborn, 1998b; Douglas & Glen, 2000; Karapetrovic, 2002; Zeng et al., 2005; Zeng et al., 2007; Zutshi & Sohal, 2005a; Pojasek, 2006 and Salomone, 2008, and the establishment of auditor competence for different MSSs is considered by Douglas & Glen, 2000; De Moor & De Beelde, 2005 and Kraus & Grosskopf, 2008. Moreover, the processes under review, along with all their controls (environmental, health, safety, and quality) have to be evaluated only once and there is less duplication of effort during the planning, execution, and even follow-up phases of the audit (Kraus & Grosskopf, 2008).

Figure 5. Integration of procedures 2006-2010



Source: own elaboration

Table 4 shows the Wilcoxon statistic (Z) and the related bilateral significance for each group of procedures in the 2006 and 2010 survey answers. Significant differences are shown in the planning ($p=0.000$), control of non-conformities ($p=0.008$), preventive and corrective actions ($p=0.014$), product realization ($p=0.000$), improvement ($p=0.011$) and requirements ($p=0.000$). These results show that the level of integration of these elements is higher in 2010 than in 2006 at a 95% confidence level. These procedures can be classified under the different requirements of ISO 9001: 2000 (ISO, 2000), following the specific chapters of the standard, namely Chapter 4: “Quality Management System” (control of documentation, record control), Chapter 5:

“Management Responsibility” (planning, management review, internal communication), Chapter 6: “Resource Management” (resource management), Chapter 7: “Product Realization” (product realization, determination of requirements) and Chapter 8: “Measurement, Analysis and Improvement” (internal audits, control of nonconformities, preventive and corrective action, improvements). Taking this classification into account, our results indicate that procedures related to product realization and procedures related to measurement, analysis and improvement are the ones that have experienced a higher increase in their level of integration. This results differ in some ways to the results found by Bernardo et al. (2009), who found that procedures related to product realization were the least integrated, while procedures related to measurement, analysis and improvement had the highest degree of integration.

Table IV. Wilcoxon test for procedures integration level (2010-2006)

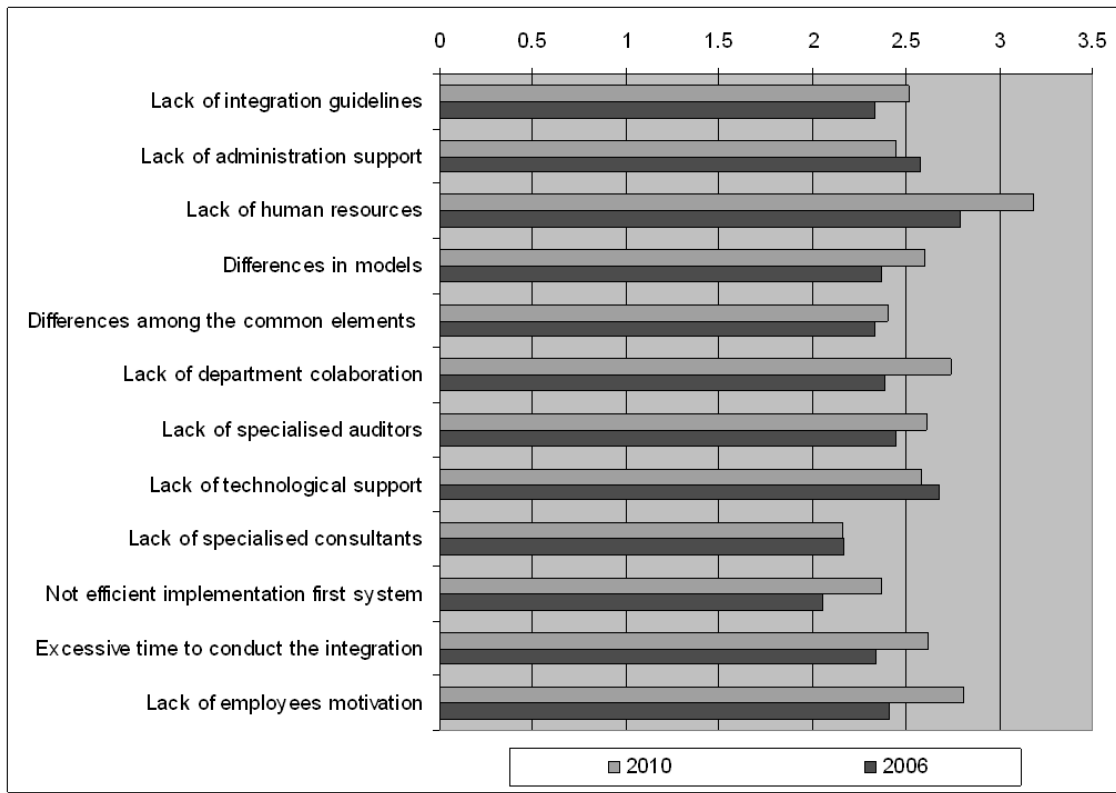
	Z	Sig. (p)
Planning	-3.877	.000*
Internal audits	-1.414	.157
Management review	-.277	.782
Control non conformities	-2.652	.008*
Preventive and corrective actions	-2.449	.014*
Product realization	-3.601	.000*
Resource Management	-1.388	.165
Requirements	-3.649	.000*
Improvement	-2.546	.011*
Document control	-1.414	.157
Record control	-1.134	.257
Internal communication	-1.789	.074

* Statistically significant based on positive ranks

The difficulties of integration over the years

Although the integration of MSs generally makes sense, organizations naturally encounter difficulties in the process (Karapetrovic & Willborn, 1998a; Karapetrovic, 2003). The surveys presented in this paper included one question about the integration difficulties (1 to 5 Likert scale), which was posed to organizations that reported full or partial integration of their standardized MSs, and explored the main difficulties encountered in the integration process (Karapetrovic et al., 2006; Zutshi & Sohal, 2005; Asif et al., 2009; Karapetrovic & Willborn, 1998a; Wassenaar & Grocott, 1999; Matias & Coelho, 2002; Zeng et al., 2007 and Asif et al., 2010). In order to evaluate the changes in perceptions of companies regarding the difficulties of MSs integration and address the gap in the current literature on this topic, the results obtained from 2006 and 2010 surveys are compared. The comparison of the importance of difficulties detected in both surveys is presented in Figure 7.

Figure 6. Difficulties of integration 2006-2010



Source: own elaboration

In 2006, the difficulties most mentioned by firms regarding the integration of their MSs were the lack of human resources, with a mean importance level of 2.79, followed by the lack of technological support (2.68), and the lack of administration support (2.57). In 2010, the results change slightly, as the most-cited difficulty remains the lack of human resources (3.94), followed by the lack of employees motivation (2.81), and the lack of department collaboration (2.74). These results are specially relevant, as they show the importance of motivating and implicating the human resources in order to achieve a successful integration of the systems. The least important difficulty is the lack of specialised consultants (2.2 and 2.1 in 2006 and 2010 respectively).

A Wilcoxon test was performed on all twelve factors found in both surveys (three additional factors were studied in the 2010 survey only). With a 95% confidence, two factors (inadequate implementation of the initial system and excessive time to conduct the integration) indicated a statistically-higher level of perceived difficulties in 2010 compared to 2006, while one factor (lack of administration support) showed a statistically- lower level of difficulties in 2006 compared to 2010. The other eight factors showed no statistically-significant differences. From the significant results, it is possible to extract two different types of difficulties experienced by firms regarding IMSs (Zeng et al. 2007). One of them is related to external factors (lack of government support), while the other two significant variables represent internal factors.

Logistic regression 2006

In order to analyse the impact of the difficulties that firms have during the integration process on the level of integration, we use a logistic regression taking the level of integration (partial and full integration) as the dependent variable and the difficulties as the predictor variables. “No integration” is not considered in this analysis, as these firms have not undertaken the process of integrating their MSs and therefore have not experienced any difficulty regarding this topic.

In table 6, a likelihood ratio test is used for the overall model evaluation. We also provide a goodness-of-fit measure, the Hosmer-Lemeshow test, as an indicator of model appropriateness. Two additional descriptive measures of goodness-of-fit, presented in Table 6, are the R^2 indices, defined by Cox and Snell (1989) and Nagelkerke (1991), respectively. These indices are variations of the R^2 concept defined for the OLS (Ordinary Least Squares) and can be used together.

The likelihood ratio value (46.22) indicates that the model is appropriate. Regarding the goodness-of-fit, the Cox and Snell R^2 (0.335) and Nagelkerke R^2 (0.519) present an acceptable value and the Hosmer-Lemeshow test shows a significance of 0.555. This test is statistically significant when it takes values over 0.05; therefore we accept our model as valid.

Table V. Model evaluation and goodness of fit tests for the logistic regression

Test	χ	df	Sig. (p)
Overall model evaluation			
Likelihood ratio test	46.223		
Goodness-of-fit tests			
Hosmer-Lemeshow	5.869	7	0.555
Cox and Snell R^2	0.355		
Nagelkerke R^2	0.519		

Source: own elaboration

The results of the logistic regression in 2006 provide the statistical significance of individual regression coefficients (Bs) which are tested using the Wald chi-square statistic. In 2006, there are no significant difficulties that predict the integration level. Therefore, we cannot conclude that the integration level is related to the difficulties experienced by organizations during the integration process.

Logistic regression 2010

In 2010, the only significant predictor for the integration level is the inadequate implementation of the initial system in the organization ($p=0.029<0.05$).

The odds ratio for the significant variable “inadequate implementation of the initial system” is 0.103. For this variable, when it increases in one unit, the level of integration decreases by 70.7% ($1-\text{odds} \times 100$).

Regarding the confidence interval on the odds ratio, "low" and "high" confidence values are provided. That is, when the 95% confidence interval around the odds ratio includes the value of 1.0, indicating that a change in value of the independent variable is not associated in change in the odds of the dependent variable assuming a given value, then that variable is not considered as a useful predictor in the model (Novales, 1997). Therefore, as the variable “inadequate implementation of the initial system” in our model has a confidence interval around the odds ratio which does not include the value of 1.0 (between 0.013 and 0.791), it indicates that the variable is considered as a useful predictor in the logistic model. So, when firms have difficulties when implementing the first system, they achieve a lower level of integration. This is an internal difficulty that should be solved by organizations in order to be able to achieve a high level of integration and benefit from the advantages of full integration (Salomone, 2008; Asif et al., 2009; Griffith and Bhutto, 2009; Khanna, 2010 and Asif et al., 2010).

The results of the logistics regressions for 2006 and 2010 are especially relevant, as they have implications for the organizations willing to implement new systems and/or integrate the systems they already have. These firms should pay attention when implementing the first standard in the firm. This is the most relevant difficulty and it has an effect on the overall level of integration that organizations achieve. Therefore, organizations should introduce mechanisms such as the use of implementation guidelines, integration guidelines and the training of the systems managers responsible for the implementation and integration of the systems, in order to improve the efficiency of the implementation of these systems in the organization.

Conclusions

The main objective of this research is to contribute to the understanding on how IMSs evolve over time, as well as to analyze how the perception of the challenges related to the IMSs changes within a period of time. Additionally, the paper aims to evaluate the extent of integration and the difficulties experienced by firms during the implementation and integration of standardized MSs in organizations with more than one MS. In order to accomplish these objectives, the first study on the evolution of integration of MSs was undertaken. We conducted an empirical analysis which investigates data on the perception of quality and environmental system managers of the impact of MSs implementation and integration during a four-year period.

The first conclusion to be drawn from this study is that the majority of firms with more than one MS integrate them into a single system. Therefore, organizations seem to prefer integration over keeping their MSs separated and they evolve towards a state of complete integration (Douglas & Glen, 2000; Karapetrovic et al., 2006; Zeng et al. 2007; Salomone, 2008; Karapetrovic & Casadesús, 2009 or Bernardo et al., 2009). Specifically, 89% of firms in 2006 and 84% of the organizations analysed in 2010 decided to integrate their MSs.

Regarding the human resources involved in the different MSs, only the results of the MS managers and inspectors show significant differences from 2006 to 2010. Therefore, we conclude that, in 2010, the responsibility for managing different MSs falls to the same person more than in 2006. As for the work procedures, there is an increase of integration over time in planning, control of non-conformities, preventive and corrective actions, product realization, improvement and determination of stakeholder requirements. These results show that the level of integration of these elements is higher in 2010 than in 2006. Finally, comparing the 2006 and 2010 samples, the documentation resources and goals are shown to have different integration levels, with a higher integration level in 2010 for the objectives.

The third conclusion is that, for the analysed samples, little relationship exists between the integration difficulties, on one hand, and the level of MS integration, on the other. The only difficulty that predicts the integration level is “inadequate implementation of the initial system”. However, although not statistically significant, the effect of time is present regarding the integration difficulties, as the perception of the difficulties we encountered was higher in 2006 than it is in 2010. Therefore, firms perceive a decline of the importance of the majority of difficulties over the four year period.

As an exploratory study, this paper opens a new line of research in the field of MS integration and contributes to the understanding on how IMSs evolve over time. However, due to the unavailability of other similar studies of the impact of IMS over time in the literature, it was not possible to compare the results of these surveys to similar surveys conducted, for example, in a different country. Nevertheless, we expect we would probably obtain very similar results in that case, since the majority of the works studying IMS effects, although obtaining static results, lead to very similar conclusions.

For future research, given the answers regarding the difficulties experienced by organizations, it would be interesting to further study these results and identify the relationship between the integration difficulties and financial performance measures. It would also be interesting to study how the perception of firms regarding the integration benefits evolves over time. Finally, another future research line could be directed towards exploring to which extent new standards contribute to integration, how the standards structure impacts integration and whether they have been written in order to facilitate integration.

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Robust design methodology at the back-end of product development process; an attempt towards sustainable development

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Introduction

Creating benefit to the present society without compromising the future has become increasingly important topic in the last decade. Focusing only on economic benefit of product development is no longer sufficient. Social and environmental benefit of product development process should also be considered. Various ways to achieve these benefits include, amongst others, continuous improvement ([de Ron, 1998](#)), policy and principles for sustainable production ([O'Brien, 1999](#), [Veleva and Ellenbecker, 2001](#)), eco-design ([Luttropp and Lagerstedt, 2006](#), [Ben-gal et al., 2008](#)), design for sustainability ([Spangenberg et al., 2010](#)), and product life cycle assessments ([Kaebnick et al., 2003](#), [Vinodh and Rathod, 2010](#)).

Genichi Taguchi, who is known as the pioneer of robust design, defines quality as the losses a product imparts to the society resulting mainly from product failure after sale ([Taguchi and Clausing, 1990](#)). This appears to have a strong connection to sustainable development since quality is also defined by those who do not necessarily use or purchase the product. Research on the broader applications of robust design has identified three principles, namely, awareness of variation, insensitivity to noise factors, and continuous applicability ([Arvidsson and Gremyr, 2008](#)). Those robust design principles are in fact applicable in almost any design process, not only in the statistical design of experiment. In line with the application of statistical thinking beyond the science itself, Hoerl and Snee ([2010, p.123](#)) wrote that “...in the twenty-first century it seems that society needs statistics to be primarily an engineering discipline, with a secondary focus on statistics as a pure science”. They gave a specific example of how statistical engineering, instead of statistical science, is needed today than ever before “...we feel strongly that at this time new strategies to better utilize control charts for maximum benefit in health care, finance and other service industries are needed even more than additional research on the mathematical properties of control charts” ([Hoerl and Snee, 2009, p.517](#)). A practical application of robust design methodology in solving real-world problem can be seen as one example of statistical engineering.

Practices of robust design methodology have widespread emphasis on the front-end of product development process in past years ([Hasenkamp et al., 2009](#)). Unfortunately, there is not enough emphasis on its relevance at back-end of product development process. The third principle of robust design methodology (RDM) is about continuous applicability, which says that robust

design principles should be applicable in all stages of product development process. This paper aims to apply robust design methodology principles at the back-end of a product development process as a way to create greater customer satisfaction and support a sustainable product development. Specifically, a new theoretical framework combining RDM principles with exploratory data analysis (EDA) is proposed and used to analyze the warranty claim data of a Swedish manufacturing company.

This paper is structured as follows. Section 2 provides the theoretical background in the related areas. The methodology of the research is described in Section 3. The results and the analysis are presented in Section 4. Section 5 provides some discussions on the findings and its practical implications. The conclusion of the study and further research is presented in Section 6.

Theoretical Background

In early literature, sustainable production was defined as the ultimate result of a continuous improvement of industrial activities with respect to cost and time efficiency, product and process quality and effectiveness. Life Cycle Assessment methodologies are widely recognized as a suitable tool in the assessment of environmental impacts of manufactured products and its processes ([Kaebernick et al., 2003](#), [Vinodh and Rathod, 2010](#)). End of life product information feedback, or sharing, helps to close up the flow of information and knowledge into a product design stage in order to consider the environmental implications of a design ([Lee et al., 2006](#)). In accordance to this, warranty claim analysis and result may be used as an approach to sustainable product development. One main cause of environmental damage is unsustainable production and consumption. Achieving sustainable production will require changes in industrial processes of the products produced ([Nowosielski et al., 2007](#)).

Robust design methodology is described as an approach to reduce performance variation in products and processes or to improve product manufacturability or product life ([Andersson, 1996](#), [Goh, 2002](#), [Shoemaker et al., 1991](#)). These results can be successfully achieved only if the application of robust design is widespread throughout a product life. One of the three underlying principles of robust design methodology is continuous applicability, stating that practices to achieve robustness can be applied in all stages of product development ([Arvidsson and Gremyr, 2008](#)). In order to achieve robustness of products or processes, producers and designers must create awareness of variations in the products and processes they produce or design. It is a prerequisite to create an awareness of variation to increase the understanding of robustness ([Gremyr, 2005](#)). Potential sources of variation that affect product performance are usually not possible to control by designers, and are known as noise factors ([Johansson et al., 2006](#)). Therefore, another principle of RDM is to create insensitivity to these noise factors. RDM, when applied especially based on the continuous applicability principle, functions as a continuous improvement activity.

Improvement initiatives rely on three most fundamental dimensions. They are an established quality management system, requisite quality technology comprising tools and methodologies and a capable quality information system ([Goh, 1993](#)). Quality information is defined as the know-how of product or process performances, all variability included, based on data collection. Capable quality information system could be achieved at all stages of a product, front-end or the development stage and back-end or product in-use stage. Based on previous study and application of robust design methods, emphasis have been on the design phase of products focused on

reduction of variation through parameter design and design experiments ([Allen et al., 2006](#)). Robust parameter design have been much discussed in association with experimental designs and data analysis ([Robinson et al., 2004](#)). Such application shows emphasis of robust design application at the front-end and identifies a lack in research on application or practices at the back-end of a product development process. In applying the continuous applicability principle of RDM, robust design methodology is applied at the back-end of the process through analysis of warranty claim database.

Warranty claim data can be considered as the voice of the customers, but at the back-end of a product cycle. These ‘voices’, if analyzed or interpreted, using a statistical tool and/or quality concepts, will translate to product improvement ideas to be applied at an earlier stage. An opportunity is presented to organizations to create a proactive mechanism in order to react quickly to deviations in product performance through implementation of a field feedback loop ([Magniez et al., 2009](#)). Such mechanism could be designed based on the customer warranty claim database to measure actual field reliability of products and generate valuable information to be fed back into the design process ([Lawless, 1998](#), [Meeker and Hamada, 1997](#), [Meeker and Escobar, 2004](#), [Thomas and Rao, 1999](#)).

Further, the development of RDM principles were associated with practices and a set of tools in an attempt to elucidate the why, what and how of RDM application ([Hasenkamp et al., 2009](#)). A gap was identified in practices needed for RDM’s third principle - continuous applicability. Here, we present that warranty claim analysis as a practice of the continuous applicability principle. The framework proposed involves integration of RDM principles with the three steps of Exploratory Data Analysis (EDA), which is applied as a statistical tool in the analysis of warranty claim database.

EDA is suggested here as a systematic way of analyzing such field data. There is no shortage in availability of data in most organizations today due to computer technology. Often, at the start of solving a problem using a statistical engineering approach, one has to first understand what is going on by looking at the data. In such situation, the exploratory data analysis (EDA), which was advocated by John Tukey ([Tukey, 1962](#)), befits. The goal of EDA is to discover patterns in data through ‘listening’ to the data in as many ways as possible until a plausible ‘story’ of the data is apparent ([Behrens, 1997](#)).

More recently, De Mast and Trip (2007) proposed a framework for applying the EDA in a quality improvement project. Three steps are discerned in EDA process, namely display of data, identification of salient features and interpretation of salient features. The principles of EDA were formulated based on the purpose to parameterize a problem through framing of variations and sources of variations. A number of ways were identified in order to display the data to reveal the distribution. Identification of salient features is done through assuming a neutral reference distribution and looking for deviations from this reference. Identified salient features should then be paired with context knowledge in order to interpret them. A model of EDA was presented to exhibit idea generation through confrontation between empirical data and subject matter knowledge in de Mast and Kemper (2009). This model of EDA was re-applied in relation to the warranty claim analysis and presented in the analysis section of this paper. Based on this model, the ideas generated to improve quality and reliability of the products is used to close the feedback loop into the product development process.

Research Methodology

This project was initiated through collaboration with an organization as part of the Sustainable Production Initiative at Chalmers University of Technology. A total of six visits to the manufacturing facility were accomplished in order to access the claim database and conduct interviews with relevant personnel. The maintenance of the claim database in MS-Access at the organization was the responsibility of not more than 3-4 personnel. Data collection was done through accessing the database, which was followed by interviews with the responsible parties in an attempt to comprehend the input, output and analysis level of the database. The interviews were semi-structured, mostly based on questions relating to the claim process and system. Interviews and meetings were carried out by two of the authors at the premises of the organization. Notes were taken by authors during each meeting and interview. Mainly the interview questions were on the working of the claim database, in terms of input document, data entry, frequency, authorization, distribution and sharing of information in database, report generation, data updates and maintenance of database.

Further discussion with Production and Finance personnel enabled the understanding of product assemblies and internal claim cost analysis. The information gathered here were mainly on the flow of the claim process within the organization and personnel involved.

Proposed Theoretical Framework

Upon review of RDM literature and iterative usage of EDA on the dataset, an integration of RDM principles and EDA steps was proposed. In their application to this case study of claim data analysis towards improving robustness of processes, the principles and steps were found to complement each other. The proposed framework is illustrated in Figure 1 below.

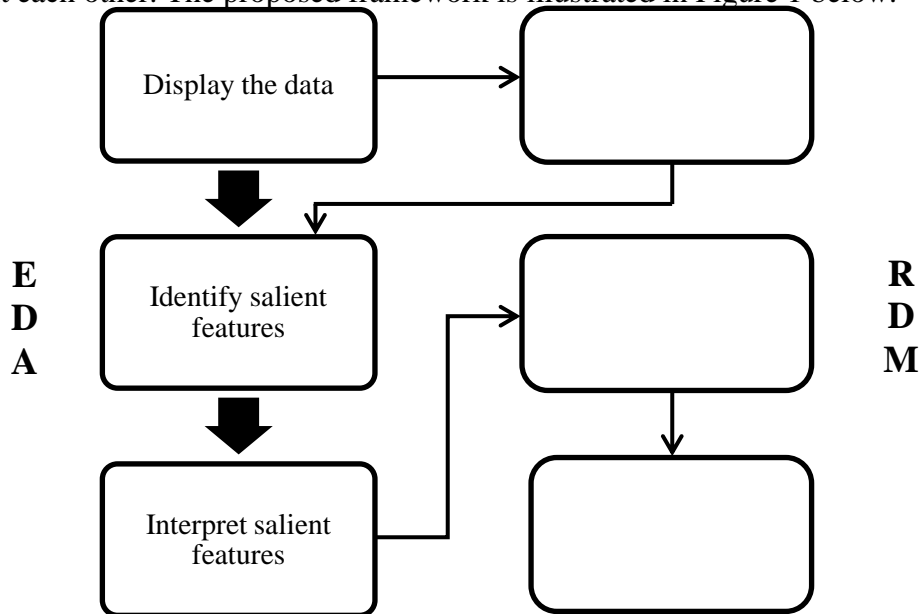


Figure 56: Theoretical Framework of EDA-RDM

Empirical Setting

The organization under study is an internationally leading supplier of equipment and systems for heavy and medium-heavy trucks and trailers. Their customers include suppliers on the global truck market, including European truck and trailer manufacturers, and also ‘body builders’ who complete building of a truck after they have left the factory. Both the body builder and trailer manufacturers are important links in the chain to reach the end customer. This business area has its own sales companies in Sweden, Germany, Denmark, Norway, Belgium, the Netherlands, the UK and France. The Multi-Function Coupling (MFC) was launched in 2008 as a new revolutionary concept for connection of truck and trailer. The new MFC enables faster connection and disconnection, while reducing idling time and thereby also CO₂ emissions. MFC is said to have increased safety and ergonomics levels, permitting more efficient operation and reduced wear which leads to prolonged service intervals. Today, this product has been adapted to vehicles from Scania, Volvo, MAN, DAF, Mercedes and Renault ([VBG, 2010](#)).

Claim Database

This improvement project is based on the product claim database stored in MS-Access at the manufacturing facility. The database contains claim forms, list of products and parts, list of failure codes, list of customers and list of departments in the organization. The claim of products by customers, including sales offices, dealers and end customers have been stored in this database, and was made available to the authors during this project. The products claimed include MFC from 2008 onwards. The content of the database was copied onto statistical software JMP in order to analyze the distribution of the data. The method adopted for the analysis is exploratory. Exploratory Data Analysis (EDA) was applied due to its purpose of identifying potential causes. A large amount of data was available for analysis with a number of variables, and based on the fact that no previous analysis has been performed on this data set, an exploratory option seemed appropriate in order to identify salient features through display of data in graphical methods, which are especially powerful as they have the potential to lead to underlying causes of product failures or claims ([de Mast and Bergman, 2006](#)).

Results and Analysis

The organization state their most important key factors for long-term success as focus on strong customer relations and the customers’ needs, among others ([VBG, 2010](#)). In an attempt to enhance their focus on customer needs, an improvement project of exploring, analyzing and understanding customer claims and their causes was initiated. It is also a part of the organization’s initiative to introduce and implement robustness in the processes in order to stay aligned with the offerings of the new MFC with regards to safety and reliability.

Results

The dataset analyzed in this project contained claim data of 5 years, from 2006 until end 2010. Upon analysis of data distribution, it was realized that one customer, A5, represented a large number of claims during these years, 704 out of 2838. Here, a salient feature was identified based on the fact that this customer stood out within the distribution of customers over time with an

abnormally large number of claims recorded. Further investigation clarified that this particular customer was made up of many dealers and sales offices from one country. As this particular customer base was not representative of individual claims, it was decided to exclude this customer code from the analysis in order to identify other salient features.

Based on the new distribution, histogram of customers and number of claims show customer B5 was recorded with the highest number of claims, 101 out of 2134. Once again, this number was represented by a group of customers under one sales company of another country. It was clear that further narrowing down of the data or categorization of data based on customer codes was required. Customer codes with assigned number 5 indicates customers outside of Sweden, and codes assigned with number 1 are of customers within Sweden. In the specific analysis of claims of customers outside and within Sweden, a new set of results were obtained, as presented in Table I and II.

Table I: Number of Claims by Customers

Outside Sweden		Sweden	
Customer Code	No. of Claims	Customer Code	No. of Claims
A5	704	A1	73
B5	101	B1	43
C5	49	C1	41
D5	47	D1	41
E5	32	E1	38

Similar approach was applied in identification of failure codes from the dataset. Customers outside of Sweden recorded a high number of failure code number 8F. Further discussion showed that failure code 8F was assigned to a general failure described as non-function. Decision was made that all failure coded 8F shall be investigated further and assigned more suitable and correct codes. Therefore, distribution was re-analyzed upon excluding code 8F from dataset. Tables below show reasons of failure as claimed by customers, within and outside Sweden.

Table II: Number of Claims by Failure Codes

Outside Sweden		Sweden	
Failure Code	No. of Claims	Failure Code	No. of Claims
1F	164	2F	388
2F	163	6F	232
3F	92	4F	200
4F	50	7F	168
5F	48	1F	130

The final item to be addressed in the claim database was parts/products rejected by customers. The same categorization was made as before in division of customer bases. Tables below show the parts/products most claimed within and outside of Sweden.

Table III: Number of Claims by Products/Parts

Outside Sweden	Sweden
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Part No.	No. of Claims	Part No.	No. of Claims
P1	267	P2	420
P2	180	P5	237
P3	85	P6	215
P4	41	P7	132
P5	31	P8	107

Analysis

In the process of EDA, three steps can be discerned, as below ([de Mast and Trip, 2007](#)):

1. Display the data.
2. Identify salient features.
3. Interpret salient features.

These steps were applied in the analysis of the claim database to identify three main components of the claim process, which are customer bases and frequency of claims, highest failure reasons recorded and frequently claimed parts/products. Figure 2 shows the EDA model adapted from de Mast and Kemper (2009). The model applied to the analysis exposes idea generation through confrontation between the claim data analysis results and information on subject matter knowledge gathered through discussions and interviews. The processes in this model are explained in below sections through the three steps of EDA.

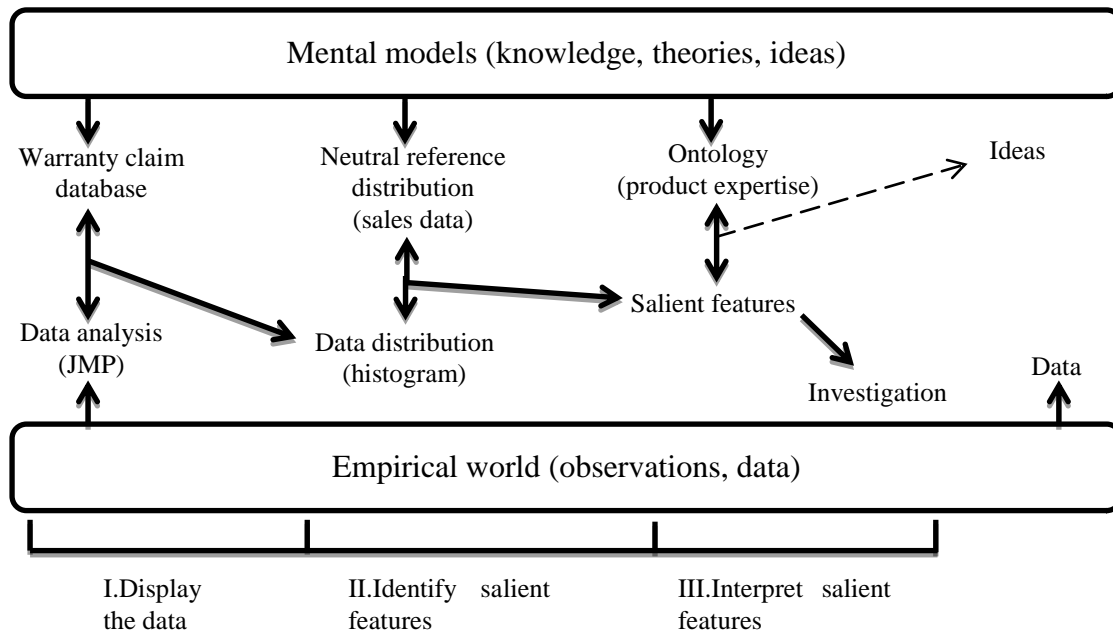


Figure 2: Mental Model of EDA

Display the Data

The first step in EDA is to display the data in a graphical manner in order to capture a pattern(s). Examples of techniques useful for EDA to reveal data distribution, other than histograms, are time series plots and boxplots. Histograms and time series plots were found sufficient for

identification of salient features in the context of this project. Data distribution is shown in a histogram below on customers outside of Sweden and the number of claims. Noting the large difference in number of claims displayed by one customer code compared to the rest in the distribution, the customer base with the highest claim was identified.

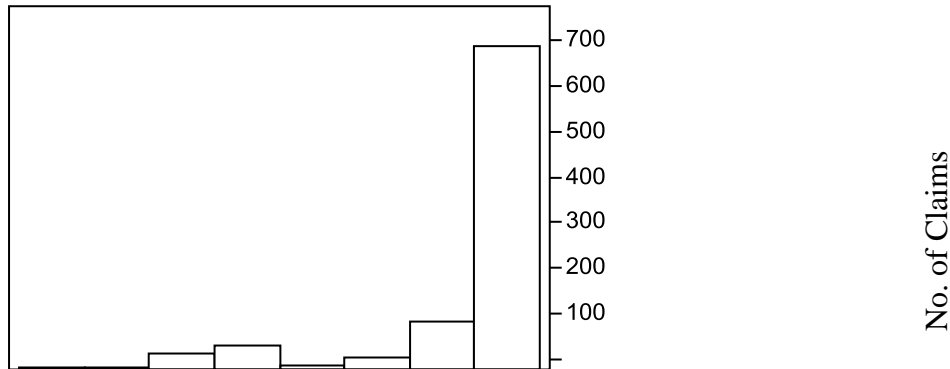


Figure 3: Claims by Customers (Outside Sweden)

The data distribution is displayed in a histogram below shows the number of claims based on failure reasons for customers outside of Sweden. Based on the graph, the top five failure reasons were identified.

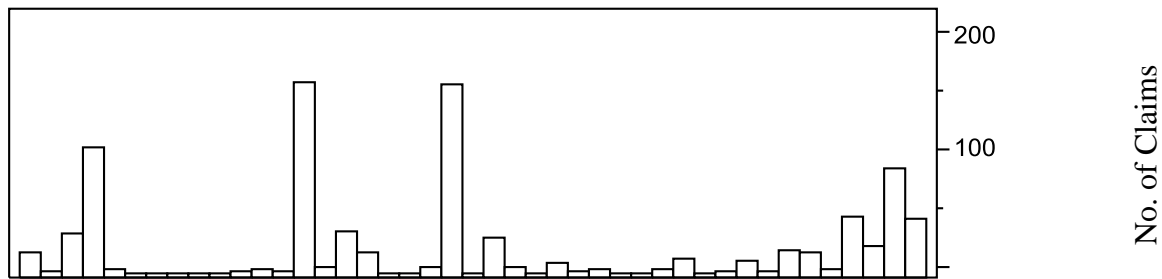


Figure 4: Failure Reasons (Outside Sweden)

The top five most frequently claimed parts/products were identified based on histogram shown in Figure 5 below.



Figure 5: Parts/Products Claimed (Outside Sweden)

Identify Salient Features

Upon displaying the distribution of data, salient features were looked for. According to De Mast and Kemper, salient means standing out from what was expected a priori ([de Mast and Kemper, 2009](#)). In this step of the process, a neutral reference distribution is identified. A reference

distribution reflects an existing knowledge about the phenomena under study but that is neutral with respect to other features. A neutral reference distribution for the claim database would be that the number of claims received from each customer mirrors the total sales of parts/products to them. Based on the sales data, number of parts/products sold to customers in the time frame of 5 years, it was identified that P4 and P6 from claims outside of Sweden and within Sweden respectively, appear as the most claimed items.

Further analysis was done in order to identify the trend of claims of P4 and P6 in terms of time, as shown in below figures. These graphs identify more detailed salient features with respect to trend of claims between 2006 and 2010. P4 shows that claims have declined over the years, while P6 shows a peak in 2008.

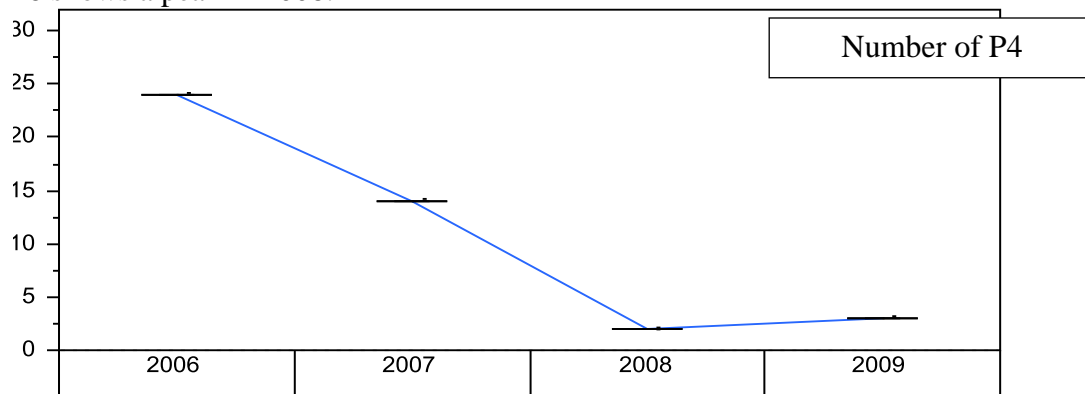


Figure 6: Time Chart for P4 Claims

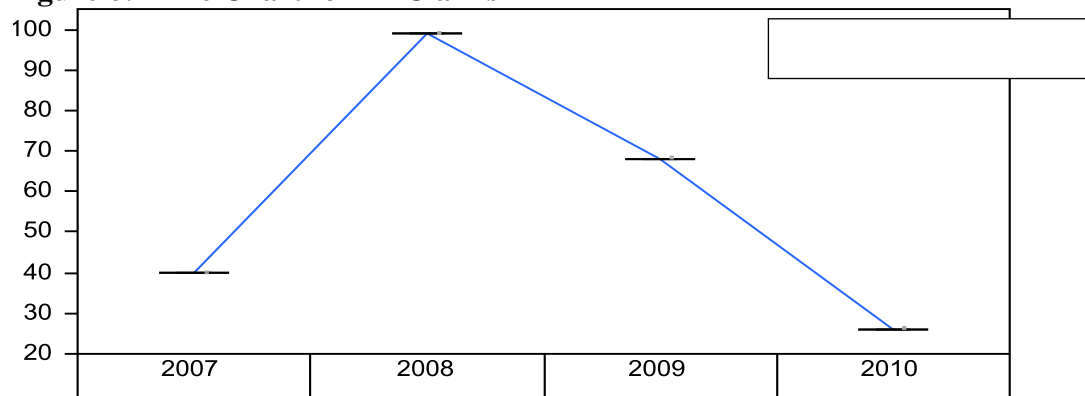


Figure 7: Time Chart for P6 Claims

Interpret Salient Features

The third step of the process is essentially a non-statistical one, as stated by de Mast and Kemper (2009), which is to theorize and speculate on the causes of patterns identified from earlier step. The patterns of data from the distribution were discussed with the project champion at the organization, who involved personnel from various other departments in the information gathering process. Interpretations of patterns or causes identified require expert knowledge of the subject, as stated in the fourth principles of EDA ([de Mast and Kemper, 2009](#)). Therefore, interviews with personnel from Production, Engineering, Marketing and Sales were conducted by

the authors in order to fit the pieces together and gather appropriate explanation for the salient features. In the context of this paper, the most claimed items, P4 and P6, were in focus.

Integrated Framework

Based on the proposed framework of EDA-RDM integration, the findings of the analysis are displayed in Figure 8 below.

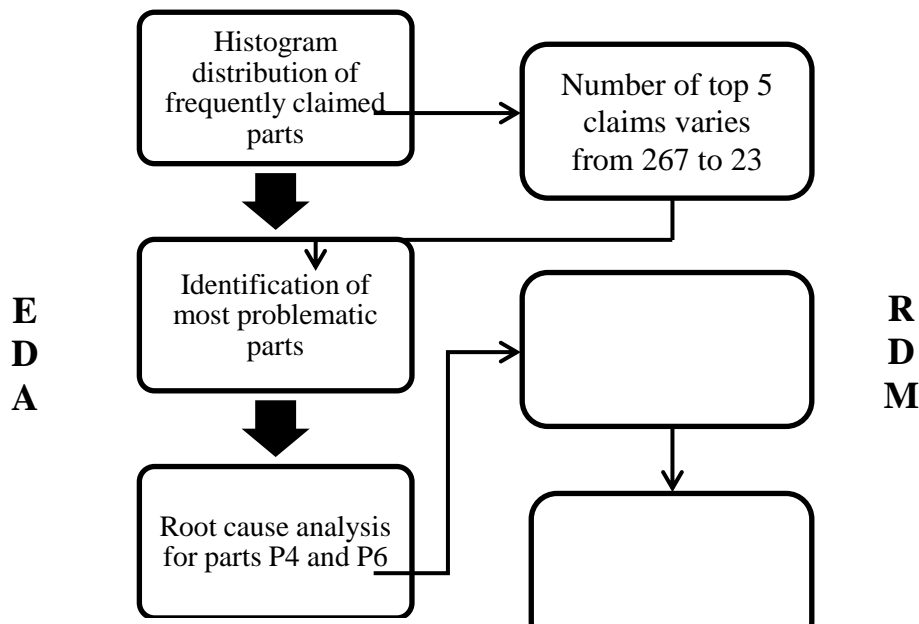


Figure 8: Integrated Framework EDA-RDM

Noise Factor Classification

Based on the analysis of claim database and claimed products, below figure of noise factor classification was adapted from Johansson et al (2006) to fit with the study. Products or parts claimed by customers fall into the ‘In use’ classification of noise factors. This classification contains two types of noise factors, external and internal, as per boxes highlighted in figure below. Products P4 and P6 identified for improvement are subjected to external and internal noise factors, which were identified upon further discussion.

- a. Operating conditions includes long haulage, distribution of merchandise, logging, off-road and construction sites usage.
- b. User-to-user variation includes varying handling during coupling and decoupling of product by drivers, daily maintenance and care.
- c. Wear and degradation includes owner’s different schedule and attitude towards major overhaul.

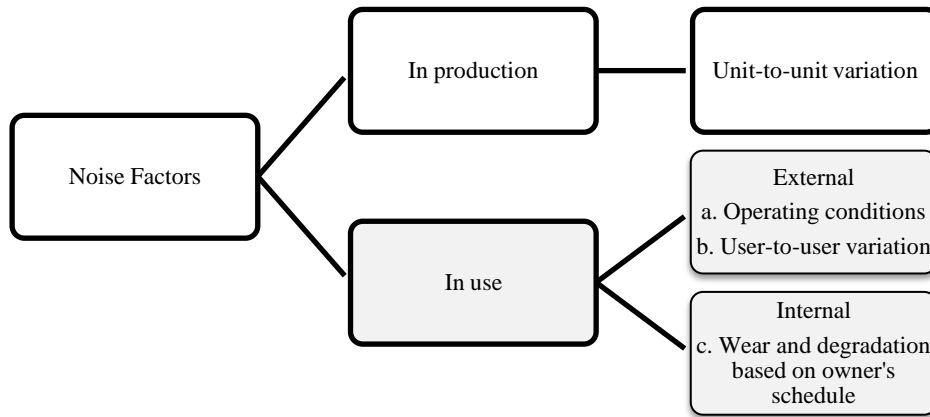


Figure 9: Noise Factor Classification

Feedback Loop

The product development process of the organization is shown in Figure 10 below. The integrated framework of EDA-RDM acts as a tool in analyzing the warranty claim information, directly from customers and users. Root cause analysis and identification of noise factors will serve as valuable design information in the product development process. Creating insensitivity to identified noise factors triggers robust practices, beginning at the back-end of the product and ending in the front-end. Constant flow of such information through analysis of claim products can contribute towards the basis of life cycle assessment initiative in the organization.

In Figure 10, the organization's product development process is shown. The Claim Database activity has been added as a result of this analysis.

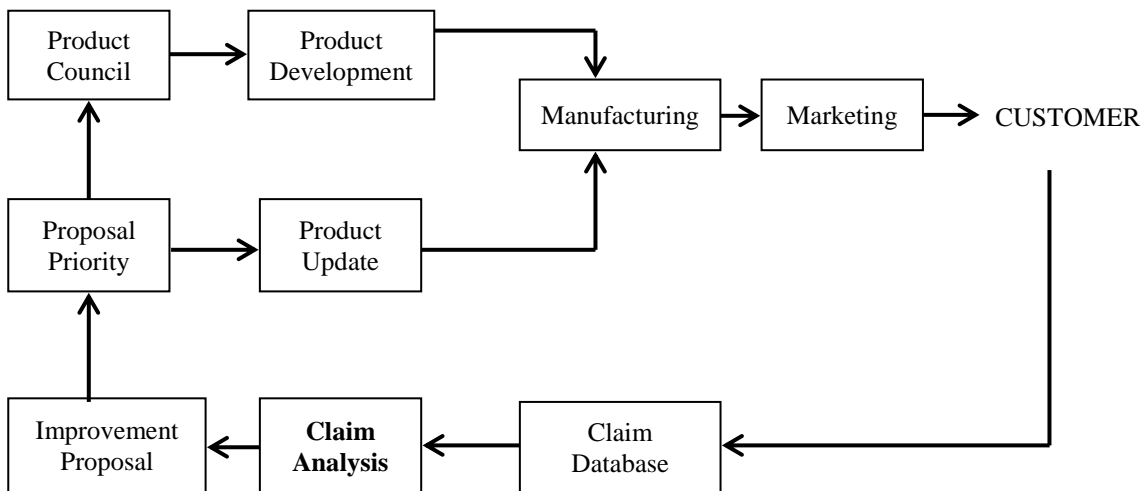


Figure 10: The Organization's Product Development Process

Discussions

It has to be born in mind that the claim database analysis is one of the most visible indicators of customer satisfaction of product quality, which makes the results an obvious source of information. As this information is implicit, it is more easily overlooked. Application of EDA principles has made visible salient features of the claim database. The display of data using histograms identified the most problematic products, as shown in Tables V and VI, where P1 and P2 were identified as the most claimed parts. The application of a neutral reference distribution, namely the sales data of these parts, further clarified the salient features. The most claimed parts then, in reference to the number of parts sold, were P4 and P6. Further, P4 and P6 displayed on a time chart reveals a trend in numbers claimed over five years. P4 was flushed out and replaced with new part called P3 in 2008, which explains the decreasing trend. P6, on the other hand, has been further developed and re-designed as version 3 in 2009. This is shown in the decreasing trend as well.

As EDA functions aptly as one tool in this project, the exploratory findings and outcome of the claim data analysis alone may not address the goals of increased customer focus, process robustness and production sustainability without the application of RDM principles. The integrated framework of EDA-RDM enhanced the analysis process through creating awareness of variation in customer claim trends and identification of noise factors during product use. Continuous applicability principle addresses the application of the rest of RDM principles throughout the product life cycle process, where results from the analysis are fed back into the product development process as design input. Root cause analysis process was initiated as an improvement idea resulting from the integrated framework application. This process includes key players from Production and Engineering teams. This is seen as a first step of application of robust principles and practices in the organization.

Going forward, the next step identified is an initiative towards sustainable product development cycle, where products are evaluated on the potential for re-use or recycling ([Vinodh and Rathod, 2010](#)).

Conclusion

The aim of this paper was to apply RDM principles at the back-end of a product development process as a way to create greater customer satisfaction and support a sustainable product development. A new framework combining EDA and RDM for data analysis has been proposed. The application of the framework has led to revelation of valuable improvement ideas for the company in the areas of practices supporting customer focus, robustness, and sustainability. In other words, this paper shows that robust design thinking at the back-end of product development process can be regarded as one way to create higher level of customer satisfaction and thus supports a sustainable development.

The research results are limited to the data recorded during the last 5 years (2006-2010). A further investigation on the interrelationships between various departments of the company with respect to the claim database will be done in the near future. Another future direction of this study includes development of indicators in an attempt to measure the continuous application of RDM principles not only at the front-end and back-end, but also during the production stage of the products.

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Supply Chain Quality Relationship Management: managing triadic relationships towards improved performance outcomes

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Type of paper: literature review

Introduction

Over the past few years, with the increased attention given to outsourcing and to the global supply chain, Supplier Relationship Management (SRM) has become a common concern, both for practitioners and academics (Cousins, 1999; Cousins and Spekman, 2003; Mehta, 2004; Soltani *et al.*, 2011). Increased discussion on the topic has emerged, on the form of specific companies dedicated to SRM (e.g., BravoSolution) and academic publications (e.g., Emmet and Crocker, 2006, 2009), but there is still disagreement and confusion over the nature and measurement of the relationships established and ultimately over how they affect performance. Consequently, the main aim of the present paper shall be to critically review the literature in order to understand the nature of buyer-supplier-supplier relationships and its consequences for quality performance, identifying the main gaps in the field and providing a road map for future empirical research on the role of collaboration in triadic relationships and in supply chain performance.

Several authors discuss the benefits of SRM and strategic supply (e.g., Day and Lichtenstein, 2006; Emmet and Crocker, 2009; Trent, 2005) and focus on how the use of software management tools can improve SRM from a procurement perspective (eg., Webb, 2007; Park, *et al.*, 2010), facilitating and promoting innovation, resource sharing (information, operational, financial or social capital), cost savings and greater quality integration (e.g., Whipple, Lynch and Nyaga, 2010:507). Additionally, it is argued that to achieve these benefits, open communication, trust and long-term relationships are vital (e.g, Gadde and Håkansson, 2001). Furthermore, most of the research on relationships considered dyadic arrangements (buyer-supplier or supplier-supplier relationships) originating different typologies that do not represent the full complexity of supply network relationships (e.g., Choi and Wu, 2009).

As a result, both practitioners and academics maintain and argue the assumption that closer relationships improve overall supply chain (SC) performance, particularly in terms of returns, cost savings, quality improvements (Gadde and Håkansson, 2001:138-139; Macbeth, 1994:25) as well as quality performance (Fynes, Búrca and Voss, 2005). Nevertheless, most companies do not engage in this “ideal” type of collaborative approaches and it is not empirically clear how and in what sense these quality performance improvements actually occur. A lot has been written on

inter-firm relationships, SC quality and on performance, but it is still not clear if these performance improvements can be extended through the network (since most studies rely on dyads and their perceptions) and there is a lack of clarity in what concerns the role of the established relationships (whether collaborative or not) towards SC quality performance.

For this reason, this paper intends to discuss these assumptions, suggesting a new term for the literature that encompasses previous research but broadens the scope of relationships considered in order to allow further research towards the understanding of the role of relationship types and structures in the implementation of SC quality systems. For this purpose, this review is structured around four main titles: we shall start by briefly focusing the main literature and research on relationship management (RM) that characterizes the shift towards the *relationship paradigm*, followed by the contextualization of *supply chain quality management* (SCQM) and its links to collaboration literature. Finally, the supply chain quality relationship management (SCQRM) concept is suggested and explained as a step beyond dyadic RM, SCQM and *supply chain relationship quality* (SCRQ) (Fynes, Voss and Búrca, 2005).

The Relationship Paradigm

Relationship management (RM) research sits right within the link between marketing and operations management (OM). However, perceived as a *soft* issue, relationships have been studied mostly from a marketing perspective at an individual level (intra-organisational relationships) and, when B2B relationships are considered (inter-organisational relationships) this is done from the distribution channels perspective, comparing levels of integration and still grounded by marketing theories and principles such as *relational exchange theory* (Macneil, 1980; cited by Simpson and Mayo, 1997:210). From an OM perspective, relationships are bound to be different and the focus of research tends to be on buyer-supplier relationships and selection practices, where the main goal is to understand the benefits and pitfalls involved in their interaction. Accordingly, some frameworks have been suggested to assist companies in the management of their relationships such as:

- *Kraljic Matrix*, (1983; cited by Cousins *et al.*, 2008) used to categorize suppliers (as bottlenecks, critical, routine or leverage) and portraying the general strategies to adopt;
- *Maturity Grid* (Macbeth and Ferguson, 1994) for partnership sourcing;
- *Partnership Model* (Lambert, Emmelhainz and Gardner, 1996) used to classify the type of partnership (I, II or III) to develop, where legal combinations are excluded and where Type I involves coordination on a limited basis within a short time frame, Type II progresses to “integration” of activities such as joint planning to avoid conflicting goals and Type III focuses on both operating and strategic integration (Ayers, 2006:210);
- *Dependency* (Historic, Economic, Technological and Political dependency) *and Certainty* (Risk VS Trust) *matrix* (Cousins, 2002), a model of inter-firm relationships, proposing two forms of competition (*adversarial* and *opportunistic*) and two forms of collaboration (*tactical* and *strategic*);
- *Type of collaboration matrix*, where three types are suggested: ‘market’, ‘operational’ or ‘strategic collaboration’ (Cousins, 2005; cited by Cousins *et al.*, 2008).

Considering the RM theoretical developments, according to Cousins (2002:72) three major areas can be broadly identified: *the economic perspective*, where inter-firm relationships are studied

according to *transaction cost economic* (TCE) principles, discussing economic power exchanges, governance mechanisms and opportunism; the *behavioural or humanistic perspective*, where relationships between firms are interpreted according to *resource-based view* and *social exchange theory* on the same basis as human interpersonal relationships (including trust, commitment, communication and cooperation); and the *Industrial Marketing and Purchasing (IMP) group perspective*, that combines both viewpoints in an “interaction approach” to describe the nature and scope of supplier–customer interaction (Kothandaraman and Wilson, 2000:344), assuming an holistic and systematic approach and focusing on relationship networks mapping (Cousins, 2002:76). Following this trend, an overall network approach to SCM has been growing in OM research as well as a growing interest in the study of the SC combined performance outcomes.

Regarding RM research, it is mostly based on dyads, either focusing buyer-supplier or supplier-supplier relationships, studying the perceptions of those relationships and their outcomes. Concerning buyer-supplier relationships, Trent (2005:54) suggests four types of supply relationships: counterproductive (lose-lose), competitive (win-lose), cooperative (win-win) and collaborative (win-win). For supplier-supplier relationships, Choi (2007:55) suggests three main relationship archetypes: competitive, cooperative and co-opetitive.

Although methodologically easier to accomplish, studies that solely focus on dyads reveal to be a partial approach that does not fully represent the complexity of the relationships involved in the SC. On the one hand, they do not consider both companies within the broader network and, on the other hand, they also do not take into account the influence between links (i.e. how buyer-supplier link affects supplier-supplier link) (Choi and Wu, 2009:10), hence the need to consider the triadic relationships (buyer-supplier-supplier). Triads (buyer-supplier-supplier) refer to the potential links between three actors in the SC network (Madhavan *et al.*, 2004; cited by Peng *et al.*, 2010:399), where different arrangements can occur (cf. Figure 1), which are expected to differently influence cooperative performance (Peng *et al.*, 2010:402).

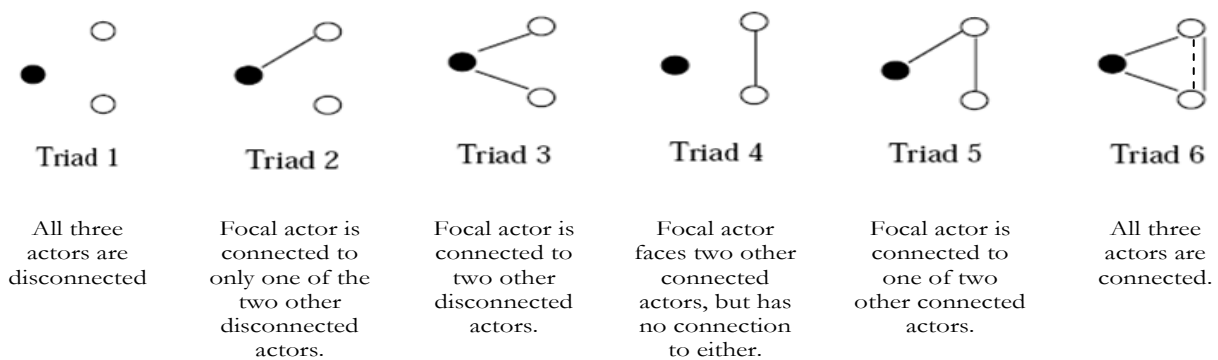


Figure 57: Six types of triads (Adapted from: Peng, *et al.*, 2010:400).

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involvement) and *relational or collaborative exchanges* (a longer-term agreement, commonly defined as *high involvement*) (Gadde and Håkansson, 2001:152) (cf. Table I).

Adversarial	Collaborative
<i>Time-span of interaction</i> Discrete events Contracts for months Low switching costs	Transaction history Supplier for 'life' Switching is the last option
<i>Personal attitudes and behaviour</i> Expertise closely held Centralize authority Power explicit and visible Buyer knows best Reactive suppliers Minimal interactions Customer-imposed stress Individual focus Live for the moment Aggressive defence Look good locally	People development Devolve authority Power two-way and hidden Supplier supports innovation Pro-active suppliers Multiple interactions Self-imposed stress Mutual respect Build for the future Open-sharing approach Group gains sought
<i>Organisational processes</i> Produce to drawing Hands-off Limited gate-keepers Static systems	Design involvement Hands-on Many touch-points Technology transfers
<i>Measurements</i> Unidirectional (vendor rating) Unidimensional (price) Internal cost reduction Inspect outcomes Limited feedback: blaming Learning limited	Total acquisition cost Relationship measurement Supply chain effectiveness Control inputs and processes Frequent feedback: improvement Success shared and rewarded

Table XXX: Features of Adversarial and Collaborative Relationships (Source: Macbeth, 1994:21).

Nevertheless, because different types of relationships and levels of involvement are developed within the network of relationships, these are interpreted within a continuum approach, with transactional exchanges in one end and relational exchanges in the other (Heide and John, 1992; cited by Simpson and Mayo, 1997:210) (cf. Figure 2). Even though this relationship continuum is generally recognised, the confusion between the intermediate terms and definitions remains, particularly in what concerns terms usually used as synonyms such as collaboration, cooperation, alliances and partnerships. In an attempt to clarify these terms, we have chosen to distinguish cooperation and collaboration following Trent's (2005) classification (although some authors still use them as synonymous - e.g. Choi, 2007), suggesting here four broad types of relationships along the continuum: *competition*, *co-opetition*, *co-operation* and *collaboration*.

First, *competition* refers to the typically one-off adversarial and arm's length relationships portrayed by TCE studies, where companies focus on their individual profits and benefits.

Second, *co-opetition* (Noorda, 1993; cited by Nalebuff and Brandenburger, 2002:4) is a term used when companies are forced to both compete and co-operate due to their position in the network. Third, *co-operation*, or *tactical collaboration* as defined by Cousins (2002:80), refers to “a joint enterprise over a limited domain” (Child and Faulkner, 1998:113), that is, improvements or joint activities in terms of technology coordination (e.g. EDI links), new product developments or operations improvements (Spekman *et al.*, 1998), which reflect solely *market or operational collaboration* (Cousins, 2005; cited by Cousins *et al.*, 2008). Hence the inclusion of alliances and joint ventures as well as Lambert *et al.* (1996) partnership types I and II. Finally, in collaboration or ‘*Strategic Collaboration*’ (Cousins, 2002:80), total SC integration is expected through the development of closer relationships (with higher levels of trust, commitment, mutuality and effective communication – Barratt, 2004), not always under formal agreements (Child and Faulkner, 1998: 120-124). Similar to the definition of a *strategic alliance* – as defined by Liao, Hong and Rao (2010:7), since Child and Faulkner’s (1998) definition of a *strategic alliance* refers more to cooperation – or a partnership type III (Lambert *et al.*, 1996), companies shall rely on deeper levels of information sharing, joint strategic planning (in terms of both *market and operational collaboration* - Cousins, 2005; cited by Cousins *et al.*, 2008), shared costs/benefits, and higher levels of visibility, transparency and flexibility (Emmet and Crocker, 2006:53).

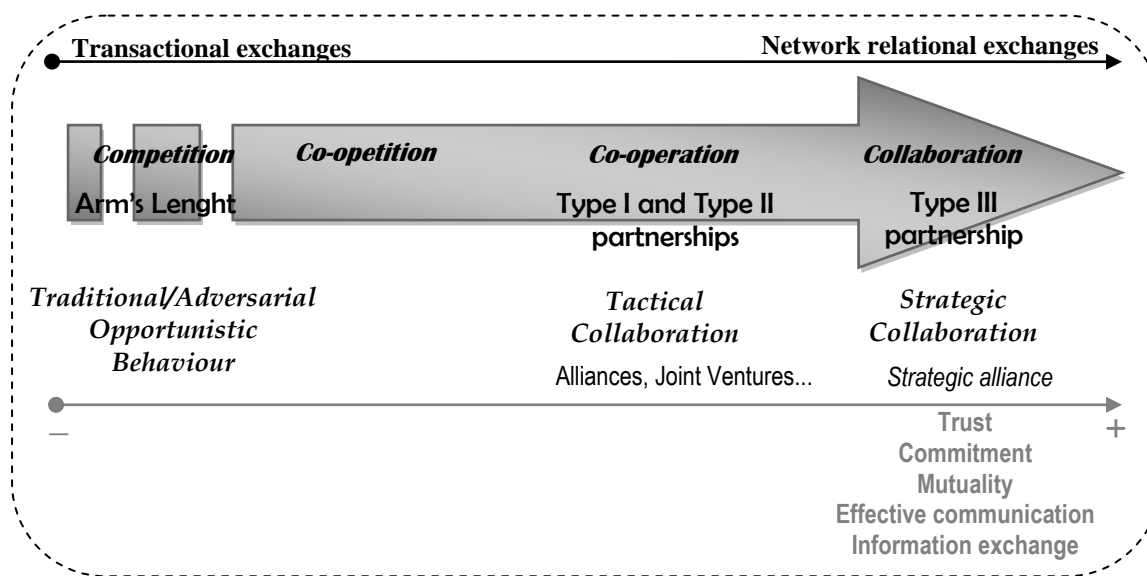


Figure 58: Relationship Typology and Evolution of RM research (Based on: Barratt, 2004; Bensaou, 1999; Choi, 2007; Cousins, 2002; Lambert, Emmelhainz and Gardner, 1996; Liao, Hong and Rao, 2010; Spekman, Kamauff and Myhr, 1998; Trent, 2005).

Given this array of relationship possibilities, companies need to make sure they clearly understand their implications and that they choose to develop the ones that best fit their existent portfolio, since not all relationships should be collaborative (Barratt, 2004; Day *et al.*, 2008).

This portfolio will then include the different SC network relationships that will be established between the different actors, nodes and links, therefore, *Strategic Supplier Relationship Management* (SSRM) (Day *et al.*, 2008:40), reveals fundamental to determine the nature and scope of involvement of the established relationships (Ford *et al.*, 2003:85-86), in order to achieve both operational and strategic benefits (Day *et al.*, 2008; Trent, 2005). Consequently,

relationships are defined as processes that need to be strategically managed towards the achievement of pre-defined outcomes (Cousins, 2002:78; Lambert, 2004:19) and SC is defined as a social network where extended relationships are considered to improve competitive advantage (Choi *et al.* 2001; cited by Choi and Wu, 2009:9).

Supply Chain Quality Management (SCQM)

This need for external integration (SRM) through the development of closer relationships and collaboration is not something new. The benefits generated by closer relationships with fewer suppliers have been emphasized since the 80s with Deming's quality fourteen points (1986; cited by MacBeth and Ferguson, 1994:62; Cousins, 2002:74). Deming (1981–1982), Garvin (1987), and Juran and Gryna (1988) (cited by Stanley and Wisner, 2001:289) argued that the “effective management of external supplier quality is a critical element of quality management”. Additionally, acknowledging the prospective benefits of collaborating with their suppliers in managing quality in their supply chains (Choi and Rungtusanatham, 1999; cited by Sila, Ebrahimpour and Birkholz, 2006:491), a few examples can be mentioned such as Dell, Toyota and Daimen-Chrysler with the concept of *Extended Enterprise* (Dyer, 2000; Iyer, Seshadri and Vasher, 2009; McClellan, 2003; Wu, Choi and Rungtusanatham, 2010).

Concurrently, as research interests move from the traditional organization-centred approach towards the consideration of the overall SC network (Kuei *et al.*, 2001; [Robinson and Malhotra, 2005](#)), managers are no longer concerned with their individual performances but with the competitive advantage of their SC.

Therefore, even though individually TQM and SCM have proved to be two fundamental philosophies and practices critical to organizational performance ([Gunasekaran and McGaughey, 2003](#); [Robinson and Malhotra, 2005](#); [Casadesus and Castro, 2005](#); cited by Vanichchinchai and Igel, 2009:250), they remain difficult to combine. On the one hand, due to the lack of conceptual clarity of both (Vanichchinchai and Igel, 2009:255) and, on the other hand, due to the complexity generated in an organizations' processes and structure (Vanichchinchai and Igel, 2009:253), which requires the involvement and continuous collaboration at internal and external levels ([Gimenez, 2004](#); [Sohal and Anderson, 1999](#); cited by Vanichchinchai and Igel, 2009:254).

Given this, while some authors still focus on the conflicts or trade-offs between QM and SCM, others focus their complementarities, arguing that QM is the fundamental building block for SCM (e.g., Flynn and Flynn, 2005). Since products, information and processes pass from one chain member to the other, their quality is affected by all of the involved in the SC (Sila, Ebrahimpour and Birkholz, 2006:492).

Hence, to combine the characteristics of both, and to widen quality to the overall SC (Robinson and Malhotra, 2005; Sila, Ebrahimpour and Birkholz, 2006), a new management concept was developed, named *supply chain quality management (SCQM)* (cf. Figure 3).

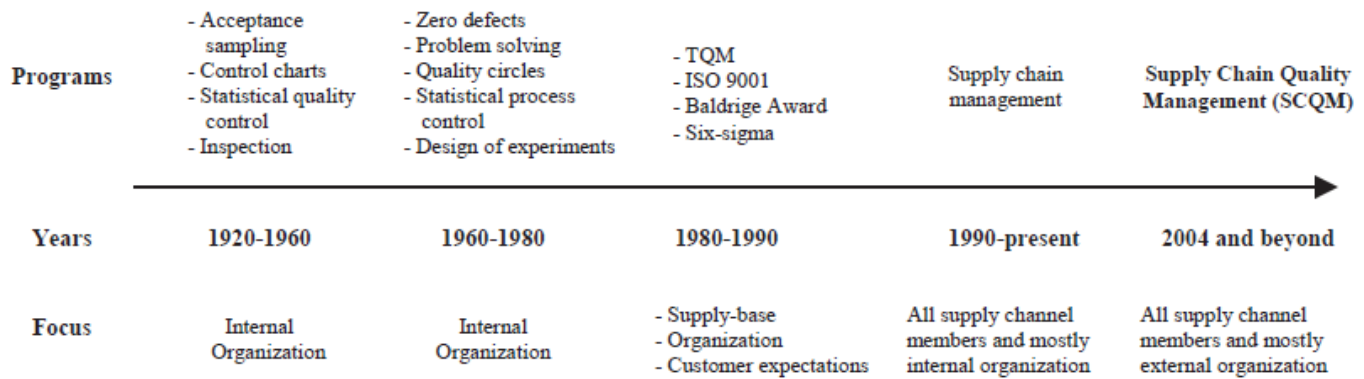


Figure 59: Evolutionary timeline and SCQM focus (Source: Robinson and Malhotra, 2005:331).

According to [Ross \(1998; cited by Sila, Ebrahimpour and Birkholz, 2006:492\)](#), SCQM can be seen as “the latest stage in the total quality movement” defined “as the participation of all members of a supply channel network in the continuous and synchronized improvement of all processes, products, services, and work cultures focused on generating sources of productivity and competitive differentiation through the active promotion of market winning product and service solutions that provide total customer value and satisfaction”.

Foster (2008:461) also defines SCQM as the “systems-based approach to performance improvement that leverages opportunities created by upstream and downstream linkages with suppliers and customers”. In turn, Robinson and Malhotra (2005:319) focus “the formal coordination and integration of business processes involving all partner organizations in the supply channel to measure, analyze and continually improve products, services, and processes in order to create value and achieve satisfaction of intermediate and final customers in the marketplace.”

According to Kuei and Madu (2001; cited by Kuei *et al.*, 2008:1127), SCQM encompasses 3 simple equations where “SC = a production–distribution network; Q = meeting market demands correctly, and achieving customer satisfaction rapidly and profitably; and M = enabling conditions and enhancing trust for supply chain quality.” Furthermore, a conceptual model for SCQM implementation critical factors is proposed by Kuei *et al.* (2008:1129) while Chen and Paulraj (2004:121), highlighting collaboration benefits, argue the effective management of several SC factors to affect SC performance positively.

Even so, SCQM is quite a recent concept that still needs further literature and empirical research (Flynn and Flynn, 2005; Foster, 2008; Lin *et al.*, 2005; Madu, Kuei and Jacob, 1996; Sila, Ebrahimpour and Birkholz, 2006; Soltani, *et al.*, 2011) and despite the fact that some studies have supported the relationship between SCQM practices and their positive impacts on performance (e.g., Kahnali and Taghavi, 2010:45), their effects on the network and SC performance are not clear nor consensual (Lin *et al.*, 2005:357; Kaynak and Hartely, 2007; Kanji and Wong, 1999, cited by Kahnali and Taghavi, 2010:47), hence the need for further research.

Collaboration and SCQM

Collaborative relationships provide greater advantages than transactional relationships enabling both quality and cost improvements (Larson, Carr, & Dhariwal, 2005; cited by Whipple, Lynch and Nyaga, 2010:507). Through the connection of the downstream and upstream network actors (Lin *et al.*, 2005; Kahnali and Taghavi, 2010:46), they are expected to positively affect SC performance (measured by variables like quality, delivery, cost and flexibility) (Fynes, Búrca and Voss, 2005).

Although widely accepted, collaboration is still an “amorphous meta-concept” (Barratt, 2004:39) that has been interpreted differently by several authors. Nevertheless, there seems to be a general agreement that, if SC integration (internal and external) is achieved, through supply quality management (SQM), developing upstream and downstream close relationships, this will generate improved quality performance (which includes “conformance” and “design”) (Fynes, Voss and Búrca, 2005:343). Lo and Yeung (2006:208) define supply quality management (SQM) as the “various management efforts for managing supply function through establishing close and long-term buyer-supplier relationship in order to improve the overall organisational quality performance.” They also identify three vital SQM areas: *supplier selection*, *supplier development* and *supplier integration* (Lo *et al.*, 2001; cited by Lo and Yeung, 2006:209)

Nonetheless, given the lack of clarity and agreement over the basic concepts so far discussed, the implementation of SC collaboration towards SCQM, becomes hard to achieve. Consequently, while some companies suspect the benefits of SCQM others acknowledge them, but they do not fully implement it, including solely critical customers in their quality systems, instead of considering critical suppliers as well by investing in developing and reinforcing these relationships focused on quality to achieve greater long-term performance (Sila, Ebrahimpour and Birkholz, 2006:500).

As a result, even though companies recognise that they are affected by the external processes of the members of their SC and their relationships, in most cases they have no knowledge whatsoever of these processes, nor how to improve them (Barratt, 2004:31). Additionally, as the trends in research methodology, they tend to focus the dyadic relationships, which is not coherent with an overall network approach to ensure total SC quality, where the better you know your partners and the network interlinks, the easier it will be to suggest and implement continuous improvement processes (Gooch, 2001 and Witt, 2003; cited by Sila, Ebrahimpour and Birkholz, 2006:493). This occurs mainly because these practices are considered costly to implement, demanding not only resource availability, but also the development of a “collaborative culture” that includes “trust, mutuality, information exchange, openness and communication” (Barratt, 2004:33/35), that most companies that still follow traditional ways are not willing to develop.

Supply Chain Quality Relationship Management (SCQRM): *old wine, new bottle?*

According to Fynes, Voss and Búrca (2005:340), the literature has commonly focused the nature and dimensions of SC relationships (such as *trust*, *adaptation*, *interdependence*, *co-operation*, *communication and commitment*), but is yet to empirically study the influence of the actual relationships on quality performance. These authors suggest that the positive correlation of these dimensions will be strong indicators of “supply chain relationship quality (SCRQ)” which they

define as “the degree to which both parties in a relationship are engaged in an active, long-term working relationship and operationalise the construct using indicators of communication, trust, adaptation, commitment, interdependence, and co-operation” (Fynes, Voss and Búrca, 2005:342).

Conversely, we suggest the adoption of a new term: Supply Chain Quality Relationship Management (SCQRM) (*in* Soares and Soltani, 2010:6) as the foundation towards the understanding of how the different type of relationships developed between the members of the network (here portrayed by triads) ultimately influences operational performance, particularly the implementation of quality systems. Although similar to the SCRQ suggested by Fynes, Voss and Búrca (2005), SCQRM is not *old wine in new bottles* as it refers to the need to go beyond SC relationship dimensions (as depicted by SCRQ) and RM research as it stands, through the consideration of a strategic SC quality approach where critical suppliers and the portfolio of relationships established is considered in a broader context than individual or dyadic levels. Besides the conceptual discussions done so far in the literature, and in order to avoid the myths of collaborative scalability and supremacy, there is still a need to empirically assess and try to gain further understanding on how and which type of relationships favour SCQ performance and in what ways, that is, how it affects the five performance objectives: quality, speed, dependability, flexibility, and cost (Slack, Chambers and Johnston, 2010:40). Furthermore, the focus here is definitely on the need for SSRM, therefore this conceptualization implies the consideration of a continuum of relationships (as in figure 2), instead of just focusing long-term relationships as SCRQ, and the assumption of a strategically managed portfolio of network relationships towards enhanced quality.

Consequently, SCQRM recognizes both SCQM and SCRQ, assuming that companies need to strategically develop trust and commitment, based on mutuality and effective communication where information is shared throughout the whole chain (Barratt, 2004), increasing visibility, transparency and sharing benefits in order to improve SC performance (Emmett and Crocker, 2009). Furthermore, SCQRM concerns buyers and suppliers’ perceptions and the ability of companies, not only to understand them, but also to strategically manage them in order to develop valuable relationships with their partners, engaging in different types of relationships that, as a whole, make the network efficient (e.g., Day *et al.*, 2008; Ford *et al.*, 2003; Gradinger, 2009; Soares and Soltani, 2010; Trent, 2005). This concept emerged from the need to empirically understand how the different relationships within a triadic context actually affect SC and quality performance. Also, it allows the consideration of a broader approach to the effects of relationships in SCQM, in order to further explore two needed areas of research: the network relationships returns (Child and Faulkner, 1998:116; Ford *et al.*, 2003:83) as well as the variety of potential obtained value (Cousins, 2002:78).

Conclusion

In order to achieve the main goals of the present paper, this review attempted to clarify and critically discuss the conceptual and empirical research so far presented in RM, providing the gaps and future research routes.

It became clear that, SRM models are mainly dyadic, mostly based on buyer-supplier relationships and used as supplier selection tools, some focusing on legal arrangements others on operational agreements, others arguing the need to focus on triads to understand the complex

exchange network, and most of them confusing the terms partnership, cooperation and collaboration. Moreover, even though effective relationship management can impact operational performance not only through procurement but also through the quality systems implemented in SC as a whole, this is rarely considered. Running smooth operations is any managers' dream, but the extent to which they consider SC relationships fundamental to achieve that varies across industries.

For this reason, collaboration has become the latest buzzword in SRM, the one concept that everyone is talking about as if it represented the principle to follow. However, authors have agreed that relationships can be interpreted within a continuum and that a collaborative approach is not always the most adequate within the existent portfolio of relationships. Therefore, assuming collaboration as a magic solution to all problems and taking these assumptions for granted without clarifying what closer relationships means and the extent to which they are close can be dangerous, since they can simple refer to different degrees of cooperation or partnership, involving solely innovation agreements or limited knowledge and information sharing (Lambert, Knemeyer and Gardner, 2010; Whipple, Lynch and Nyaga, 2010). In fact, how can one infer that collaboration improves SC performance if the effects of this type of relationship have not been measured? Moreover, the question still is if we can actually have *collaboration*, in the true sense of the word, within a network and, if so, how can this be measured, quantified and how will this affect SCQ performance results.

Given this, future research suggestions include the development of SCQRM conceptual and empirical frameworks in order to address the OM relationship research gaps; the need to go beyond perceptions in explaining the influences of relationships in SCQ performance (Barratt, 2004; Fynes, Voss and Búrca, 2005); the need to understand “which factors affect and are affected by long-term channel exchange relationships” (Simpson and Mayo, 1997:209); and the need to explore the results of different relationship arrangements in SCQM and SC performance.

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Excellence Toolbox - decision support system for quality tools & techniques selection and application

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Introduction

Quality tools & techniques allow to collect data concerning events and processes occurring in the production system and process them into information necessary to maintain and/or increase process capability to meet requirements, and generate knowledge about processes, based on experience while solving problems in team work (Adams *et al.*, 2001; Bamford and greatbanks, 2005; Herbert *et al.*, 2003; Linderman *et al.*, 2004; Lyons *et al.*, 2008; McQuater *et al.*, 1996; McQuater *et al.*, 1995). They are often attractive due to their form, i.e., visualization of the obtained result (diagrams, charts, tables, graphs); improve the work of an individual employee; and may be used in team work. The way of their usage is not complicated - it may be usually described using simple instruction, program or algorithm of application. Furthermore – thanks to their universality and the interaction in short periods of time, are associated in practice with most stages of the production process. Their importance stems from the fact that without the availability of reliable and complete information, it is difficult to talk about taking effective actions in the scope of regular improvement of manufacturing processes (Shamsuddin and Masjuki, 2003; Sousa *et al.*, 2005; Spring *et al.*, 1998).

To facilitate access for often inexperienced users to a useful quality tool, in the case of specified organizational and production conditions, a new authored method has been developed. The method deals with selection and application of quality management tools & techniques for the needs of improvement of the manufacturing processes, with the idea of its implementation in the form of software application. This method is characterized by:

- flexibility - domain knowledge concerning strongly differentiated, due to their nature and purpose, quality tools & techniques; was recorded in a uniform, newly structured manner (in a form of set of features describing tools and their states),
- usability - implemented as a decision support system (DSS) on the selection of quality tools, taking into account both the possibility of applying the tools & techniques, as well as limitations in their practical usage,
- effectiveness – verified by the implementation of its algorithm in the form of a prototype software method, and further improvement of the mechanism for requesting the DSS system.

Research methodology

Analysis and synthesis of the state of knowledge concerning quality tools

The way of describing the quality tools & techniques in the rich literature of the subject is similar; it includes a name of a tool, sometimes alternative names, the purpose of its use, a detailed description, the application procedure, examples of applications, any variety of a tool, and observations and comments (Benbow *et al.*,2002; Brassard and Ritter, 1994; Breyfogle, 2003; Hamrol, 2008; Oakland, 1993; Tague, 2005). The most frequently proposed form of searching of appropriate quality tools is the key in the form of a table, where one of the dimensions is formed by specified instruments (their names), the second - the name of the phase of the problem-solving cycle, the cycle of improvement or purpose of the instrument. The fact of the usefulness of a particular tool is marked in the table at the intersection of the appropriate row with a column matrix. In this way – the table supports "manual" selection of a tool, taking into account two, sometimes three criteria, which leads ultimately to the fact that the potential user - after studying the whole handbook and filtering instructions in the table - remains still helpless with many possibilities of choosing tools.

Gaining knowledge on quality tools & techniques – for the needs of the developing method - so numerous literature sources, and on such a broad spectrum of quality tools (ranging from technological solution (e.g. SPC) to organizational and behavioral techniques (e.g. NGT)) was hindered by diversified and unstructured way of characteristics recording of individual quality tools. Noticing this difficulty simultaneously became the basis for raising and solving the problem: whether and what kind of structure should be given to a description of tools, so that within its scope one could "fit" the characteristics of all the quality tools?

Analysis of the collected material indicated the validity of accounting, in the further development of paper – arrangements which contain reported in the literature, numerous classifications of quality tools. Due to this fact, classification criteria underwent closer analysis. It turned out that all the collected classification criteria can be divided into two separate classes:

- reflecting theoretical possibilities quality tools application,
- reflecting practical limitations in their application.

While the first group is totally independent of the place of tools application, the other indicates the conditions that must be fulfilled in order for the tool, in the given organizational and production conditions, to be useful. Since the first group of criteria is "theoretical", it was called in the further part of the elaboration, "scientific". The second is associated with the practice – so it was described as "workshop criteria" (Table I and Table II).

Table I. QT&T classification (theoretical view - *possibilities*)

Classification criterion	Example of characteristics
when to use	for grouping
QM support	yes
problem solution phase	problem defining
language	English
input data	numeric
short description	statistical
place in PDCA	PDC
place in DMAIC	D
graphic form	diagram
user	individual or in team
level of learning about the process	understanding
benefits	high
computer aided?	yes
type of knowledge	know – why
type of data processing	off - line
recommended in standards	no
methodology approach	focused
versions	no
tool function	analysis

Table II. QT&T classification (practical view - *constraints*)

Classification criterion	Example of characteristics
organization cell	shop floor
production type	mass production
production phase	measurement
problem type	technical
user required qualifications	advanced
required resources	low
costs	high
level of complexity	average
domain	mechanical engineering
enterprise	SMEs
product characteristics	optionally
production characteristic	manufacturing
problem importance	low
usage efficiency	high
management support	required
influence on quality	high

The most common criterion for the classification of quality tools & techniques (QT&T) is their purpose, for which they are used in connection with the examined process in the enterprise – improvement of this process or problem-solving. In such a scope, the tools are assigned as useful and helpful in one of the stages of manufacturing process improvement (Anand *et al.*, 2010; Brassard and Ritter, 1994; Tang *et al.*, 2007; Wu and Lin, 2009) or the stages of problem solving in the enterprise (Lari, 2003; Hagemeyer and Gershenson, 2006; Tari and Sabater, 2004).

In many classifications - regardless of the arrangement of tools for the needs of implementation of improvement programs – tools are distinguished depending on their specific purpose, function or purpose of use. Using only this criterion, in the following works, tools have been distinguished:

1. in (Brassard, 1994):
 - counts,
 - measures,
 - for generation,
 - for deciding,
 - for implementation;

2. in (Tague, 2005)
 - planning and implementation of projects,
 - generate ideas,
 - analysis of the process,
 - collect and analyze data,
 - analysis of the causes,
 - evaluation and decision making;

3. in (Hamrol, 2008)
 - for: visualization,
 - grouping,
 - monitoring,
 - identifying relationships,
 - ranking,
 - assessment of capacity.

The examples are illustration of the diversity of terms, defining the purpose of tools application. Since various classifications contain different sets of tools that exist in some parts in other classifications - in this way, a single tool obtains in an artificial way several different characteristics, which can also confuse a potential user, while benefiting from several different sources of knowledge concerning quality tools (Starzyńska, 2009).

The next stage of the study was therefore to identify the specific characteristics of the individual tools in various classification approaches and the "recognition" of the possible ranges of state characteristics, with the help of which each, single tool may be described. While the tables I and II show examples of detailed characteristics of different tools on a random basis, table III provides a synthesis of collected knowledge on quality tools & techniques, in which each classification criterion (feature) has its equivalent, finite set of characteristics (states of a given feature). Gathered at this stage of research, knowledge of quality tools was recorded in the database of MS Excel spreadsheet.

Table III. Characteristic of selected QT&T (fragment)

Tool name	Input data	When to use	Place in PDCA	Graphic form	User	Level of complexity
Fishbone diagram	ideas	grouping	PC	diagram	team	low
Pareto diagram	numbers	ranking	C	diagram	individual	average

Flowchart	ideas	flow modeling	DC	chart	individual/team	low
Matrix diagram	ideas, numbers	relation analysis	C	matrix	team	average
Relationship diagram	ideas	relation analysis	C	diagram	team	low
Tree diagram	ideas	relation analysis	P	diagram	team	low
Control chart	numbers	capability study	D	chart	individual	high
Scatter diagram	numbers	relation analysis	A	diagram	individual	high
Histogram	numbers	capability study	DC	graph	individual	average
States of possible characteristic:	2	5	4	8	3	3
	<i>numbers</i>	<i>grouping</i>	<i>Plan</i>	<i>Diagram</i>	<i>Individual</i>	<i>High</i>
	<i>ideas</i>	<i>ranking</i>	<i>Do</i>	<i>Matrix</i>	<i>Team</i>	<i>Average</i>
		<i>flow modeling</i>	<i>Check</i>	<i>Chart</i>	<i>Individual/Team</i>	<i>Low</i>
		<i>relation analysis</i>	<i>Act</i>	<i>Graph</i>		
		<i>capability study</i>		<i>Table</i>		
				<i>List (checklist)</i>		
				<i>Table</i>		
				<i>None</i>		

Knowledge of the specific characteristics of nearly a hundred QT&T helped to develop the matrix of relationships, allowing in practice to use these instruments in certain sequences. In the available descriptions of the instruments of quality management, it is often mentioned, or even recommend to use them in connection with other quality tools, which for the purpose of this study have been respectively called “the preceding tools” or/and “following tools” in relation to the selected tool. They may respectively provide data and information for the given tool (method) or make use of the results of work with previously applied tools. To build the matrix of dependency/relationship, results of previously conducted literature analysis were used. Description of the functionality of the developed matrix of relationship is connected with the explanation of signs, used in the description of the matrix (Table IV).

Table IV. Relation matrix among QT&T – relation types

	Tool A	
Tool B	←	start with
Tool C	↑	go to
Method D	∩	use within
Tool E	↔	replace with
Tool F	↻	is a version of

Signs in the legend indicate that in the found relationships between tools or methods, one recognized more relations than only the relation of "priming" and "succession." And so the arrow pointing left in the matrix cell (Table IV) indicates that the tool A, located above it, in the same column of the matrix occurs in a logical ordering prior the tool B, for which there is an indication in the appropriate row on the left. The opposite situation shows the arrow pointing up, such an indication in the developed matrix should be interpreted as a situation, in which after using the tool C, one can pass for further analysis, using the tool A. The U-shaped narrow informs that in the D method, A tool is used (as its component). The arrow mark symbolizes situations, in which one tool (here Tool E) can be used interchangeably with other similar instrument (here interchangeably with A). Last of the designations in table IV points to the fact that one of the tools (here Tool F) is a variation of another (Tool A). The starting point to build a matrix with the functionality resulting from the possibilities of a popular spreadsheet, was an attempt to show tools and methods as elements that can be integrated.

Due to the presented richness and diversity of the available tools on the one hand, and the need for an easy and fast way of reaching an appropriate tool by an inexperienced user, in production conditions, at the later stage an original method of their selection and application was developed. This method was called the matrix of criteria.

A new method of selection and application of quality tools for process improvement

In the further part of elaboration, it was assumed that the potential user of the tools is a kind of client – formulating his/her needs and requirements when it comes to looking for a tool. On the other hand, each tool has its own characteristics in the form of set of characteristics, the set of which to a greater or lesser degree, may correspond to what the user is looking for. In turn, each of the properties (attributes) of a tool may take different states, which determine the level of compliance with the requirements of searched tool. In this way, a new concept of the quality tools description emerged - in the form of a finite, fixed set of attributes (properties), characterized both by a specified state (or states), which in the process of tools searching (e.g. by asking questions), to a lesser or greater extent meet the expectations of the user.

The main idea to develop a criteria matrix method (MMC) was the transition from the characteristics of individual quality management instruments in the form of their unstructured description to defining them by a finite set of features, consequently allowing for defining of multiple criteria of their selection by the user.

The criteria matrix method (MMC) algorithm

Stage one – designing of user’s matrix

"The engine" of criteria matrix method is so called user’s matrix. It is a matrix which columns correspond to the criteria of tools selection, but in the lines are located individual states of tool characteristics, corresponding to the specific selection criteria (for each selection criterion - a different set of states of the corresponding feature). Thus, the user’s matrix's dimension is closely dependent on the number of accepted searching criteria (e.g., 6 criteria gives a horizontal resolution equal to 6 cells). Vertical resolution is as high as the maximum number of states of the one of the considered criteria. Specific selection criterion may be, for example: the ease or difficulty of use of tools, the speed of implementation into practice, the possibility of execution by only one person, the amount of data required for decision making, the precision (accuracy) of the obtained result, the objective (effect) of application, etc.

It was assumed that the more selection criteria, the greater the accuracy of the method of the matrix of criteria, and therefore - the aptness of choice. At the same time, the user is obliged to introduce a greater number of input data (so he/she must define more requirements).

The example of user’s matrix is presented in Figure 1.

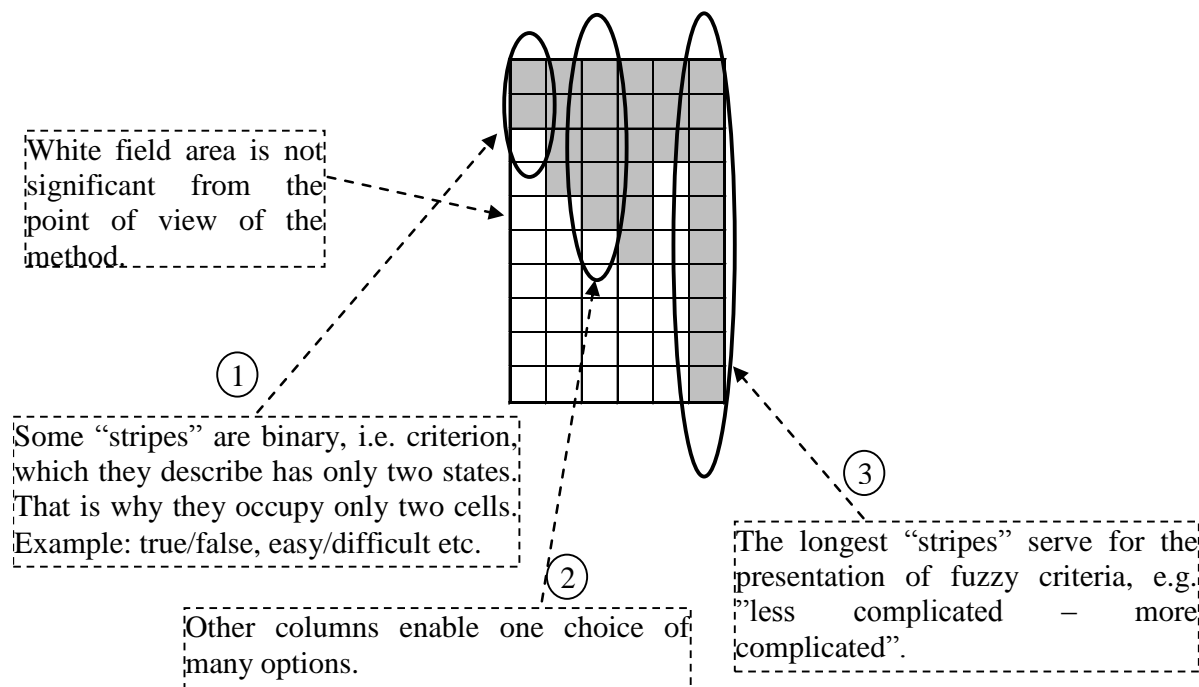


Figure 1. User’s matrix (Starzyńska and Hamrol, 2010)

In Figure 1, a user’s matrix was presented, which contains 6 criteria (6 vertical gray bars). The first column contains the two possible states of the first features, the second bar - four states, and the last bar contains 10 states. This last - as the most numerous one – indicates vertical resolution of the matrix, in the presented example (6x10 matrix). Such a format of the matrix is determined by the criteria selected by the user (there are 6 of them), among of which the criterion of

"complexity" may take (taking into account all of the tools in the database), ten different values, so 10 features of characteristics (10 states traits).

Stage two – designing of database

Due to the previously defined by the user criteria of tools selection (there are 6 of them here), the database of tools is "filtered" in the vertical arrangement, that means that in the created templates, describing tools irrelevant criteria, from the point of view of the potential user, are not taken into account. At this point of the algorithm, takes place their encoding into the form of filled matrix cells in accordance with the previously designed shape of the matrix's user (Figure 2).

If the considered tool is characterized by a particular feature (state or states of a given characteristic) – responses are the cells of matrix with the number 1; the remaining fields are filled with zeros. This does not include the last "fuzzy" bar that fills up gradually with decreasing values in both directions from the value of "1".

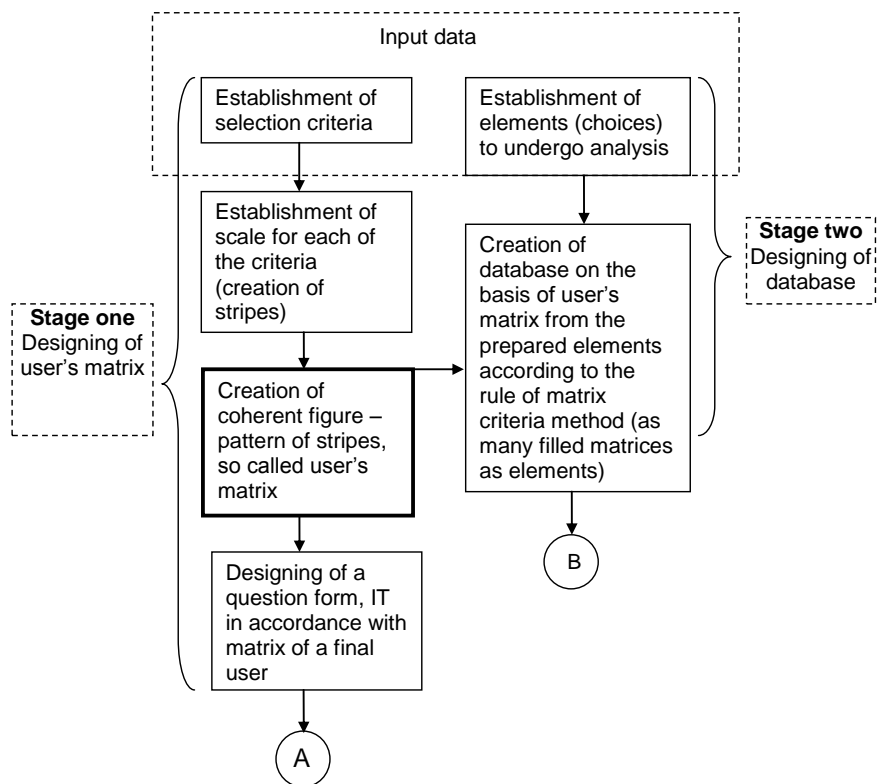


Figure 2. Method algorithm – stage 1 and 2

Stage three – filling of user's matrix

At this stage of the algorithm, i.e. filling of user's matrix, the decision maker is asked to specify his/her requirements (via a computer program). For each column of the user's matrix, one question is assigned. Questions may be differently formed, however the obtained answer must be unambiguous (single choice). Having obtained answers to all the questions, the algorithm generates the response keys, that is tool templates, the base (structure) of which is the matrix of

the user. This key is applied to each item in the database to count the points, in effect allowing for the creation of the rating of considered tools (Figure 3).

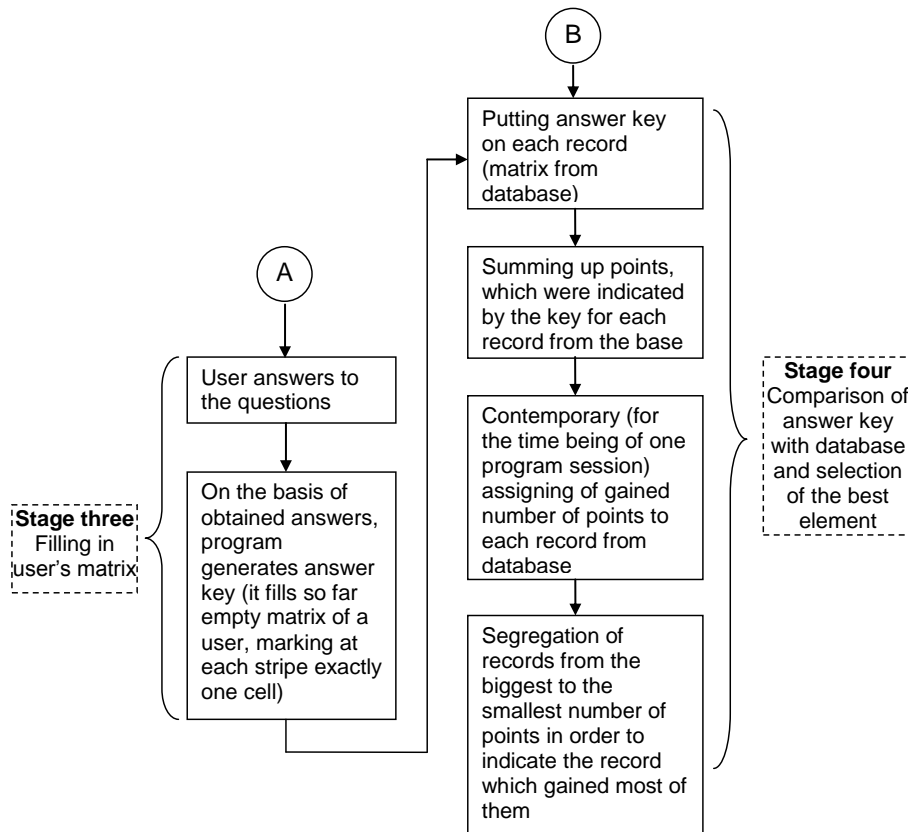


Figure 3. Method algorithm – stage 3 and 4

Stage four – Comparison of answer key with database – selection of a tool

The final stage of the presented method is the imposition of the answer key to each element (here: a quality tool) encoded in the database and counting of the numerical values from the appropriate (identified by the template - key) fields. The method is constructed so that from each bar in the matrix, a given element of database may receive a maximum value of one. One of the basic assumptions in the matrix of criteria is the fact that the numerical value read from each bar, during the final compilation of the key with each of the tools from the database, may equal at maximum 1.

Summing all the numerical values, indicated by the key allows granting to each element in the database a certain number of points. Awarded points assigned to each item in the database allow to sort the items from the one which scored the most points (which means that best fulfills the criteria put by the user) to the last (the one that fulfills user's criteria worst). Finally, a quality tool which obtains the highest number of points in this set ranking, is selected. The idea of such proceedings is also presented in Figure 4.

0	1	1	1	0	0,1
1	0	0	0	1	0,2
	1	0	0	0	0,3
	0	0	0		0,4
		0	0		0,5
			0		0,6
					0,7
					0,8
					0,9
					1

1. Fishbone diagram
1.5 score points

1	0	0	1	1	0,6
0	0	0	0	0	0,7
	1	0	0	0	0,8
	0	1	0		0,9
		0	0	1	
			0		0,9
					0,8
					0,7
					0,6
					0,5

2. Pareto diagram
4 score points

0	0	0	1	0	0,4
1	1	0	0	0	0,5
	0	1	0	1	0,6
	0	0	0		0,7
		0	0		0,8
			0		0,9
					0,9
					1
					0,9
					0,8
					0,7

3. Flowchart
0.8 score point

0	0	0	0	0	0,8
1	0	0	0	1	0,9
	1	1	0	0	1
	0	0	1		0,9
		0	0		0,8
			0		0,7
					0,6
					0,5
					0,4
					0,3

4. Matrix diagram
1.8 score points

0	0	0	1	0	0,6
1	0	0	0	1	0,7
	1	1	0	0	0,8
	0	0	0		0,9
		0	0	1	
			0		0,9
					0,8
					0,7
					0,6
					0,5

5. Relationship diagram
2 score points

0	1	0	1	0	0,1
1	0	0	0	1	0,2
	0	1	0	0	0,3
	0	0	0		0,4
		0	0		0,5
			0		0,6
					0,7
					0,8
					0,9
					1

6. Tree diagram
0.5 score point

1	0	0	0	1	0,9
0	1	1	0	0	1
	0	0	0	0	0,9
	0	0	0		0,8
		1	1		0,7
			0		0,6
					0,5
					0,4
					0,3
					0,2

7. Control chart
3.7 score points

1	0	0	1	1	1
0	0	0	0	0	0,9
	0	1	0	0	0,8
	1	0	0		0,7
		0	0		0,6
			0		0,5
					0,4
					0,3
					0,2
					0,1

8. Scatter diagram
2.6 score points

1	0	0	0	1	0,7
0	1	1	0	0	0,8
	1	0	1	0	0,9
	0	0	0		1
		1	0		0,9
			0		0,8
					0,7
					0,6
					0,5
					0,4

9. Histogram
5.9 score points

Figure 4. Example of QT&T ranking

The presented method is characterized by the simplicity of operation, based on an efficient algorithm, with the possibility of easy expansion of the database tools, and in consequence - the

possibility of working with a large number of quality criteria for the selection of tools. Flexibility of the method, however, is conditioned by the necessity of obtaining much information from the user, reflecting his/her expectations, workshops constraints, etc. The user must also demonstrate the consistency of expectations when providing answers to questions. The method is easy to adjust and adapt to achieve the maximum effect (accuracy). The disadvantage is the fact that the analyzed elements (added to the database) must be substantially similar to one another (and able to be described using the same characteristics). Furthermore, the effectiveness of the method is dependent on a large number of considered criteria, what allows to achieve satisfactory 'gaps' between the sorted items.

Software prototype of the MMC method

The purpose of a prototype program development was the need to test the criteria matrix method due to the accuracy of hints as to the choice of tools by the user (at this stage, also the expert). For the needs of testing of the developed algorithm - MS Excel has been selected. The choice was made due to its high flexibility and ease of use. At the stage of creating of the first prototype version, an obstacle occurred, as a result of which – a basic algorithm of the method has been modified, compared to the original (Figure 2 and 3), while retaining its while preserving its primary functionality. The change consisted in the fact that, instead of one key, so far generated by the user's responses, a lot of keys were applied - just as much as all the elements (records) in the database. However, user's preferences were recorded in a form of a single matrix, which during operation of the program was compared to each record in a database of Excel spreadsheet.

Tests carried out with the first version of the program were very promising, however, revealed a need for remark implementation to the method of matrix of criteria. Therefore an interface of a modified version of the prototype program was developed. The difference consisted of adding a new element - a selector of significance, which enables increase of the multiplier - importance of one or more criteria. With the usage of the modified prototype software of the MMC, one has also carried out simulations. The results of these simulations are presented below in the form of conclusions:

- assigning importance has a decisive influence on the result in the tool selection process. It generates risks: there are few situations that tool at 100% corresponds to the criteria chosen by the user and the user gives the weight without the awareness which criteria are not fulfilled (it is the case that decides whether the best tool for the situation will be generated). Proposal of “depletion” of the range of importance;
- since intermediate values of weight have no influence on the indication of the QM tool, it is better to replace the scale of 2-9, with priority importance: low, normal, high. Such solution is simpler to use for the user,
- since certain criteria: the type of data and the user, eliminate tools with the opposite features than those indicated by a user, should these be called the limits of the “process, a situation, user”? and be used as a pre-filter of tools. The user may but does not have to indicate these restrictions, and then determines the other criteria.

The MMC software prototype was developed as a tool for verifying the accuracy of the method for quality tool selecting, based on the indicated, by the user of the under construction system, set

of searching criteria. In particular, the second version of the prototype has enabled to obtain a satisfactory hint of the system in the form of tool rating. Further phase of work is the implementation of the method in the form of a decision support system (DSS).

Decision support system for quality tools & techniques selection and application

The result of the work in the project is an application used for the selection of an appropriate quality improvement tool in the enterprise. The main objective of the application is to help inexperienced users to choose the right tool by responding to a series of questions, clarifying the needs and expectations of the user. The essence of the created system is to support the selection of appropriate tools, targeted to both the quality managers and workers in direct production. The basis for building the system was - presented in point 2.2 of this study - the method of the matrix of criteria (MMC).

The functionality of the system

The main function of the system is to help the user in the process of selection and application of quality tool - useful in the given organizational and production conditions. The application was designed to provide as much flexibility as possible to the knowledge stored in the database. This is reflected in the possibility of introducing new quality tools, introducing new criteria for their searching, supplementing the rules of conflict, necessary for the proper functioning of the hint system. Moreover, the interactive interface allows the user to easily get acquainted with new tools and implement evaluation of quality tools used in the practice. As such, it can be operated by skilled and unskilled user.

DSS elements

The developed system is characterized by typical solutions for systems known as decision support systems (DSS). Elements of the system are shown in Figure 5.

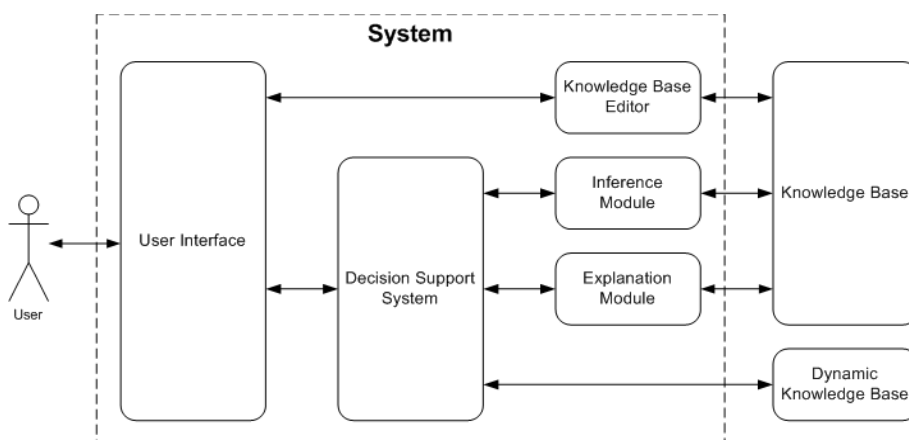


Figure 5. DSS model for QT&T selection

Knowledge base was implemented in the system in the form of a relational database. Presented in the earlier part of the paper (point 2.2) the characteristics of the tools by defining a set of features

and status of these features (stored in a database system) has allowed to gather and record in the knowledge database – rich knowledge concerning the domain of QT&T.

Knowledge stored in the system can be divided into static and dynamic knowledge. Static knowledge includes the entire set of quality tools introduced into the system, in relation to their characteristics (selection criteria) and the values of these characteristics (properties of tools). Part of the knowledge recorded in the system has character of the acquired and dynamic knowledge, being the result of tracking/analyzing the history of user's actions and recording so called sessions.

The source of this knowledge is a mechanism for learning the system (designed and implemented an algorithm in the system) consisting of a continuous enrichment of knowledge by collecting information on selections of the user (using the system) and an evaluation of the effectiveness of the applied tools, and also learning about behaviors and preferences of the user and keeping statistics of tools selection. The algorithm provides a basis for decision support mechanism for the selection of a specific tool, by current moderating of results of the conclusion mechanism. The main element of the system is the conclusion mechanism (inference module) in the form of an algorithm implemented in the system, of the MMC method (see point 2.2).

Explanation module also deserves attention in the system. It allows the user to obtain information as to why this system has given such and not the other hint. Simultaneously, with the ranking list of the proposed tools, occur also graphic matrices, illustrating the degree of compliance of the characteristics of a given tool with the expectations of the seeker (Figure 6). The user may also obtain information on how he/she came to the obtained, has possibility of read the description of the tool, examples of its use, etc.

Work with the system can be divided into two main parts: the so-called expert interface and the user interface. A user through the user interface (also Figure 6), uses the knowledge gathered in the system, and at the same time is a source of new knowledge (the return to the selection session enables him/her evaluation on the usefulness of the tool, he/she chose, in practice). On the other hand, the gathered in the system knowledge, for the given moment, may be continuously extended by further quality tools.

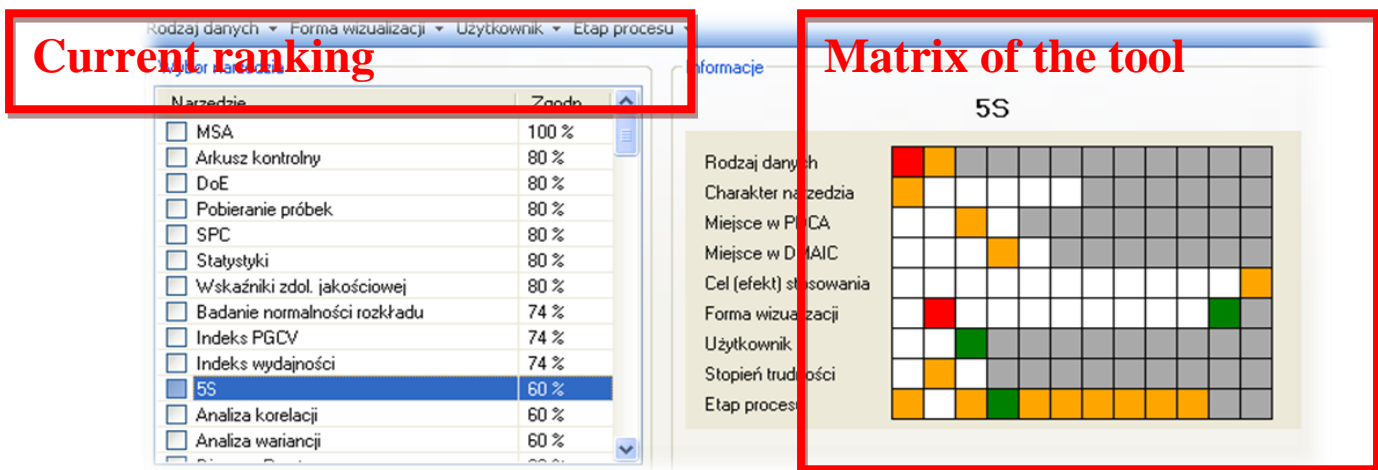


Figure 6. Elements of DSS system – user interface

Built in the system editor of knowledge allows adding, editing and deleting of data from the database of the program. This part of the program is intended mainly for the expert to introduce knowledge about the tools, and data are presented in the form of a tree (Figure 7).

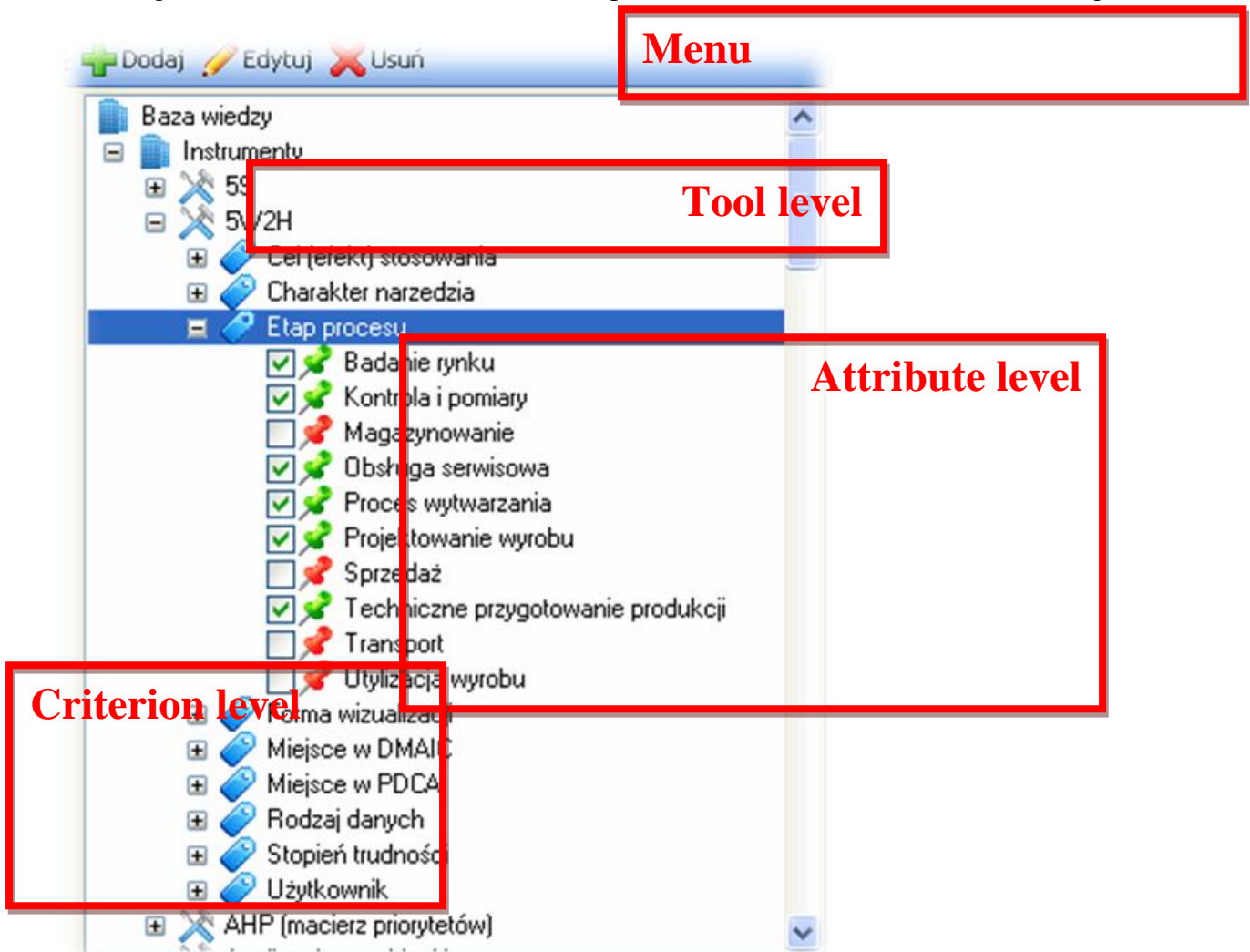


Figure 7. Tree fragment in the editor of knowledge - three levels

The user interface allows in a direct way to find the right tool, fulfilling the specified by the user criteria. A user goes through the next steps of the decision making process by clicking on the appropriate tab, the selection of the next criterion can be made independently or based on the suggestions of the system (automatic selection as a result of "learning" system).

The application will remember the changes, which the user makes while selecting the features (or rather their states) in each tab, based on the method of the matrix of criteria (module of the same name is located in the main window). In the database both the order of selection of criteria and features indicated by the user are recorded. User after using the selected tool may return to previously saved session and assess whether the selected tool fulfilled his/her expectations in practice. Evaluation of the session is very important so that the program could determine whether

a given "path" of selection is correct. In this way, the collection of information about sessions allows for effective finding of the searched tool through the usage of the previous experience of other users of the system.

In each successive step of the decision making process, the user selects the features of his/her interest, corresponding with the next selection criteria. The tab, which is the equivalent to the selection criterion, indicates a finite list of states of a given attribute. The list of features (according to the accepted criteria) consists of a list of possible states for the indicated feature. With the moment of indication by the user of a specified, desired property, in the bookmark's window, there is information about the number of tools that fulfill a particular feature, and so called compliance rate is calculated. At any time of searching for an adequate tool, one may pass to the "Summary", in which one finds the current ranking of tools that fulfill the requirements of the seeker of the quality tool and the percentage rate of compliance of a tool (or rather its features) with requirements of the user.

Pointing the cursor on each cell of the graphical matrix, the user receives information about the state of feature hidden under the given cell in a row, corresponding to another feature. At the bottom of the tab "Summary" there is also help, divided into six categories, describing the highlighted tool in the tool ranking. Help allows to get familiar with the characteristics of the given tool and the extension of the user's knowledge about its use (Figure 8).

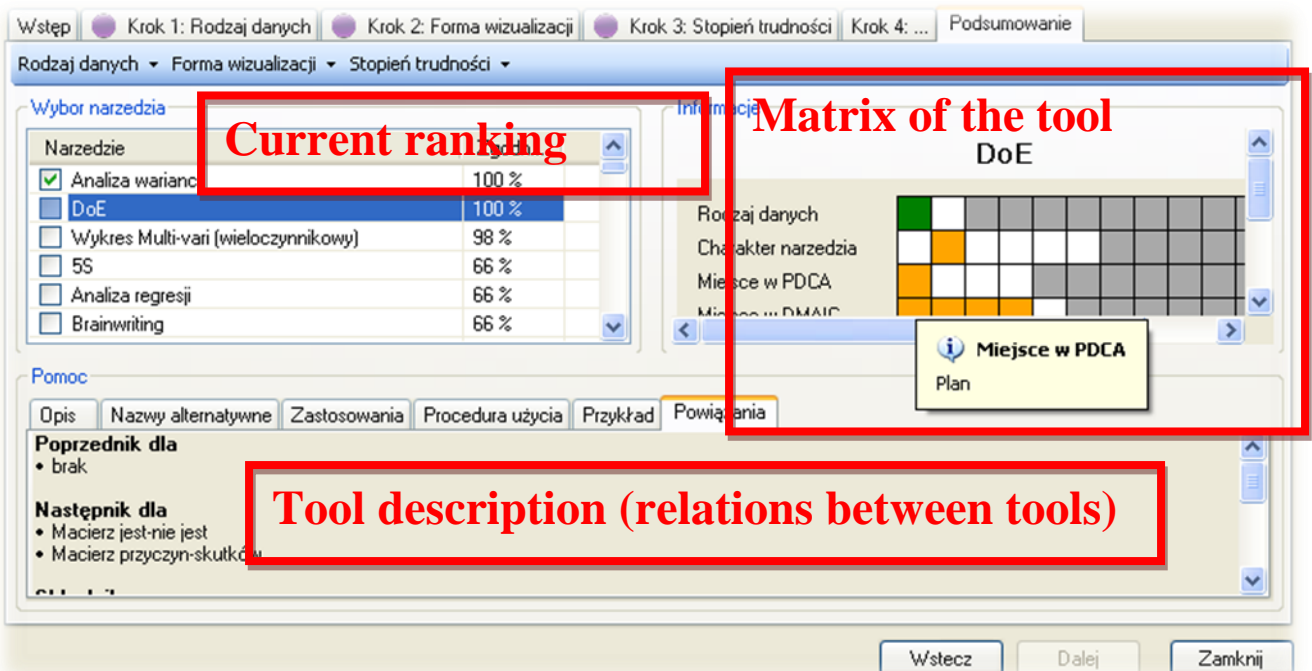


Figure 8. The window of selected tool description

In order to determine more precisely the characteristics of the searching tools, the user can assign importance to each of the searched criteria (low, normal, high priority). In addition, the criteria may be identified as critical to enforce the fulfillment of the conditions by the sought tool. Critical criterion must be absolutely fulfilled. Tools that do not meet the critical criteria are not

taken into account when calculating ranking. This results in a significant narrowing of the group of the searched tools. Bookmark with critical criterion is marked with a red symbol.

Selection of features tools that meet the selection criteria results in the creation of tool ranking, which can be seen while going to that tab "Summary". This list shows the ranking of the tools sorted by relevance with the selected user-selection criteria. The view of graphical matrix for each tool from the list allows for visual analysis which criteria is fulfilled by the tool, i.e. what features it possesses. Compliance of the tool is calculated due to the number of fulfilled criteria. It has been adopted that the feature meets the criterion of choice "globally", i.e. if it indicates at least one of the states within the scope of a given, multi-state feature. Thus, if the tool meets all user-selected features, the compatibility is 100%. Tool "MSA" (Figure 9) has one failed feature (red color), despite this compatibility is 100% since an alternate feature is fulfilled (or rather its state) under the criterion of "visual form".

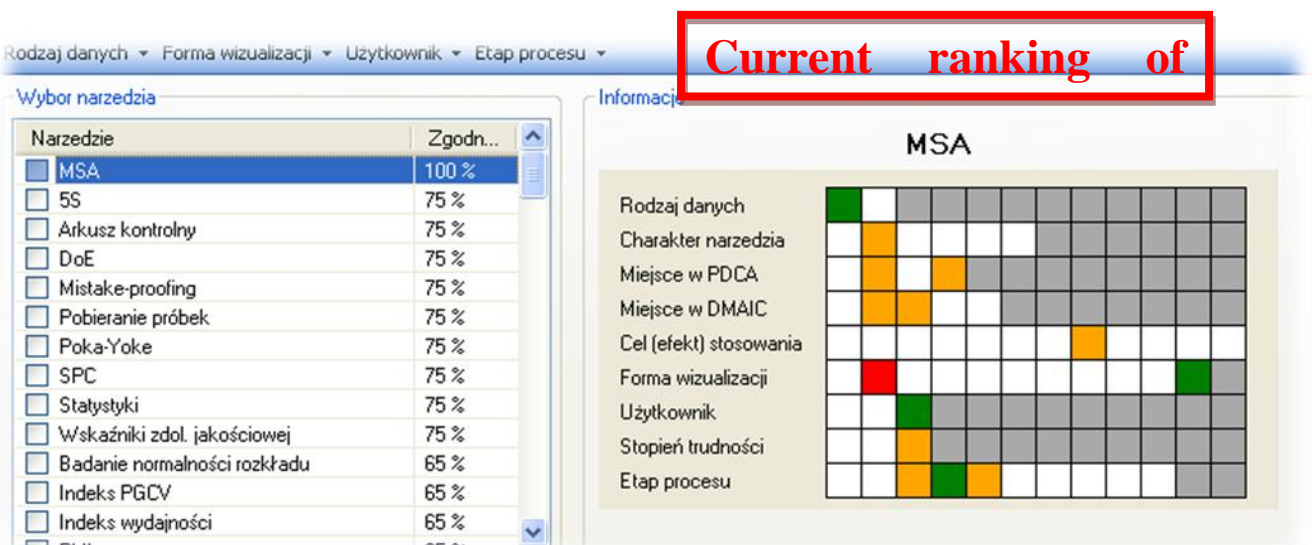


Figure 9. The results of the sample tool ranking

If the tool is described with a given feature, and no value of this feature was introduced to the system by the editor of knowledge, it is highlighted in the graphical matrix (in the "Summary") in black color. In this case, compliance of the tool with the requirements the user is calculated in a different way. Criterion, which has a "gap" of knowledge is ignored. In addition, the tool gets a "penalty" equal to 1% for each criterion, with the lack of knowledge. In this way, a tool with "lack of knowledge," will always be lower in the ranking than the tools that meet the corresponding criterion, but higher than tools that do not meet this criterion (since there is a chance that the criterion with "lack of knowledge" may be useful in practice).

Conclusions

This paper presents a new method for selection and application of quality management tools and techniques (MMC) for the needs of improvement of manufacturing processes, with particular attention to conditions of their application in the practice of enterprises. Compared to previous studies in this field, the solution is characterized by two distinguishing marks:

- whereas the way of presentation of QM tools in available studies is aimed at broad indication of their possible applications and does not take into account the limitations of their usage in practice - the proposed method fills this gap – it enables choice of the useful tool while taking into account such constraints as process limitations, informational, organizational, staff and others (reflected in the selection criteria),
- the method has been implemented in the form of a software application, supporting the choice of instrument for QM, taking into account multiple selection criteria (decision support system DSS).

Further work will consist in improving the functionality of the system, development of a network version of the software and further filling with knowledge. The method of recording of this knowledge is not limited only to the quality tools & techniques - it is possible to incorporate into the system tools and methods used in the broad sense, integrated management systems and solutions on the borderline of management and organization of production, being a guarantee of excellence creation in business development - hence the name of the application: "Excellence Toolbox".

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Exploring Environmental Labeling as a Means of Product Differentiation in the Outdoor Industry

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Category: Research paper

Introduction

In an increasingly competitive market, finding a way to distinguish your product and brand from your competitors becomes a matter of survival. In marketing, this is often referred to as a matter of positioning (Ries, 2001; Aaker, 1982) or creating a Unique Selling Proposition (USP) that gives consumers a compelling reason for buying your particular brand or product (Reeves, 1961). As stated by Keller (1993) these reasons may be based on product-related or non-product-related attributes or various benefits. The vital process of distinguishing a product or offering from others to make it more attractive to a particular target market is furthermore referred to as product differentiation (Chamberlin, 1933, 1951). Put simply, the ideas about USP and product differentiation suggest that your product needs to be perceived as positively unique, or else it will die.

However, finding new means of product differentiation that are both highly relevant to the target customers and hard for competitors to copy is a tough challenge. As a result there is a continuous search for new and better means of differentiating in practice. Since all products to a greater or lesser extent cause environmental impact during their life-cycle, one such means might be by sustainability and environmental aspects. Bergman & Klefsjö even argue that *“as awareness about environmental issues gains strength in the public opinion, environmental friendliness in different forms will no doubt be an important argument for the quality conscious customers’ choice of products”* (Bergman & Klefsjö, 2010, p.598). Consequently, social and environmental responsibility might not only be a matter of goodwill and responsibility, but also a potential source of differentiation and competitive advantage. In order to realize this potential a company’s social and environmental responsibility need to be communicated to the customers. To do this, using a certification process combined with eco-labeling is a systematic approach. A certificate from an independent party, confirmed by a label, could function as a guarantee to the customer that the product fulfills specified requirements.

Despite the fact that green product labels frequently are envisioned as potential drivers for positioning the product’s image and as product differentiator in theory, this has proved to be more problematic in practice. Misleading labels that have been used to profit from the “green market” may have negatively affected the customers’ opinion about eco-labels in general. This *green-washing* has been frequently discussed, defined i.e. by Lyon & Maxwell (2011, p.9) as *“...the selective disclosure of positive information about a company’s environmental or social performance, without full disclosure of negative information on these dimensions, so as to create*

an overly positive corporate image”. As a result, firms have a hard time choosing which eco-labels to actually put on their product. Furthermore the potential winnings from a certification process together with the use of eco-labeling are unclear. Does it really increase the attractiveness of the product?

This study aims to contribute to clarifying these issues by examining the role of environmental labeling from the customers perspective. More specifically, the purpose is to explore to what extent environmental labeling is currently being used, and whether it functions, as a means of differentiation and a driver of attractive quality within the outdoor industry.

Environmental Certification and Labeling

Certification is a common name for processes that are used to decide whether a product, system or person meets certain specified requirements. Consequently, a certificate can work as a guarantee to the customer that the product or service meets these requirements. Certificates may be either mandatory or voluntary. They can consist of requirements of different kinds but are often related to security, social and environmental issues. Different types of environmental certifications are becoming more common (Swedac, 2011).

Products that are certified may in some cases be allowed to use a label to communicate the awarding of the certificate to the customer. In the international standard ISO 14024:1999, the overall goal of environmental labeling is clearly described as “...*through communication of verifiable and accurate information, that is not misleading, on environmental aspects of products and services, to encourage the demand for and supply of those products and services that cause less stress on the environment, thereby stimulating the potential for market-driven continuous environmental improvement*” (ISO 14024:1999, p.6). Obviously, environmental labels are meant to work as a quality attribute and a means of differentiation.

The ISO14020 series distinguishes between different types of environmental labels. Type 1 environmental labeling programs, specified in ISO14024, award their environmental label to products which meet a set of predetermined requirements. These labels are voluntary, can be operated by public or private agencies and can be national, regional or international in nature. Type 2 environmental labeling is specified in ISO14021 and refers to self-declared environmental claims. These are made without certification from an independent party. Type 3, specified in ISO14025, includes environmental declarations and are meant to be used to compare different products with each other.

In addition to the actual criteria of the environmental label, several factors affect how customers are influenced by these. To reach the overall goal of ISO 14024, the content of the label needs to be communicated to the customer in an objective way and the label criteria has to be easily understood. There appears to be a proportion of consumers that find product labels hard to understand (D'Souza, Taghian & Lamb, 2006). Moreover, lack of information and subjective information is confusing to the customers and could cause a negative attitude to environmental labels in general.

To study customers' preferences regarding environmental labeling today is therefore of interest. Do environmental labels actually encourage *the demand for products that causes less environmental impact*? In this study four labels are included. The first one, the Nordic Eco-label,

is one of the most commonly used eco-labels in Sweden and is used for a lot of product categories. The other three are mainly used for textile products and are commonly used on ski jackets. The included labels are described below.

The Nordic Ecolabel

The Nordic Ecolabel is a voluntary ecolabel that was established in 1989 by the Nordic Council of Ministers. The purpose was to provide an environmental labelling scheme that would contribute to sustainable consumption. Products are certified from a life-cycle perspective. Today there are 63 product groups and more than 1100 Swedish companies that market Nordic eco-labelled products. (The Nordic Eco-Label, 2011)

Unfortunately, the Nordic Ecolabel is a well-established environmental label in Scandinavia. Bjørner, Hansen & Russell (2004) have found that this label has a significant effect on consumers' brand choices.

Oeko-Tex

The Oeko-Tex Standard 100 is an international testing and certification system for textile raw materials, intermediate and end products at all stages of production. This standard was developed in 1992 in order to ensure a comprehensive level of safety for all levels of production. Today more than 9500 manufacturers in over 80 countries have their products tested and certified according to this standard and there are 95 000 certificates issued.

The Oeko-Tex standard 100 has four product classes, depending on how intensively the product comes into contact with the skin. Product Class 1 includes textile and textile toys for babies and small children up to the age of three. Class II includes textiles where a large part is in direct contact with the skin. Class III includes textiles that do not come into contact with the skin. Class IV includes materials for interior and decorating purposes. Manufacturers are entitled to label successfully tested products or article groups with the Oeko-Tex logo. They are also allowed to advertise in other ways as long as it has been proven within the laboratory tests that all components, including accessories, comply with the specified test criteria. A certificate which is issued is valid for one year and can be renewed as often as required. (Oeko-tex association, 2011)

Bluesign

Bluesign technologies ag, based in Switzerland, was founded in 2000 by a group of textile and chemical experts. The bluesign standard is based on five principles of sustainability: *Resource productivity, consumer safety, air emission, water emission and occupational health and safety*. The focus is not on the finished product, but rather on the individual components.

To get the "bluesign[®] safety" certification for final products, all components of the final product have to comply with the requirements of the bluesign standard. The implementation process is divided into three steps. First, a screening is done to evaluate the company on-site. Then during the implementation step, critical factors during the screening phase are resolved and an implementation plan is conceived. Finally, if the inspections performed are successful, certificates are issued. (Bluesign, 2011)

Eco Index

The Eco Index initiative is led by the Outdoor Industry Association and the European Outdoor Group. The Eco index is a tool that is designed to advance sustainability practices within the outdoor industry and helps companies to measure their ecological footprint and to identify areas for improvement. It is a comparative scoring system that measures the products environmental impact during its life cycle and built around five guiding principles: *collaboration, open-source information, transparency, scalability* and *global reach*. (Eco index, 2011)

According to the website, Eco Index is currently an internal supply chain tool and not a consumer oriented label (ibid.). However, in practice it is used as one by several companies.

The Kano Model and Classification of Quality Attributes

Customers have different needs and expectations and react differently depending on whether these are fulfilled or not (Bergman&Klefsjö, 2010). A conceptual model of the different types of customer needs is the Kano model, presented by Kano, Seraku & Takahashi (1984) and further discussed in Kano (2001).

Kano, Seraku & Takahashi (1984) classify some quality elements that are based on the correlation between physical fulfillment and user satisfaction. Quality elements that provide satisfaction when they are fulfilled but when not fulfilled are considered acceptable are called *attractive*. The elements that result in satisfaction when fulfilled but dissatisfaction when not fulfilled are called *one-dimensional*. These are expected by the customer. Elements that are taken for granted when fulfilled, but result in dissatisfaction when not fulfilled are called *must-be*. These are necessary. There are also elements that do not result in either satisfaction or dissatisfaction. These are classified as *indifferent*. Finally, elements that cause dissatisfaction when fulfilled and satisfaction when not fulfilled are classified as *reverse*. The relation between these elements and customer satisfaction are described in Figure 1:

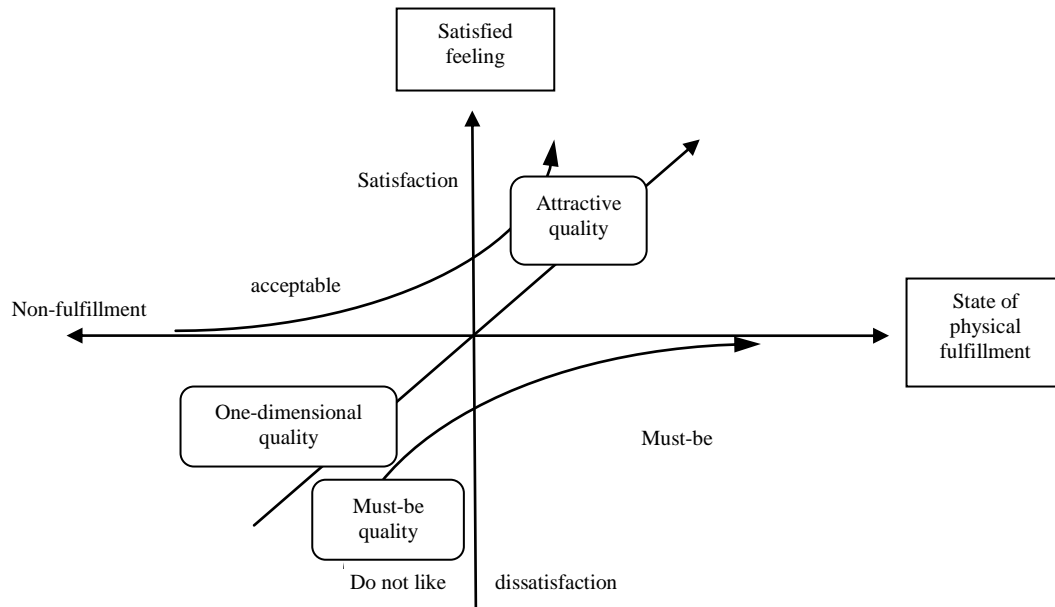


Figure 1 The Kano model (From Kano, 1984)

Moreover, customers' preferences can change over time, e.g. Kano (2001) or Löfgren, Witell & Gustafsson (2011). For example, elements that when first introduced were classified as attractive can change to be merely expected after some time.

One tool that could be used to examine how different product characteristics are experienced by various customers is the Kano questionnaire. By asking people how they feel if the characteristic is present and if the characteristic is not present, a classification of the quality attribute could be made. The Kano questionnaire could either be five-level as described in Kano, Seraku & Takahashi (1984), or three-level as described in Kano (2001). Witell & Löfgren (2007) recommend practitioners to use the five-level Kano methodology.

Method

A Kano questionnaire was designed to investigate how the included labels have an influence on customers. The respondents had to answer the questions below, followed by a picture of each of the labels:

- *If you want to buy a new ski jacket and it displayed this label, how would you feel?*
- *If you want to buy a ski jacket and it didn't display this label, how would you feel?*

For each question, five possible answers were provided: *positive*, *expect that*, *neutral*, *can accept that* and *don't like it*. The questions were tested on eight students who also then did the data collection. The questionnaire was given directly to ski tourists in the region of Åre in Sweden during the Easter holidays of 2011. All respondents were in the age between 18 and 35 years, about as many women as men. The answers were classified according to age, gender and their awareness of environmental impact when buying new products.

Findings and Discussion

227 answers were collected. These were classified by their identified quality element, according to the Kano questionnaire. The result is presented in Table 1.

Table I: Results from Kano questionnaire

	The Nordic Ecolabel	Oeko-Tex	Bluesign	Eco Index Points (86%)	6/7
Attractive	94	62	49	66	
One-dimensional	48	20	7	19	
Must-be	12	25	6	13	
Indifferent	63	109	153	114	
Reverse	1	3	2	5	
Doubtful	2	1	1	0	
Incomplete	7	7	9	10	

A graphical comparison of these elements for each of the labels is presented in Figure 2.

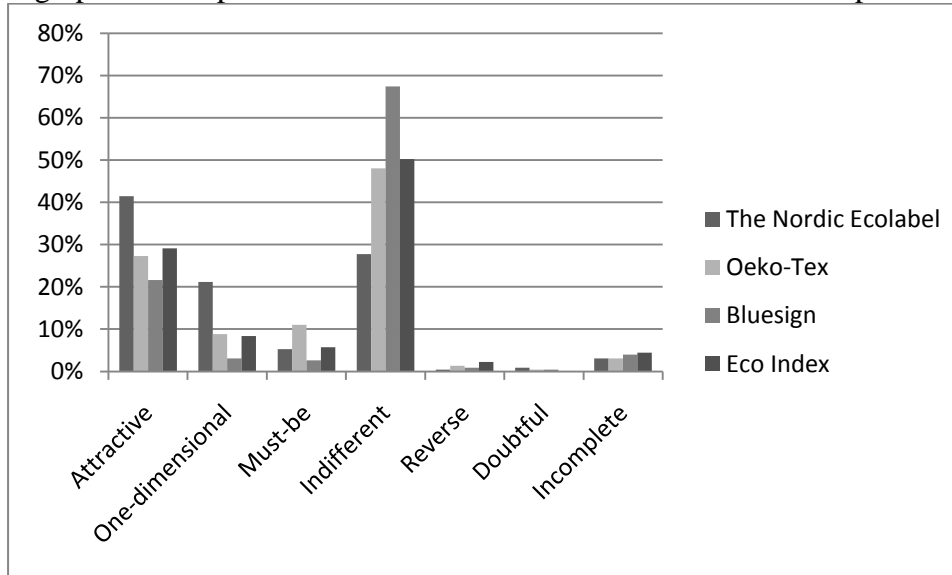


Figure 2 Results from Kano questionnaire

67 percent of the respondents said that the Nordic Ecolabel influenced them in some way. For the other labels this share was 48 percent (Oeko-Tex), 29 percent (Bluesign) and 45 percent (Eco Index). Between 22 and 41 percent of the total answers, depending on label, could be classified as *attractive*. Between 3 and 21 percent could be classified as *one-dimensional*, and between 3 and 11 percent could be classified as *must-be*.

This study was carried out to explore whether environmental labeling is currently being used, and functions, as a means of differentiation. Although many customers find environmental labels attractive, *more attention may need to be done by the companies to communicate the meaning of these*. However, consumer education is a very big challenge.

Grading the total environmental impact may be one possible way to communicate label to the customers. This could give the company the opportunity to get a total score that they can improve continuously. The score is also easy to understand by the customers, provided that it reflects the real environmental impact. Eco Index is such an initiative but still quite new.

The answers may however not exactly mirror the actual buying behaviour. When buying a product is it possible to get more information about each of the labels. However, since the Nordic Swan is found to be more attractive, a lack of knowledge about the meaning of the others is identified. A quite large group said that the products environmental impact play an important part in their buying decisions. This rate could maybe be increased, by informing more about the label criteria.

The study does not evaluate the criteria of each certificate. In order for the environmental certification of products and the delivery of an ecolabel to become more significant competitive advantages, ecolabel programs must be credible and transparent, and the methods must be harmonized (Lavallée & Plouffe, 2004). This could be a subject for further research, as well as how to communicate the label criteria more effectively.

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Reflexion of various perspectives of prevention – What Quality Management can learn from?

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Introduction

Products, processes and organizations become increasingly complex. To remain competitive in this complexity efficient design of products, processes and organisation as well as continuous improvement of those elements are decisive. An effective approach to realise organisational design and continuous improvement is the holistic realisation of prevention. Prevention is an essential part of quality management. Nevertheless, prevention in quality management is not fully described. (Luban, 2010)

To describe prevention in quality management an investigation has been conducted in the fields shown in Figure 1. This investigation is based on literature and includes different perspectives of prevention. The results are evaluated whether aspects of prevention of the considered fields are transferable to prevention in quality management and whether recommendations for prevention in quality management can be derived.



Figure 60 considered fields within the investigation on prevention

Understanding of Prevention

Prevention is interpreted in various ways in the considered fields. Apart from the differences between the fields there is even within the particular fields no definition which is consistently accepted. In general prevention originates from the Latin term “*praevenire*”; which means to avoid something or somebody.

To illustrate the differences of definitions only within one field, medicine and psychology are closely considered. For example SCHÜZ defines prevention in context with health psychology as

the measures to improve or to prevent diseases. (Schüz, 2006) Whereas the German Federal Ministry of Health defines prevention as the sum of possibilities to behave health-consciousness. (BMI Gesundheit, 2010) Especially the public health sector has developed different definitions of prevention. A selection of those definitions is described in the following and presented in Figure 2.

The Parliamentary group of the German parties distinguish between primary, secondary and tertiary prevention. Those categories are explained in the course of the paper. This approach emphasises the importance of health promotion which is assigned to prevention. (Deutscher Bundestag 2005)

The Federal Assembly of the Swiss Confederation focus on risks of diseases. In difference to the definition by the German parties this approach is only directed to diseases, it does not consider health promotion. (Bundesamt für Gesundheit Schweiz 2009)

The last presented approach is developed by the German Federal Ministry of Health. In the *Guidebook for healthy Prevention* “prevention is defined as preventive measures to avoid an undesired event or an undesired development” (Bundesministerium für Gesundheit 2010). This approach focuses again on diseases and does not consider the aspects of health promotion.

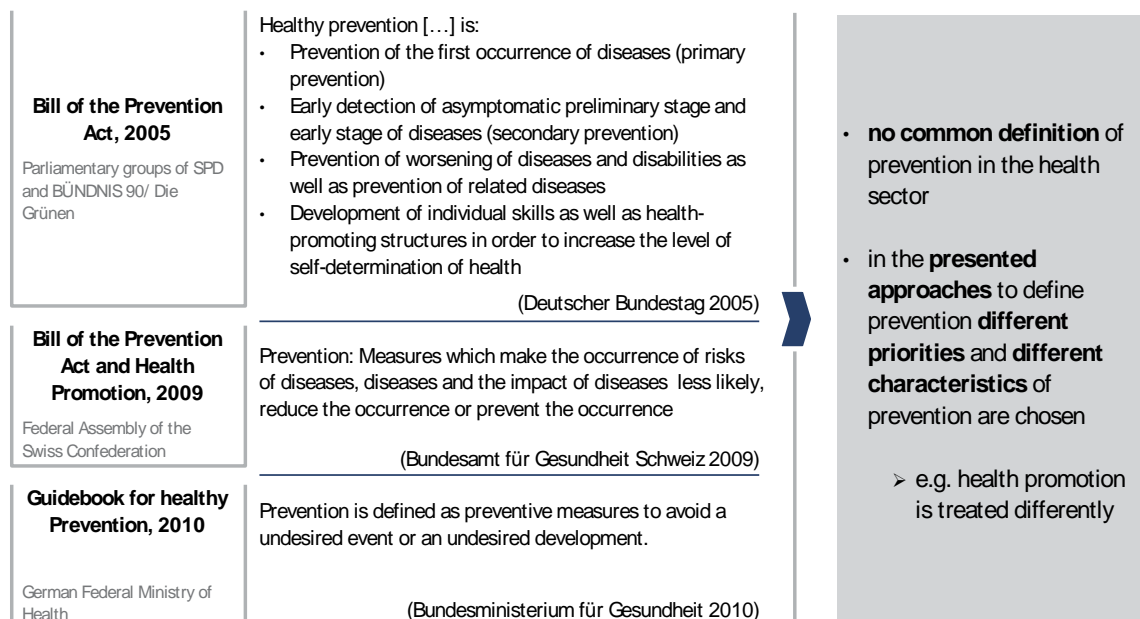


Figure 61 comparison of different approaches of defining prevention by the public health sector

Regarding the further investigated fields similar perception can be made. Prevention is widely discussed and field-specific differentiations, e.g. crisis prevention, addiction prevention, prevention of violence or crime prevention and many more (Schubarth 2000, Deibel et al 1999, Meier 2010, Schmid 2001) have been developed. It is already criticised that prevention becomes a buzzword and is increasingly meaningless and not precise. (Schubarth 2000)

Despite the specific applications prevention in general has the common objective to avoid something. Therefore it is necessary to define which conditions need to be prevented. In regard to the different definitions of prevention the main difference is the consideration of risk and risk factors. Depending on the specific fields there are further distinctive features of prevention which differ within the fields. Health promotion can be interpreted as such a feature because it is treated differently as shown in Figure 2.

Prevention is a central topic in quality management. Even so it is remarkable that there are only few approaches to investigate prevention systematically in quality management. (Luban 2010) Quality management literature regarding prevention reveals the concept of *preventive quality management*. Preventive quality management and preventive quality assurance is defined as follows:

- *“Under preventive quality assurance should be understood the quality assuring measures which are applied in the concept development phase, the construction and industrialization phase. [...] The Start of Production illustrates the end of the preventive quality assurance in the automotive industry.”* (Göbbert 2003)
- *“Under preventive quality management is to understood all activities be used in product development through quality planning and quality control.”* (Dietmüller 2007).

Most of the common and excepted concepts of preventive quality management focus on the development process. SCHULZE and MOHR for example developed a broad approach of preventive quality management. They base their concept on the thesis “Prevention instead of Reaction”, but still they only consider the development process (Schulze 2008). Beyond the development process prevention is almost undescribed in quality management. In summary prevention needs to be redefined in a comprehensive way considering the whole value chain.

In order to derive a consistent understanding of prevention in quality management the knowledge of the investigation on prevention is to be used. As a result of the investigation on prevention different aspects can be recommended to define prevention in quality management.

The first recommended aspect for prevention in quality management is the avoidance of non-conformity. The customer determines what is meant by conformity. Therefore it is very important for a comprehensive understanding of prevention that intern as well as extern customer relations are considered. Furthermore risk consideration needs to become an integral part of prevention. A systematic approach to realise prevention can only occur through analysing risk factors and applying measures to reduce the risk. In addition to those described recommendations prevention must address the whole organisation. Every process, process participant and every product must be taken into account by prevention. Beyond avoidance prevention needs also to focus on the consistent improve of quality. In summary Figure 3 gives an overview of aspects which can be used to define prevention in quality management.

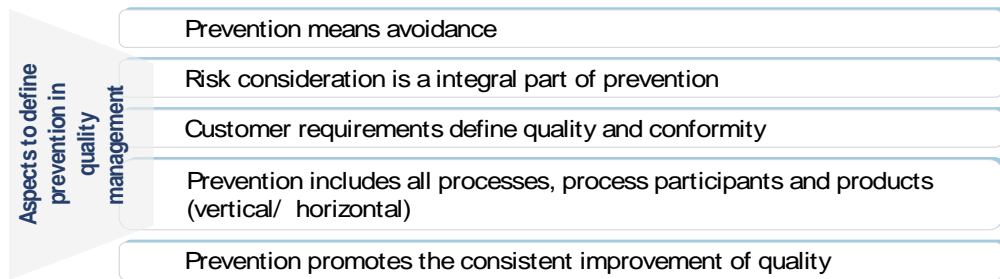


Figure 62 aspects to define prevention in quality management resulting from the cross-sector investigation on prevention (Authors' design)

Categorization of Prevention

Apart from the understanding of prevention the categorization of prevention is investigated. Prevention is categorized in every investigated field and is mostly part of a prevention concept. Three methods of categorization have been established. Figure 4 outlines the different approaches to categorize prevention. It is distinguished between the aim of prevention, the target groups and the level of intervention.

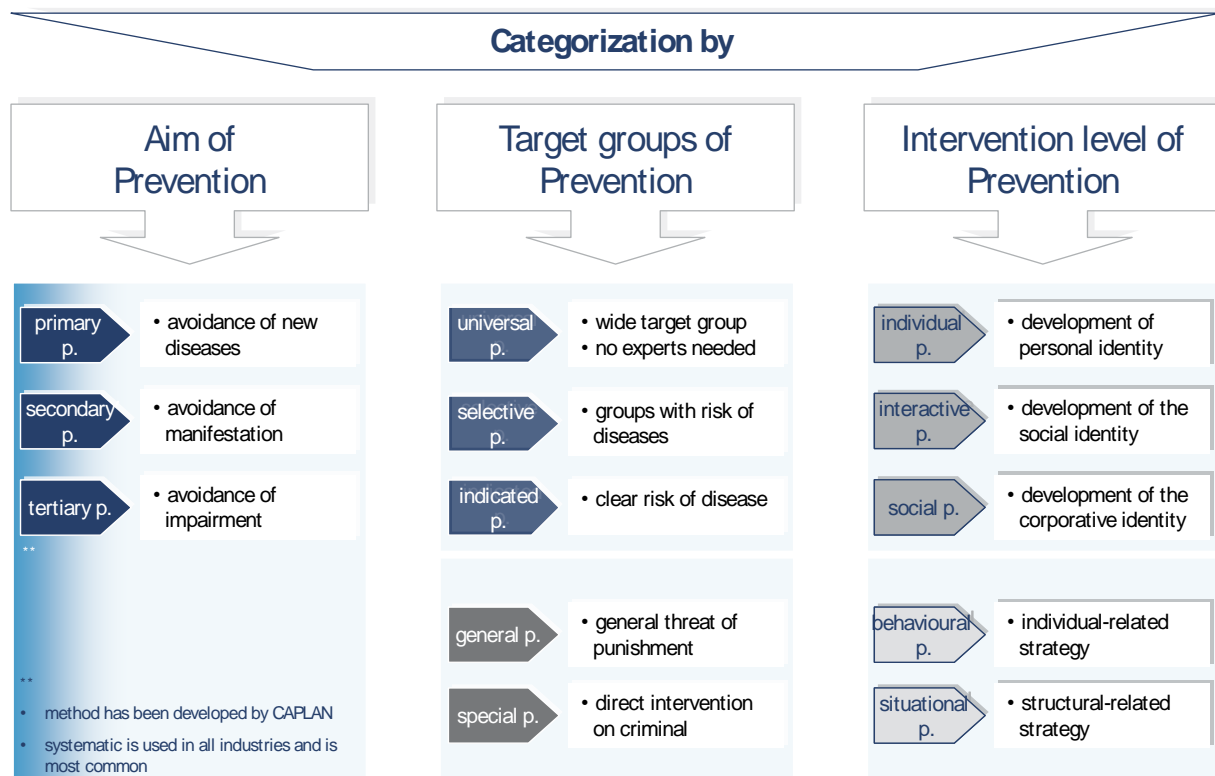


Figure 63 methods of categorizing prevention used in the investigated fields (Authors' design)

One of the first approaches to categorize prevention has been developed by CAPLAN for social medicine. CAPLAN categorizes prevention with regard to the aim and distinguishes between

primary, secondary and tertiary prevention. (Caplan 1964) The concept of CAPLAN has been adopted by various people of different fields. As a result there exist different adoptions of primary, secondary and tertiary prevention. The categorization by CAPLAN as well as a selection of adoptions is described in the following.

- In social medicine **primary prevention** relates to the avoidance of new cases of mental disorder. It addresses the whole population and is not concerned about a specific person. (Caplan 1964)

Concerning primary prevention in quality management LUBAN points out the importance of establishing structures and general conditions, like the introduction of a quality management system. (Luban 2010) KAISER, however, interprets primary prevention as the positive general prevention in criminology. (Kaiser 1997) In social work SCHUBARTH describes the primary prevention as structural, group-related or individual-related measures. (Schubarth 2000)

By considering primary prevention it can be said that similar to the understanding of prevention the categorization does not underlie general standards. All of the presented interpretations of primary prevention have in common that they refer to CAPLAN.

- The consideration of risks and risk factors is crucial for **secondary prevention**. As an example for social medicine the definition of secondary prevention of CAPLAN is presented. CAPLAN defines secondary prevention as “programs which reduce the disability rate due to a disorder by lowering the prevalence of the disorder in the community” (Caplan 1964). Similar to primary prevention SCHUBARTH, LUBAN or KAISER have generated concepts for secondary prevention in the respective fields. The concepts have in common that they address risk groups and furthermore, they pursue the identification of non-conformities as early as possible. Secondary prevention in criminology refers to negative general prevention Thereby potential offenders are deterred by the use of fear of punishment.
- **Tertiary prevention** refers to an occurred non-conformity. It pursues the reduction of damages by target-oriented intervention. (Caplan 1964) Rehabilitation is an example for tertiary prevention. Theoretical approaches of the investigated fields concerning tertiary prevention reveal only slight differences. These differences are due to a specific alignment on the individual field.

As shown in Figure 4 prevention can also be categorized by using further methods. The categorization of target groups distinguishes universal, selective and indicated prevention. This method has been developed by GORDON in 1983. (Gordon 1983) **Universal** prevention addresses everybody. Furthermore, the measures require no professional advice or assistance (Gordon 1983). The second target group considered by GORDON is characterized by an increased risk. The so named **selective prevention** is only applied when risk and costs are balanced. (Gordon 1983) **Indicated prevention** focuses on the population with manifest risk. (Gordon 1983)

A specific categorization method is established in criminology. Criminology distinguishes between general prevention and special prevention. **General prevention** responds to people who have not been criminal but might be in future. Furthermore general prevention is divided into

positive and negative forms. Positive general prevention pursues to establish a sense for right and wrong through the definition of sanctions. The negative general prevention is directed to people who have not yet been criminal but who show an increase risk factor. Fear of been punished should prevent them to become criminal. (Kaiser 1997) **Special prevention** responds to people who are criminal. The execution of punishment is a measure of the special prevention. The aim is to prevent people of being criminal again.

An additional approach to categorize prevention is the consideration of the level of intervention. A special approach of social work will be described. SCHUBARTH distinguishes the individual level, the interactional level and the social level. The approach has been developed for the avoidance of violence. **Individual prevention** pursues to support the development of personal identity in order to learn to deal with frustration and aggression. (Schubarth 2000) The development of social identity is regarded by **interactive prevention**. Through social identity the interaction with family, school and friends is much easier. Finally the social level is very important to feel integrated in society. Therefore community identity needs to be developed by **social prevention**. (Schubarth 2000)

In difference to the approach by SCHUBARTH, which is specially developed for social workers, the distinction of behavioural and situational prevention is common in all investigated fields. **Behavioural prevention** is an individual-related strategy and pursues to influence the individual behaviour. Whereas **situational prevention** focuses on the modification of physical and social environment. Therefore the situational prevention is a structural-related strategy. (Schüz 2006)

The knowledge generated by investigating the categorization in different fields can be transferred to prevention in quality management. The investigation on categorization methods shows that the distinction between primary, secondary and tertiary is most versatile. Besides it offers the possibility to combine different categorization methods. MEIER, for example combines primary, secondary and tertiary prevention with offender-related, situational and victim-related prevention. (Meier 2010) LUBAN considers likewise the distinction between primary, secondary and tertiary as reasonable. (Luban 2010)

An additional aspect to categorize prevention in quality management is risk management. Risk and risk factor become central criteria for the categorization. Risk management is a decisive part of quality management and it enables to anticipate non-conformity and to react before occurrence. But it is still necessary to define individual criteria to categorize prevention in quality management. Figure 64 shows a deliberately general approach to categorize prevention in quality management. The approach has been developed by the author and considers the knowledge gained by the cross—sector investigation on prevention.



Figure 64 resulting approach to categorize prevention in quality management (Authors' design)

Following the developed approach shown in Figure 64 **primary prevention in quality management** pursues to avoid unidentified or not considered non-conformities. This form of prevention is addressed to every process, process participant and to the whole organisation. Within primary prevention it is necessary to establish basic requirements by defining structures, organizations and processes which are suitable for prevention. An additional aspect of primary prevention in quality management is the consideration of quality culture and human-related aspects, for example a sustainable qualification concept.

Secondary prevention in quality management is directed to the risk consideration. It occurs when risk and risk factors have been identified. Secondary prevention intervenes in order to reduce risks and to avoid the manifestation of non-conformity. In difference to primary prevention it only addresses processes and process participants with increased risk. The implementation of statistical process control, SPC, or quality feedback loops is exemplary for secondary prevention. Furthermore the quality method "Failure Mode and Effects Analysis" (FMEA) can be assigned to secondary prevention.

Tertiary prevention in quality management regards to the case when non-conformity occurred. Basically, repetition must be avoided. Furthermore, it is important to assure that similar processes or products with risk potentials are identified. Besides negative effects caused by non-conformity have to be minimized. Fundamentally tertiary prevention in quality management should not be negative afflicted. Even if defaults must be avoided they also represent potential for improvement. Therefore tertiary prevention contributes to the continuous improvement process.

The contribution to continuous improvement in quality characterises prevention. Every category of prevention contributes to quality improvement. Primary prevention in quality management establishes the requirements for quality management. Necessary capacity for risk management and quality information system are planned within the organisation to state only two examples. Preventive quality methods like the FMEA include the definition of preventive measure to ensure the avoidance of manifestation of risk. As a result processes become more effective. Tertiary prevention pursues the generation of a learning organisation which is characteristic for a continuous improvement of quality as well.

In addition to quality improvement prevention bears much more potentials. Within the cross-functional investigation of prevention two different perspectives of potentials appeared. Prevention affects diseases, crisis and faults. The influence on health, peace and quality can be interpreted as a different perspective. Figure 6 illustrates the possible perspectives of potentials resulting from the investigation.

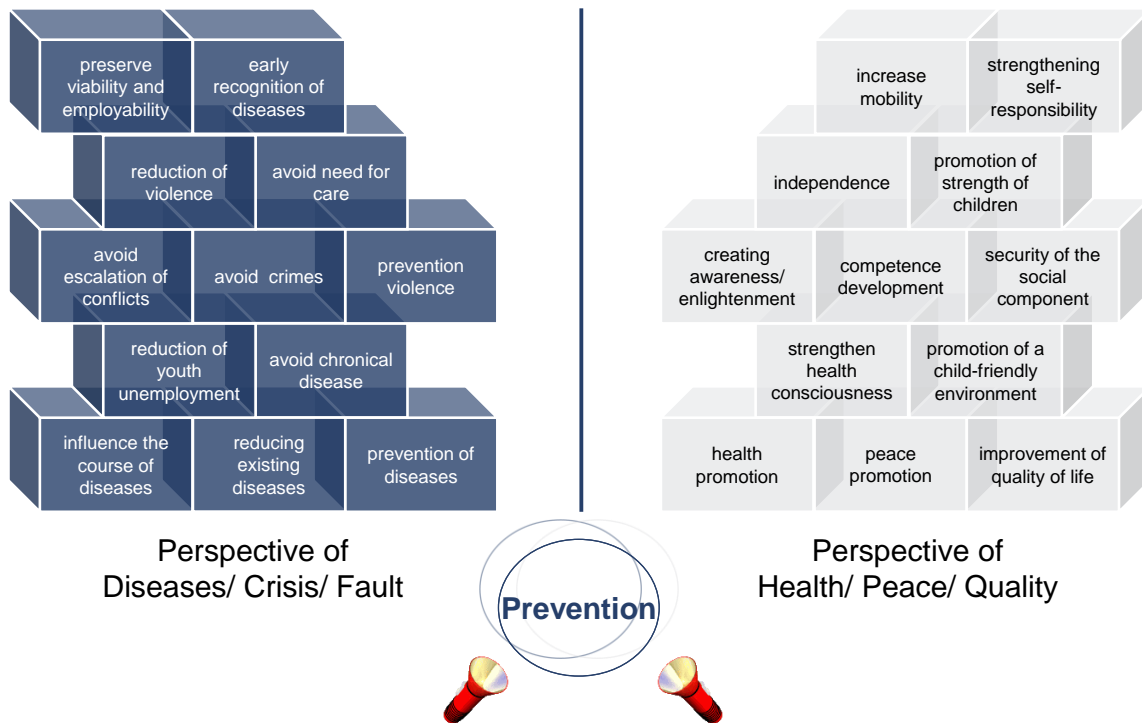


Figure 65 perspectives on potentials of prevention

Until now prevention in quality management pursues the development of a customer-oriented, innovative, fault tolerant and robust product. (Grundlach 2006) Furthermore, the planning of the customer requested quality is regarded as prevention. In addition prevention pursues the target to determine and reduce risk early in the development process. These targets reflect the focused understanding of prevention on the development process.

The cross-sector investigation demonstrates much larger potential of prevention. The transfer of a comprehensive understanding to prevention enlarges the potentials of prevention in quality management. The above mentioned targets remain but there will be also an extended perspective on the targets. For example, prevention does help to establish a sustainable quality culture and contributes also to the establishment of a corporate culture. Those cultures improve the identification of the employee with the company. Prevention can motivate employees and promote fault consciousness. Furthermore, primary prevention in quality management ensures that the right people do the right thing. As a result it enables employees to develop their competences. Those examples outline the potentials of prevention from the quality perspective. Of course, prevention also pursues the reduction of scrap and rework and effect the economic success directly. Furthermore, prevention empowers processes and reduces risks. Those examples

represent potentials from the fault perspective. The cross-sector investigation shows that the potentials of prevention are various and it shows that the possibilities of prevention in quality management have not been exhausted yet.

Summary

Prevention is an extensive topic which is variously discussed in medicine and psychology, politics, social work and pedagogics, criminology but also in quality management. But it is necessary to define prevention in a comprehensive way. Otherwise the potentials of prevention cannot be tapped. Regarding the categorisation of prevention it is important to consider that the categories built up on one another. The way primary prevention in quality management is described in this paper, it illustrates the bases of prevention. Secondary and tertiary prevention cannot be successfully implemented if primary prevention has not established the framework conditions. The establishment of prevention promoting organization, structures and processes is necessary to implement an effective prevention.

Even only few literatures in quality management are regarded to prevention it is a central and recognized topic in quality management. (Luban 2010) When taking into account the various potentials of prevention in quality management it is obvious that a comprehensive approach needs to be developed which defines prevention in a comprehensive way and which illustrates the potentials in detail.

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Applying Gemba-Kaizen in a multinational food company—a process innovation framework

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Introduction

The Japanese management philosophy known as ‘*Kaizen*’ (改善) was introduced as a new, creative operating strategy to improve the competitiveness of 21st Century companies (Imai, 2006). When Masaaki Imai published his first book in 1986, *The Key to Japan’s Competitive Success*, the term *Kaizen* began to receive attention from management experts and scholars around the world. A decade after publication of his first book, Imai expanded the scope of *Kaizen* in another book in 1997—a contribution which laid further stress on ‘The Japanese way’ in *Kaizen* strategy and in particular the importance of the workplace (where real action occurs) in continuous improvement.

Even ‘total quality management’ and ‘lean thinking’, which has received focused attention in the literature in recent years, was deeply rooted in the Japanese management and thus viewed as an integral element in the *Gemba-Kaizen* approach (Klefsjo, 1997; Al Smadi, 2009).

Over the decade from 2000 to 2010, several authors focused on the importance of innovating through *Gemba-Kaizen* processes to reap substantial quantitative and qualitative benefits in terms of time and money, cutting stock costs and what the Japanese term *muda* (無駄) [‘waste’] (Manos, 2007; Suárez-Barraza and Ramis-Pujol, 2010). Neesse (2007) indicates that keeping up effort in *Gemba-Kaizen* may help in achieving significant improvements to work processes, including better supply chain flows. In *Strategic Direction* (2004), the most important study of the decade was that by Brunet and New (2003), who concluded that *Kaizen* can be adapted to each company’s special circumstances and create a virtuous circle in its processes and management. Lastly, Suárez-Barraza and Ramis Pujol (2010) highlighted the importance of using *Gemba-Kaizen* for process innovation and for saving time in the work processes found in public company services. Villarreal *et al.* (2010) made similar findings in connection with a Mexican multinational company.

The foregoing studies provide a sample of the literature that tries to explain *Gemba-Kaizen* from the process innovation angle. Some of these studies, however, describe *Gemba-Kaizen* only from the standpoint of rapid shop floor activity similar to the *Kaizen Blitz*²⁷ approach (Laraia *et al.*,

²⁷ ‘Blitz’ being German for ‘lightning’.

1999; Bicheno and Holweg, 2009). Accordingly, there is little empirical evidence for understanding Gemba-Kaizen's 'philosophy' or core proposal when it comes to fostering implementation of process innovation methods. This also applies to short-term improvements (Kaizen Blitz) and Kaizen as a new way of looking at the workplace.

More specifically, the main question we sought to answer in this study was: *How was Gemba-Kaizen presented when it came to applying a process innovation approach to a food multinational in Mexico?* We formulated two sub-questions in our enquiry:

R.Q.1.1: What differences are there between traditional and Gemba-Kaizen 'office management' when it comes to innovating processes?

R.Q. 1.2: Is there any relationship between the effort put into implementing Gemba-Kaizen and process innovation methods in a multinational food company?

To answer the main research question and the two sub-questions, we first carried out a literature review of the Gemba-Kaizen approach and related themes. In that review, we also looked at the application of the Gemba-Kaizen approach to a food multinational in Mexico. The next step was to carry out an exploratory qualitative study based on a food multinational that had set up in Valle de Toluca, Mexico in 1998. The paper was structured as follows: (1) an introduction; (2) literature review of the Gemba-Kaizen approach and process innovation; (3) a description of the research methodology; (4) the research results and the process innovation methodology employed in a food multinational, including qualitative empirical evidence; (5) conclusions, management implications and the benefits of applying Gemba-Kaizen.

Literature Review

Gemba-Kaizen definition and implications

Masaaki Imai (1997) observes that 'gemba' (現場) means 'where things happen' and in a business context might be translated as 'the shop floor'²⁸ (Suárez-Barraza, 2007). In fact, Imai (1997) provides an example in his book, indicating that the reporters covering the Kobe earthquake in 1995 did so from the 'gemba'.²⁹ For Taiichi Ohno (2007), 'gemba' means the place where a company adds value. This is why Ohno (2007) translates 'gemba' as 'shop floor' or 'workplace', using the term to embrace the shop floor at Toyota and also the staff who work there.

The shop floor is where the value-adding processes take place (Imai, 1997; Suárez-Barraza, 2007; Suárez-Barraza and Ramis-Pujol, 2010). For Ohno (2007, p. 120) it is the only place where costs can be cut, given work processes may involve non-value adding activities (Ohno, 1978; Imai, 1986). That is why applying the Gemba approach (Ohno, 2007, p. 125) requires a basic idea of the Japanese management system and the Kaizen or continuous improvement concept, because Kaizen activities are implemented through the identification and elimination of waste at every

²⁸ 'Workplace' has been substituted for 'gemba' throughout save in the purely linguistic discussion of the Japanese word and in the term 'Gemba-Kaizen'.

²⁹ For English-speaking readers, this is clearly quite a different context, which one might render as 'ground zero' or 'the scene of destruction'.

moment and for everyone in all workplace processes (Imai, 1986, 1997; Wittenberg, 1994; Brunet, 2000). Therefore, Imai (1997) considers that the application of Kaizen in the workplace can best be indicated using the term ‘Gemba-Kaizen’. In reviewing Imai’s book, some writers—such as Klefsjo (1997)—indicate that Gemba-Kaizen invites company managers to leave their offices and desks and work closer to the shop floor so that they can grasp what ‘coal-face’ staff have to contend with, quality issues and/or waste in work processes. The lessons learnt by managers can then be applied to improving and enhancing work processes cheaply and through the application of common sense.

Other authors use the term “*Genchi-Genbutsu*” which incorporates the ‘gembu’ or workplace element and adds the idea of ‘going to the workplace and understanding the situation through direct observation’ (Liker, 2004; Liker and Meier, 2006). For Imai (1997), Gemba-Kaizen’s golden rules are: (a) when a problem arises, go to the workplace; (2) check appropriate action; (3) decide counter-measures; (4) remove the causes of the problem and standardise. Put simply, Gemba-Kaizen is based on watching staff every moment of the day with a view to making improvements to work processes (Imai, 1997; Al Smadi, 2009; Suárez-Barraza *et al.*, 2009).

Lastly, other authors have related Gemba-Kaizen with the ‘Jishuken’ (自主研) process (Toyota’s plan improvement activity) (Imai, 1997; Hallum, 2007; Osono *et al.*, 2008). In fact, Jishuken has two main purposes: (1) to solve problems in the workplace that need management attention; (2) to correct, enrich and deepen understanding of Gemba-Kaizen by management through first-hand, on-the-job application of the problem-solving principles using hands-on activity and coaching. It differs from problem-solving activity conducted by production workers (‘Team Members’ in Toyota’s language) because Jishuken involves only management teams to identify the problems and implement counter-measures (Marskberry *et al.*, 2010).

Background to Process Innovation Methodologies

Process Innovation appears in the literature in many varieties, schemes and modes concerning changes to company processes. Various authors have described different approaches and perspectives, whose core idea might be simply stated as the systematic analysis of flows and processes with a view to improving them. Notwithstanding this variety, some authors have tried to group these approaches by their common features in order to facilitate independent analysis. These groupings help identify the techniques, methodologies and tools involved. They also allow one to make comparisons of the application of each approach and the level of improvement sought. Each of these approaches can be identified and analysed as a function of various factors and elements (Childe *et al.*, 1994; MacDonald, 1995; McKay and Radnor, 1998; Jackson and Sloane, 2003; Galgano 2003), such as:

- ***The degree of change or type of improvement sought in process and organisational performance: incremental or radical change/improvement, whether in work methods or in the company itself.***
- ***Resources (financial, human, material) and the Information Technology (IT) infrastructure and use required (assessed as ‘high’, ‘medium’ or ‘low’).***

- **The potential risk of applying an improvement approach** (assessed as 'high', 'medium', 'low'). This factor also includes aspects such as: resistance to change; involvement and commitment by managers and staff; the impact of the corporate culture.
- **The scope of improvement**, focusing on: (i) the internal aspects of functional processes; (ii) complete (horizontal) processes; (iii) one or several processes; throughout the company's network of processes; (iv) processes outside the company (distributors and suppliers); (v) staff behaviour and the change process.
- **The expectation of results and benefits**. This may range from minor changes to radical ones. Minor changes include: solving specific product or service quality problems; dealing with customer complaints/dissatisfaction; cutting process costs/times. Radical changes include: improving the organisational structure; improving the network of processes; tackling design, production, distribution and sales inefficiencies and inefficacies and even drawing up new strategies.
- **Time and cost requirements of making improvements**. These depend on the impact of improvements ('high', 'medium' or 'low'), cost and time (both assessed likewise).

In the mid-1990s, traditional Total Quality Management concepts towards process-based techniques, methodologies. The world was flooded with business articles and books that have become Gospel (Grover *et al.*, 2000). Given the changes occurring in business, research focused on developing Process Innovation and identifying its strategic and operational importance (Elzinga *et al.*, 1995; Hammer, 1996; Zairi, 1997; Lee and Dale, 1998). These authors' main aim was to shift from Kaizen-style Continuous Improvement of processes falling within company departments to greater integration of processes that spanned organisational boundaries and yielded immediate, obvious benefits (Sirkin and Stalk, 1990).

Process Innovation thus seeks improvement to or redesign of business processes with a view to boosting customer satisfaction and organisational efficiency and efficacy (Harrington, 1991). This is all carried out through review and continuous learning of the best practices, which lead to radical redesign of a company's obsolete and inefficient processes and thus to better performance (Harrington, 1995). Various authors have given their own twist and name to the same idea. Thus Process Innovation can also be understood as "a systematic methodology developed to help significant advances in the way its business processes operate". Other contemporary authors such as Davenport and Short (1990, p. 24) defined it as: "*the analysis and design of workflows and processes within and between organizations*". Years later, Davenport (1993, p. 14), re-christened his methodology 'Business Process Redesign', defining it as: "*the critical analysis and radical redesign of existing business processes to achieve breakthrough improvements in performance measures*". In the literature, these authors are considered to be the first to contribute theoretical concepts such as Process Innovation (Dumay, 1998, p. 4). Scholarly and practitioners' literature on the subject reveals a wide range of innovation methods and resources for companies (Tinnila, 1995). Table 1 provides a summary

Table 1. Process Innovation methodologies found in the literature

Authors	Methodology name	Steps
- Harrington (1991, 1995) - Ward (1994) - Galloway (1994)	Business Process Improvement (BPI).	Stage 1. <i>Organising for quality</i> . Define critical processes, select process owners, train staff and establish measures. Stage 2. <i>Understand the process</i> . Produce flow diagrams, measure and analyse efficiency and cycle times. Stage 3. <i>Rationalise processes</i> . Find improvements and draw up a plan. Stage 4. <i>Implement, measure and monitor</i> . Stage 5. <i>Continuous Improvement</i> . Implement BPI.
- Chang (1994)	Process Improvement	1. Diagnose the current situation. 2. Select processes. 3. Get management commitment 4. Create support systems 5. Find improvements and carry out a pilot study 6. Implement improvement measures 7. Reflect on the lessons learnt
- Lee and Chuah (2001)	SUPER Methodology for Business Process Improvement	1. Choose the process 2. Understand the process 3. Measure the process 4. Execute the process 5. Assess improvements
- Gardner (2001)	Continuous Process Improvement	Stage 1. Gather data and information on process performance Stage 2. Set process target Stage 3. Assign responsibility and align strategic objectives Stage 4. Monitor performance and manage the operation
- Rohleder and Silver (1997)	Guide for Continuous Process Improvement	1. Establish organisational support 2. Choose the process and set up an improvement team 3. Define and understand the process 4. Simplify the process (eliminate obvious waste). 5. Solve the problems and monitor improvements 6. Implement changes and solutions 7. Innovate the process
- Yingling (1997)	Key Process Improvement	1. Identify key processes and link them to targets 2. Define key inter-organisational processes 3. Develop teams and support systems 4. Measure performance 5. Manage processes (maintenance and improvement).

- Carpinetti, Buosi, <i>et al.</i> , (2003)	Benchmark model for process improvement	<ol style="list-style-type: none"> 1. Choose items for improvement 2. Identify dimensions and processes 3. Draw up a process map and select criteria 4. Analyse and assess critical processes 5. Propose improvement measures 6. Implement measures and review progress
- Ugan (2006)	Knowledge management for documenting processes	<ol style="list-style-type: none"> 1. Identify the process 2. Designate process owner (the one who knows it best) 3. Set up a process improvement team 4. Define the process and break it down into sequential activities 5. Understand each of the activities within the process 6. Code and verify the semantic concepts of the map vocabulary 7. Combine these and establish a standard guideline format
- Davenport (1993)	Business Process Innovation	<ol style="list-style-type: none"> 1. Develop business vision 2. Identify the features of key processes 3. Understand and measure the performance of existing processes 4. Discover success factors and implementation barriers
- Davenport and Short (1990) - Knorr (1991) - Short y Venkatram (1992)	Business Process Redesign	<ol style="list-style-type: none"> 1. Develop the business vision and process objectives 2. Identify the processes to be redesigned 3. Understand and measure the performance of existing processes 4. Design and build a process prototype and implement improvements
- Kaplan and Murdock (1991)	Core Process Redesign	<ol style="list-style-type: none"> 1. Identify the processes for improvement 2. Define performance requirements and possible solutions 3. Develop a long-term vision of process redesign 4. Evaluate the alternatives 5. Draw up a plan of action for implementing the alternatives 6. Implement the plan
- DeToro and McCabe (1997)	Process Redesign	<ol style="list-style-type: none"> 1. Discover clients' needs 2. Select key processes 3. Document key processes 4. Measure process performance 5. Improve processes

-Elzinga, Horak <i>et al.</i> , (1995) - Zairi (1997) - Lee and Dale (1998)	Business Process Management	1. Preparation. Define key implementation factors 2. Select the process 3. Describe and document the process 4. Process quantification 5. Selection of improvement opportunities 6. Improvement implementation
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Source: Design by the authors

Nevertheless, such process innovation methodologies are hardly applied in Latin American countries. In reviewing the literature on Latin America, only a handful of references were found on the subject (Andreu *et al.*, 1996; Araujo *et al.*, 1998; Salgueiro, 1999; Albizu *et al.*, 2004; Simón *et al.*, 2004; Suárez-Barraza, 2010). The first was Salgueiro (1999) of the *Asociación Española de Normalización y Certificación* (AENC) [Spanish Standards Authority], which contains a methodology for documenting processes and creating standardised manuals on them. Much of the AENC's work is based on that of Galloway (1994), which set out process mapping and documentation procedures. However, this approach bears little on innovation and process redesign. Andreu *et al.*, (1996) noted that process innovation required a Total Quality Management approach and IT support, which together with organisational change, are considered key catalysts for process innovation. For Albizu *et al.*, (2004), process innovation projects are mainly linked to changes in organisation and work content. These authors indicate that the application of process innovation yields less radical changes than that posited by the orthodox Process Re-engineering model (Hammer and Champy, 1993) given that it allows incremental innovation and process redesign to co-exist.

On the same lines, Suárez-Barraza (2010) provides a practical, global vision of process innovation. Following Deming's premise (1986), the author notes that what cannot be measured cannot be improved. One of the findings in his work on Latin America is that it is vital "to understand processes before measuring them and, later innovating them", employing direct observation in the workplace to these ends. He defines his methodology in the following terms: "*A Gemba-Kaizen methodology which: continually seeks to discover, redesign, innovate and improve processes in a holistic, integrated fashion; boosts process performance; adds value; gives staff pride in their achievements*" (Suárez-Barraza, 2010, p. 54). The following table summarises his methodology:

Table 1. Summary of Suárez-Barraza's Process Innovation Methodology (2010)

No.	Stage	Steps	Orientation	Tools
1	Understanding	1. Systematically schematise a company's work to understand processes and their interrelationships 2. Determine the best level of analysis for attaining the optimum level of process innovation (macro or micro processes).	Systemic organisation (System Thinking)	Systems diagram

2	Selection	<ol style="list-style-type: none"> 1. Determine the client's needs and key requirements for process selection 2. Select and decide the priority process for innovation in the light of the chosen variables 	Process and client	Process Selection Table
3	Documentation/mapping	<ol style="list-style-type: none"> 1. Document the existing process 2. Identify the process flows, its limits, initial indicators of activities that do not add value, and internal client-supplier relations 	Process	Block Diagram Flow Diagram with Participants
4	Measurement	<ol style="list-style-type: none"> 1. Gather and measure Process Innovation Indicators (number of activities, time cycle, operational efficiency) for things as they stand 2. Establish process performance indicators and measure these after redesign 3. Establish measurement indicators based on client requirements (Client Satisfaction Indicators) 	Process and maintenance	Table of Indicators
5	Analysis	<ol style="list-style-type: none"> 1. Identify and prioritise opportunities for measuring wasteful elements in the process 	Process and maintenance	Analysis of activities that do not add value
6	Innovation/Redesign	<ol style="list-style-type: none"> 1. Draw up and implement an Innovation Plan 2. Redesign the process, streamlining it as far as possible 	Daily improvement	Innovation Plan
7	Evaluation and Standardisation	<ol style="list-style-type: none"> 1. Evaluate the results of innovations and their impact on process performance, ascertaining at what redesign stage a well-defined process is at 2. Standardise critical 	Daily improvement	Evaluation Sheet of a Well-defined Process Operating Standards

		process activities 3. Disseminate the lessons learnt and the new standards		
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Source: First author.

Gemba-Kaizen applied in multinational companies

Recently, Aoki (2008) studied certain multinationals and how they had successfully transferred the parent company's Kaizen techniques in the workplace to their subsidiaries abroad. The authors studied China and noted how Kaizen application required: the elimination of waste; operational discipline; standardisation of processes; formal and informal communication channels. Basu and Miroshiv (1999) studied the human resources strategy in multinationals such as Nissan and Toyota in their UK operations and concluded that although they did not achieve implementation of all the basic elements of Japanese management systems (Kaizen and Lean Manufacturing) in Britain, they successfully internally implemented many Kaizen elements in their respective car plants there. Finally, Elsey *et al.*, (2000) confirmed that successful Kaizen transfer depended largely on exchanging instructors on the subject and focusing on workplace learning.

Literature on the subject is sparse in Latin America. In this respect, Forrester *et al.*, (2010) concluded in their quantitative study that Lean-Kaizen techniques were becoming widely adopted in Brazil's farm machinery industry and that early-adopters had improved their performance and competitiveness. Ablanedo-Rosas *et al.*, (2010) quantitatively studied 20 companies in an industrial cluster in *Estado de Hidalgo* [Hidalgo State] and the implementation of 5S as an element of *Gemba-Kaizen* but did not specify how many of the firms were multinationals. Lastly, Landa-Aceves (2009) studied the implementation of Kaizen Blitz in 'free-port' companies along Mexico's border with The United States but also failed to note how many of the five plants studied were multinationals. Although the literature is silent on the number of multinationals in the two studies on *Gemba-Kaizen* application in Mexico, one can identify some elements that either foster or hinder successful implementation of this Japanese management philosophy.

Two studies by Suarez-Barraza and Ramis-Pujol (2010) focused on the application of *Gemba-Kaizen* to Mexican multinational firms (one public, the rest privately-owned). The first, by Suarez-Barraza and Ramis-Pujol (2010), explained the importance of applying a *Gemba-Kaizen* process innovation approach to a service provided by a public company and demonstrated shorter, better-performing processes. The second, by Villarreal *et al.*, (2010), was a case study of a British multinational textile company with a factory in Cadereita, Mexico. It showed how the application of *Gemba-Kaizen* and process innovation improved plant performance, raised quality by 66.28%, and cut raw material use from 3000 WIP to 480.

Although studies are beginning to emerge in the literature on the application of *Gemba-Kaizen* in multinationals in Mexico and Latin America, there is a dearth of empirical literature on the subject. Much of the scholarly literature centres on research studies in Japan, China and the US (Basu and Miroshiv, 1999; Brunet and New, 2003; Aoki, 2008). There is also a great deal of academic and practitioner literature on successful cases of *Gemba-Kaizen* application (chiefly as a technique)—mainly in the US and focusing on Kaizen or Kaizen Blitz events (Laraia *et al.*,

1999). *Gemba-Kaizen* has thus been little-studied from the academic angle and there is still a great deal to understand in the highly specific context of multinational companies operating in Mexico and the rest of Latin America.

Methodology

Bearing the foregoing comments and this paper's explanatory nature in mind, there is a clear need to: (1) delve into *Gemba-Kaizen* drivers; (2) establish the relationship between the approach and the context of a multinational company. Accordingly, the case study methodology was adopted (Einsehardt, 1989; Yin, 1994). This approach is particularly useful when the research needs to answer 'how' and 'why' questions (Yin, 1994). The methodology is also considered suitable for research on operational management (Voss *et al.*, 2002).

In this study, given the nature of the methodology and the research questions posed, the case of a multinational food firm was chosen. The firm had been operating in the industrial cluster of Toluca, Mexico for 12 years and it was selected following the theoretical sample criteria (Ritchie and Lewis, 2003). The case chosen thus had great scope for contributing to theoretical understanding and development. Pettigrew (1997) notes that the importance of this kind of sample selection lies not in the number of cases but in an in-depth study in each case (Pettigrew, 1997, p. 342). Accordingly, such a case should lead one to create robust theories given that the emerging propositions are linked to a wide range of the empirical evidence gathered (Einsenhardt and Graebner, 2007).

To ensure data consistency, three data-gathering methods were used: (1) direct observation; (2) document analysis; (3) semi-structured interviews (Yin, 1994). For the direct observation, at least five visits were made to each company chosen. The aim was observe workplaces where the *Gemba-Kaizen* approach was being or had been applied. During this stage, snapshots were taken to record *Gemba-Kaizen* events before and after. This is of great importance in providing study evidence and drawing up the report (Buchanan, 2001). During these visits, documentation was gathered on the application of the *Gemba-Kaizen* process innovation methodology for subsequent analysis. This documentation included; Training Manuals; Web sites; Formats; Registry Sheets; Systems Diagrams; Flow Charts; Added Value Tables. Lastly, an interview protocol and a data base on the case study were drawn up to make the study more reliable (Pettigrew, 1997). The main contact was the Production Manager. He was interviewed and co-authored this research study, which focused on a process to which the innovation methodology was applied. The Plant Manager and six production line workers directly involved in the process innovation were interviewed separately. A total of 8 interviews were held in August and December 2010. These interviews strictly followed the research protocol but some flexibility was adopted regarding certain responses that bore particularly on the subject. Each interview was transcribed within 48 hours of being held and was exhaustive in terms of clarity and data saturation. Everything that arose during the analysis was clarified with the contact person through mail and by telephone. Our data analysis sought to both ensure the validity of the construct through the use of multiple sources of evidence and carefully-planned data-gathering. We also sought to increase the external validity of the research by making multiple comparisons with other case studies (Yin, 1994).

Introduction to the multinational food company

This food and nutrition company is a world-renowned multinational and is present in six continents. It has over 8,500 products, which are made in 480 factories sited in 70 countries. The company has over 253,000 workers worldwide. In Mexico, the company has 13 factories in 8 states, employing 5,600 staff and providing some 8,500 indirect jobs.

Given the company's wide range of diverse products and to focus sales strategy in consonance with specific market needs, the firm is split into Strategic Business Units (SBUs), namely: lactic products; coffees; water; chocolates; sweets; frozen products; ice cream; nutrition; cereals; culinary products; pet snacks. This study focused on the Chocolates and Sweets SBU. The factory for this SBU is sited in Toluca, some 40 minutes by car from Mexico City. It began operations in 1992 with some 11 SKUs (Stock-Keeping Units) and in 1995 expanded operations with the purchase of *La Azteca* factory, which then had three plants. Production of the acquired firm's chocolates began then, making the multinational parent company into one of the leading firms in the chocolate market. In 1998, the original *La Azteca* plants stopped operating and manufacture of all the products was transferred to the Toluca factory. The multinational's chocolates and sweets division is currently one of the three leaders in its market, together with Hershey's and Mars. It sells around 75 SKUs, some made in Mexico and others imported. It also makes some 20 SKUs for export to The United States and Central America.

Some years ago, the multinational went through a rough patch given that its operations management was top-heavy and complex. Its bureaucratic nature made decision-making slow, which pushed up its costs and hurt its market share. That is why the multinational decided to certify its factory processes to the ISO 9000 norm. In theory, this meant introducing a quality management system defining all manufacturing processes, including those at the Toluca plant. However, despite the effort put into improving work processes, the adoption of the ISO norm looked good on paper but meant nothing on the ground. A small coterie of specialists had documented the plant's processes from their desktops, far-removed from the realities of the workplace (the *gemba*). This proved a fatal flaw when it came to understanding processes because the flow diagrams reflected a departmental bias. The plant manager commented:

“When the ISO norm came in, we believed our operating efficiency would improve. Nevertheless, I think our strategy and approach failed. We underestimated the work involved and thought it would be a piece of cake. What we forgot is that the action is on the shop floor where people work. I believe that is why we failed. (E-003-N-2010)”.

Given these problems, the company decided to change tack, investing in special training of two of the co-authors (third and fourth in the list) in the principles of Gemba-Kaizen. Once the training programme had ended, the engineer Luis Casado-Navarro set up a Kaizen improvement team with a group of production line workers. The production line manufactured chocolate and covered 45 SKUs. The Kaizen improvement team comprised the line supervisor and eight multi-tasking workers. They began innovating chocolate manufacture using the Suárez-Barraza (2010) methodology, which is based on workplace realities. The following section discusses the application of the methodology to the process in question.

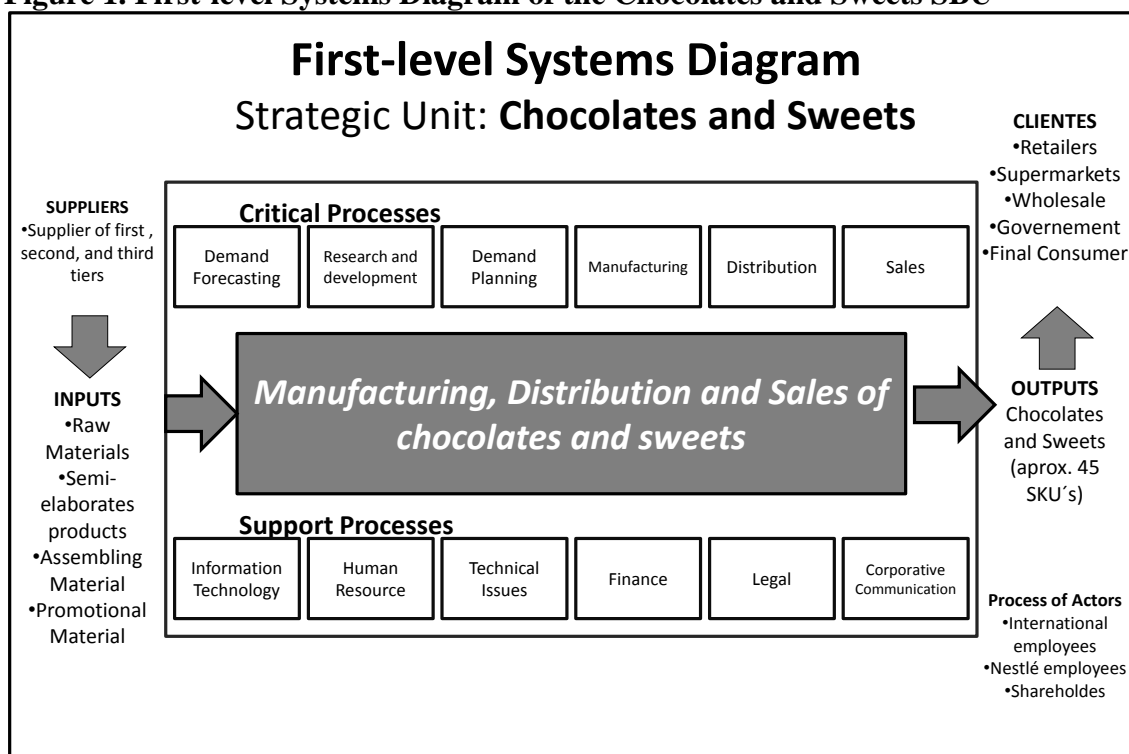
Applying Gemba-Kaizen in a multinational food company

As noted in the literature section, the Suárez-Barraza (2010) methodology comprises seven steps whose purpose is to thoroughly innovate and/or redesign a given process adopting an approach that is wholly workplace-oriented. The following section shows how the food multinational in general and the chocolate production line applied the methodology.

Understanding the process

Stage 1 in understanding the process innovation methodology revealed all the interdependencies in the firm’s existing process system. This enabled the company to grasp how its key aim, clients, outputs (products), inputs (raw materials), suppliers, business-critical and business-support processes were linked. The Kaizen improvement team’s application of this stage is given below in Figure 1:

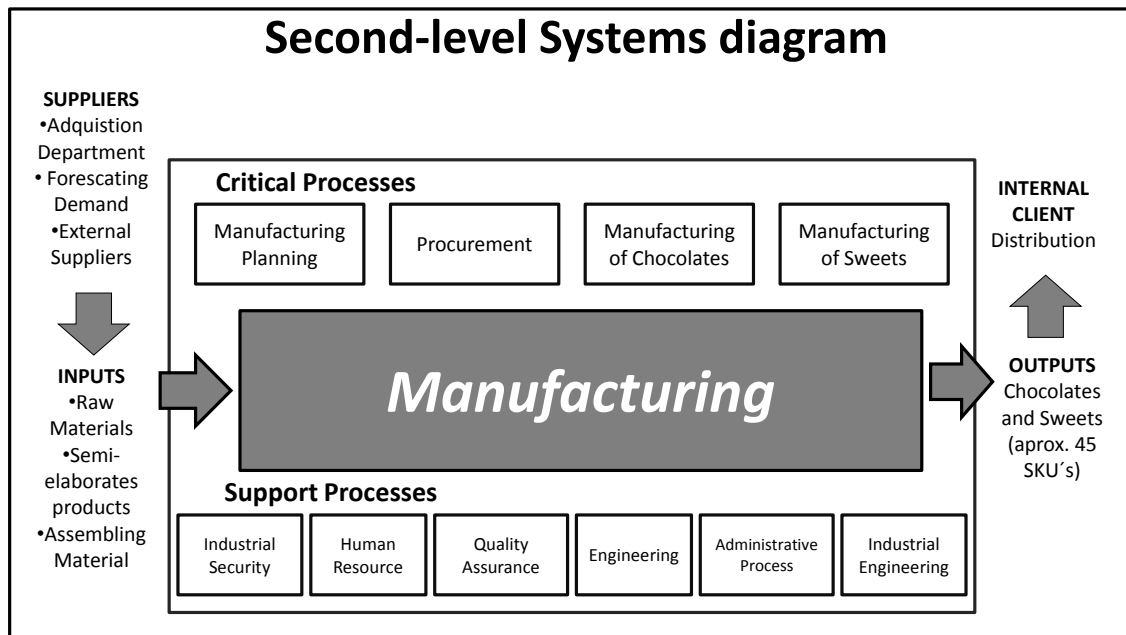
Figure 1. First-level Systems Diagram of the Chocolates and Sweets SBU



The systems diagram gives a holistic vision of the company’s processes and its core business—the Chocolates and Sweets SBU. The diagram shows: the products—chocolates and sweets and their approximately 45 SKUs, and the firm’s wholesale clients, supermarkets and end consumers, among others. Suppliers and the raw materials needed for the core process are also displayed. Critical processes (that is, those having a direct impact on clients and the product) are shown within the core process. These critical processes are: generating demand; developing new products; strategic purchasing; manufacture; distribution; sales. Support processes are those supporting the critical ones and are: information technology; human resources; finance and control; legal; corporate communication.

The first-level diagram or macro-processes diagram selected the fourth critical *manufacturing process* shown in the first systems diagram (see Figure 1). Thus the core process studied (**manufacturing**) comprises the following critical processes: (1) programming production; (2) supply; (3) manufacture of chocolates; (4) manufacture of sweets. Its support processes are: (1) ecology and industrial safety; (2) human resources; (3) quality assurance; (4) administration; (5) industrial engineering. Figure 2 shows the second-level systems diagram or micro-processes:

Figure 2. Second-level diagram of the Chocolates and Sweets SBU



Process selection

Using the Kaizen team’s second-level systems diagram of the aforesaid firm, we identified likely processes for innovation in: the manufacture of chocolates and sweets; the supply process, given its complexity; opportunities that line workers had observed in the workplace. The selection criteria proposed by James Harrington (1991) were adopted in identifying the process for improvement by the Kaizen team. These criteria were:

1. *Susceptibility to change*: Can it be fixed?
2. *Process performance*: What problems currently exist?
3. *Company impact*: Which problems are important for the company and how much do they affect it?
4. *Client impact*: Does the process meet clients’ needs? If the process fails, does it have a big impact on clients?

Once the Kaizen improvement team had analysed these four criteria, it drew up a selection matrix with a scale of one to ten, with ‘0’ indicating no application of a given criterion and ‘10’ full application of the criterion. Each of the candidate processes for redesign was rated accordingly. Table 3 below shows the results.

Table 3. Selection matrix—candidate processes for redesign

Selection criteria	Supply process	Chocolate manufacture process	Sweets manufacture process
Client dissatisfaction with process result	8	7	9
Control over process operation	9	9	9
Willingness to change	7	10	6
Support for a possible improvement project	4	8	5
Benefits obtained from the improvement	9	10	10
Likelihood of success	6	8	7
Relevance for company and staff	5	9	7
Consideration of clients' demands and needs	4	7	7
TOTAL	52	68	60

The process selected—the chocolate manufacturing process—was the one that scored highest.

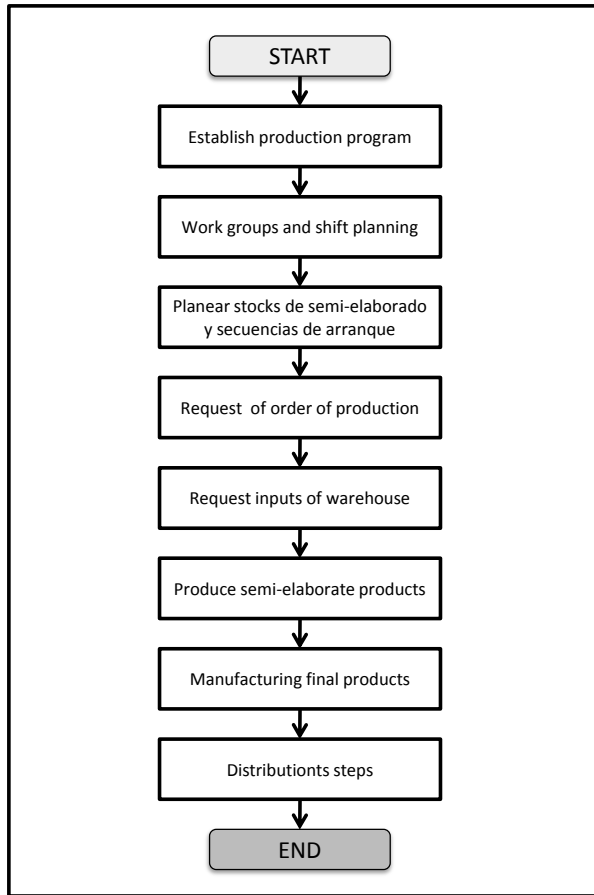
Mapping the process

Once the Kaizen improvement team had selected the process, it then went on to **document it (Step 3) and draw up a process map**. The reason for applying Step 3 of the Process Innovation Methodology lay in the need to understand the detailed operations in the workplace. The two criteria that the Kaizen improvement team bore in mind during this step were:

- **Documentation of the present situation.** *It is important to document the situation as it really is and not as an ideal. For this purpose, the Kaizen improvement team must go to the workplace to document the process through direct observation. The aim here is to quickly and accurately visualise all waste emerging from the process flow.*
- **Identify the process flow, its limits, activities that do not add value** (indications of waste are graphically shown using the cloud symbol) and **internal client-supplier relations**.

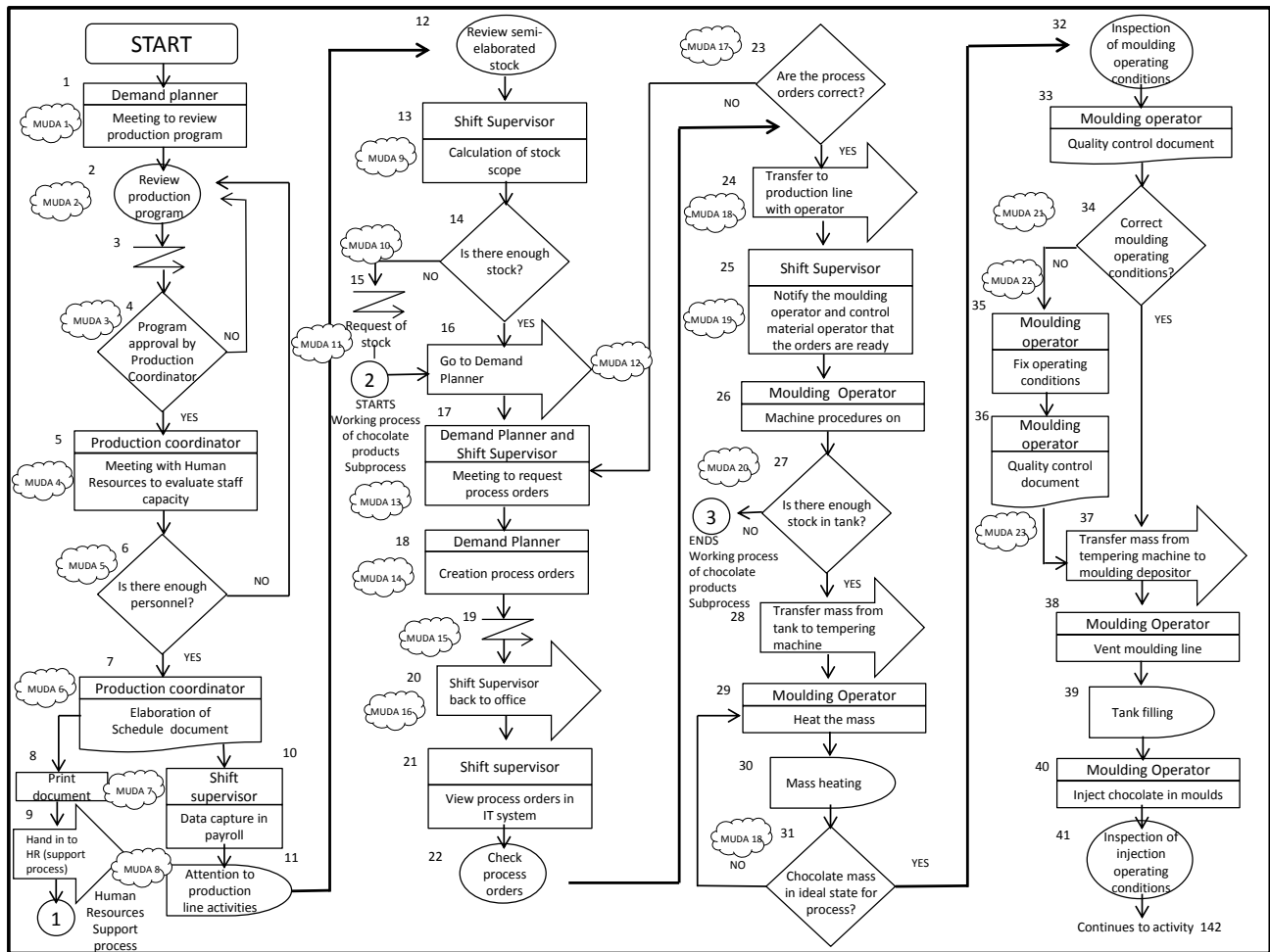
In this respect, the block diagram is the first step in applying a diagram description tool. Its purpose is to make a general description of the sequence of a given process. The block diagram drawn up by the Kaizen improvement team is shown below:

Figure 3. Block diagram showing the manufacturing process



Once the Kaizen improvement team had drawn up the block diagram, it used the tool to map the process in detail through *flow diagrams*. The symbols used to document processes follow ANSI (*American National Standard Institute*), which is unique to process innovation and redesign. The standard's purpose is not to produce a *Process Manual*. Accordingly, the ANSI symbols serve to 'flag' potentially wasteful activities. An example is given below (first page of the diagram), mapping the existing chocolates manufacturing process.

Figure 4. Flow diagrams showing the existing chocolates manufacturing process



	Limits (starting or ending activities)		Inspection		Delay
	Process-activity		Electronic transport		Notation
	Flow lines		Transport-movement		Connector
	Decision		Document		Storage

Process measurement

Process measurement is the next step in the methodology. In fact, measuring the existing process gave the Kaizen improvement team a benchmark when implementing innovation and redesign actions. The indicators to be borne in mind in attempting to grasp how the process worked before innovating and redesigning it are:

- **The number of activities making up the process:** Each of the process activities mapped are numbered to find their total number.

No. of activities = 142

- **Number of process participants (people or areas):** If one follows the Flow Diagram and participants to map the process, one can establish how many actors there are in the process. The total number of participants was 7 people, split between three areas:

Programming area:

- Programming

Manufacturing area

- Manufacturing co-ordinator
- Line technicians
- Moulding operator
- Materials control operator
- Packaging operator

Storage area

- Goods lift operator








- **Process cycle times:** The process cycle time spans from process commencement to completion. The Kaizen improvement team measured it, following all the flows in three samples. The result they came up with was:

Average process cycle time = 12 days

Process analysis

The following step in the Process Innovation methodology is process analysis. By this stage, the Kaizen Projects team had a wide range of information on the behaviour of the selected process. The next step was to sift through the information to identify parts of the process that posed problems or revealed waste. The following table shows the analysis of each existing activity revealed by the process map.

Table 4. Analysis of the chocolates manufacturing process

CHOCOLATE MANUFACTURE PROCESS		
Activity type	Flowchart Symbol	Count
Transport		8
Decisions		13
Inspection		13
Internal documents		9
Delay		-
Activities that do not add value		25
Electronic transport		3

TOTAL	71
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As the above table shows, 50% of the activities in the chocolates manufacturing process do not add value (i.e. 71 out of 142) and thus represent waste. For example, there are 13 unnecessary decisions taken to maintain 'strict' quality standards. However, the number of controls, inspections and decisions taken for quality assurance purposes is excessive. Another unnecessary item flagged as waste concerns staff movements. For example, the production programmer made the same trek (from the plant to the co-ordinator's office) three or four times merely to report to his superior. There were 25 activities that did not add value and were overwhelmingly of a bureaucratic nature, ranging from unnecessary meetings, including those to arrange further meetings to explain work operations. Accordingly, the process was full of activities which were unreliably repeated jobs that merely hindered process flow. The following table summarises the chocolates manufacturing process.

Table 5. Summary of waste in the chocolates manufacturing process

Number	Activity	Classification	MUDA type
1	Meeting to review production program	Activity	Activity that does not add value
2	Review production program	Inspection	Unnecessary inspection
4	Program approval by Production Coordinator	Decision	Unnecessary decision
5	Meeting with Human Resources to evaluate staff capacity	Activity	Activity that does not add value
6	Is there enough personnel?	Decision	Unnecessary decision
7	Elaboration of Schedule document	Document	Unnecessary document
8	Print document	Activity	Unnecessary copy
9	Hand in to HR (support process)	Transport	Unnecessary worker movement
13	Calculation of stock scope	Activity	Activity that does not add value
15	Is there enough stock?	Decision	Unnecessary decision
16	Send e-mail stock request	Electronic transfer	Unnecessary transfer
17	Go to Demand Planner	Transport	Activity that does not add value
18	Meeting to request process orders	Activity	Activity that does not add value
19	Creation process orders	Activity	Activity that does not add value
20	Shift Supervisor back to office	Transport	Unnecessary worker movement
23	Are the process orders correct?	Decision	Unnecessary decision
24	Transfer to production line with operator	Transport	Unnecessary worker movement
25	Notify the moulding operator and control material operator that the orders are ready	Activity	Activity that does not add value
27	Is there enough stock in tank?	Decision	Unnecessary decision
31	Chocolate mass in ideal state for process?	Decision	Unnecessary decision
34	Correct moulding operating conditions?	Decision	Unnecessary decision
35	Fix operating conditions	Activity	Activity that does not add value
36	Quality control document	Document	Unnecessary document

Process redesign

Once the Kaizen team had finished its analysis, it proposed a set of improvements in redesigning the process. The improvement measures included: the creation of operating standards; the scrapping of bureaucratic activities (unnecessary meetings, staff movements, superfluous quality control); training staff in new operations standards; identifying waste in the process; balancing work loads based on a new task time. The measures taken are given in the *Kaizen Report* below, which sets out the redesign actions taken:

KAIZEN REPORT **Chocolates manufacturing process**

- Ensure that information systems, mainly SAP/R3, are more reliable and automated throughout the process.
- Improve inter-stage communication in the information systems to ensure that the information gathered is available to everyone involved in the process, allowing them to consult such information without having to move from one area to another (thus cutting out unnecessary staff movements).
- Train staff in the handling and effective use of all information system applications so that they can work at full capacity.
- Draw up process standards to make activities clearer, more robust and stable whilst ensuring full visibility of the process.
- Train staff in using and monitoring standards to avoid errors and wasteful use of resources.

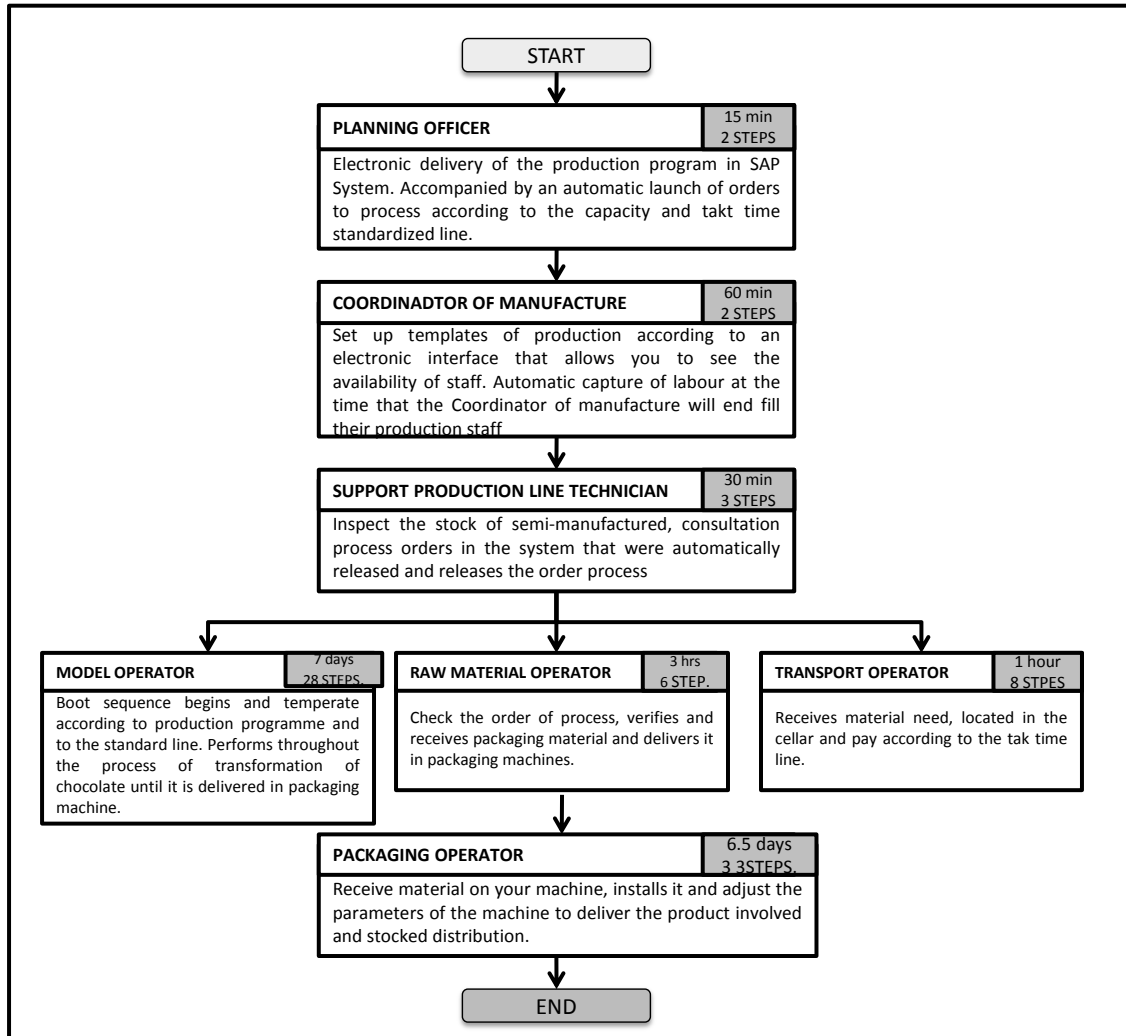
- Implement the 5S programme to order work.
- Standardise task times for activities and processes.
- Train co-ordinators in the measurement of task times, work loads and the identification of waste in the process.
- Foster the use of e-mails and other electronic means to keep staff informed and to avoid unnecessary meetings.

Tangible impacts after the improvements

As a result of the improvement measures taken, process activities were slashed from 142 to 71 (in other words, 50% of activities represented waste) The cycle time was cut from an average of 12 days before the improvements to 7.07 days—41% faster.

Once the Kaizen improvement team's actions had all been successfully concluded, the process was redesigned using a block diagram, indicating: the participant who would carry out the activity, the time for each activity in the process; the sequence of the redesigned process. The block diagram is shown below:

Figure 5. Block diagram of the redesigned process for the manufacture of chocolates



Conclusions and managerial aspects of using a Gemba-Kaizen process innovation framework

There are various benefits in using methodological approaches such as Gemba-Kaizen for process innovation, as is shown by the experience of the multinational food company in this case. Let us consider the question: *What differences are there between traditional office management and management based on Gemba-Kaizen when it comes to process innovation?* The answer is that the Kaizen improvement team yielded greater benefits because it was based in the workplace and could directly observe all the activities representing waste in the manufacturing of chocolates. The spotlight was put on waste that had hitherto lain hidden, confirming Imai (1997) and Ohno's (2007) findings. When the company's plant manager asked why the production process averaged 12 days before the chocolates were ready for delivery, the answer was always an endless stream of complaints and mutual recriminations by the sections involved. In other words, it was impossible to visualise the process from the boardroom and identify the host of activities (50% of the total) that added no value whatsoever. In fact, the Kaizen improvement

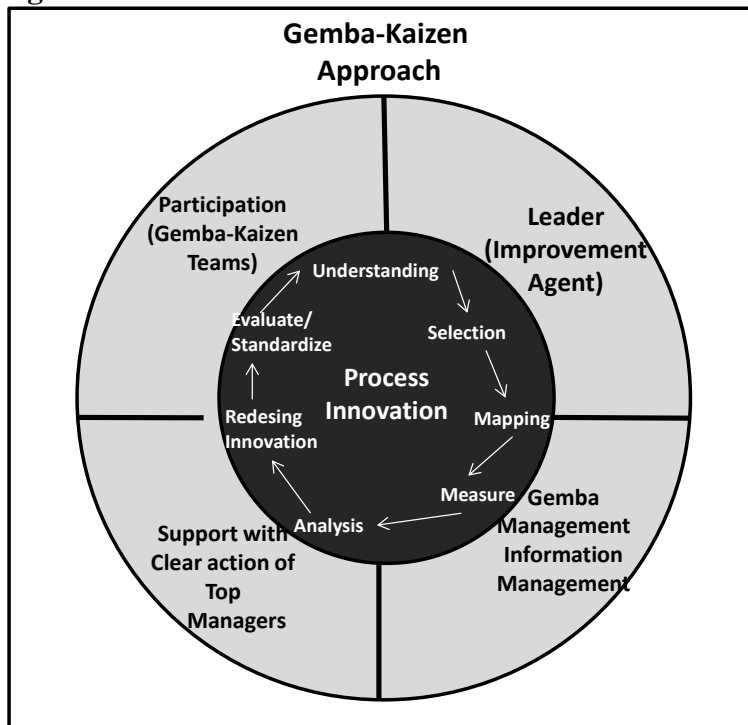
team showed the rest of the plant, including its manager, the importance of Gemba-Kaizen through detailed process mapping and analysis of the waste found.

From this point on, the multinational food company will have many opportunities for innovation in both plant processes and services. Accordingly, specific improvement objectives could be set using this combination of methodologies to create a virtuous circle of ongoing improvements in plant operation. Managers in other areas of the company also learnt a great deal from the experience and are now focusing on process innovation using Gemba-Kaizen for this purpose. Four management implications emerge from this case:

- 1) The introduction of a management approach based on Gemba-Kaizen allows identification of what really adds value for the company and end clients.
- 2) The application of a structured, proven innovation methodology led to rapid, major changes in the firm's operating processes.
- 3) Using staff who work in the *gemba* (workplace) and know its daily processes and activities like nobody else is vital to achieving active employee participation, continuous improvement and process redesign. This ensures that staff take a more pro-active vision of problem-solving and identify all activities that do not add value.
- 4) The process-based focus enabled the multinational food company in question to adopt horizontal management centred on the workplace, where the beginning and end of the process were visualised and the needs of both internal and external clients could be established. Process innovation helped the company propose improvements to the way things were done, eliminate waste and understand the sequence of critical plant processes. Based on the evidence found in this and other cases, bureaucracy builds up in companies, strangling processes with red tape.

It only remains for our second sub-question to be answered, namely: *Is there any relationship between the effort put into implementing Gemba-Kaizen and process innovation methods in a multinational food company?* Here, one can say that the application of a Gemba-Kaizen based innovation methodology allowed the multinational company to develop a single, integrated methodology for innovating its processes. Accordingly, one can conclude that there is a link between both methodological approaches in this particular case study. Nevertheless, this finding confirms what is stated in the literature of the original authors and in recent studies (Imai, 1997; Ohno, 2007; Suárez-Barraza, 2007; Marskberry *et al.*, 2010). As a result of the field work, we put forward a theoretical framework (see Figure 6) that captures the nature of this link. It is important to note that the data obtained from this case provides a snapshot of the phenomena studied but cannot be used to establish causal relationships.

Figure 6. Process innovation framework within the Gemba-Kaizen approach



Source: Design own

As in all research based on a case study, this paper has its limitations. The most obvious one is that all the findings are based on a case study. Another difficulty is to objectively handle the vast quantity of data produced by the fieldwork, making it hard to evaluate the relationships that may exist within the studied phenomenon (Eisenhardt, 1989). Last but not least, there was no direct evaluation of the impact the application of the Gemba-Kaizen approach on the company's performance. These limitations notwithstanding, our research contributes to the existing literature through an empirical study that reveals methodological relationships and their specific application. Clearly, the study may be extended to other industrial sectors or services to corroborate the framework identified.

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Two Lean roads

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Key words: Lean, Lean definitions, Sustainable improvements, Treatment of employees

Category: Research paper

Introduction

One of the most popular trends in the area of organisational development today is Lean. Lean has its historical roots within car industry. Lean originates from Toyota and Toyota production system (TPS) (Krafcik, 1988, Liker, 2004, Womack et al, 1990) and when Lean was introduced it was as a new term for TPS (Krafcik 1988). “Rather than continuing to refer to the different paradigms as recent Fordism and TPS, I would like to introduce two new terms here – buffered and Lean production systems” (Krafcik, 1988 p 44). In the following, Lean and TPS will be used interchangeably. The label “Lean” has however been put on a great variety of phenomena (Pettersen, 2009) and there are several, to some extent conflicting definitions of what Lean is. All definitions views elimination of waste as a key part, some views Lean as a system incorporating culture and treatment of individuals while others focus on tools. The different views on Lean have existed in parallel for decades and thereby created a confusion concerning what Lean is and as a consequence how Lean is to be implemented. Although implementation is an important question the really critical issue is if the changes and change system sustain in a longer perspective since a majority of changes fail in a longer perspective (Jacobs 2002). It is interesting to study if there is a connection between type of Lean and sustainability of the Lean improvement system.

This paper takes its starting point in this disagreement among what Lean is and elaborates on the differences among different definitions of Lean and what the practical consequences of different views of Lean are. The evolution of Lean initiatives in four different organisations is scrutinized. Data from these organisations were collected from 40 interviews, 6 group meetings and seven days working at workshop floors. The purpose of this paper is to study the development of Lean definitions and eventual practical implications. The results show that there are major differences concerning the interpretation of Lean among the organisations. In particular the paper identifies two types of Lean, SM-Lean and H-Lean that differs mainly concerning their view on the treatment and role of the employees. H-Lean can be achieved using several different routes and seems to have a higher degree of sustainability than SM-Lean.

The paper is structured as follows, first there is an introduction leading to the purpose. Then there is the frame of reference discussing different Lean and TPS definitions. In the next section a framework for different steps in Lean development is presented. In the consequent part the four different organisations are analysed with respect to the development of their Lean improvement systems.

What is Lean?

In the first (Holweg, 2007) article on TPS Sugimori et al (1977) describes TPS as a system based both on “reduction of cost through reduction of waste” and “to make full use of the workers capabilities”

“In short treat the workers as human beings and with consideration. Build up a system that will allow the workers to display their full capabilities by themselves”

(Sugimori et al, 1977 page 554)

In this paper “to treat the workers as human beings and with consideration” is interpreted as providing a safe and healthy workplace combined with work security. “To build up a system that allow the workers to display their full capabilities” is interpreted as a providing a system for increasing their competence to find improvements combined with a system for handling the improvement suggestions. The description of TPS as a system with focus on both on reduction of waste and human development is however rather seldom in the early publications on TPS/Lean. Shingo (1984) as example describes TPS as “to eliminate all waste”.

The term “Lean production” is first mention in 1988 and then in terms of being the opposite to buffered production systems (Kracik, 1988), buffered production systems were exemplified as having buffers to cope with any type of disturbances “just in case”.

Truly Lean operations were exemplified as:

“Inventory levels were kept at an absolute minimum so that the costs could be shaved and quality problems quickly detected and solved; bufferless assembly lines assured continuous flow production”

(Kracik, 1988 p. 45)

Kracik worked for two years at the Nummi plant, a joint venture between Toyota and GM based on TPS philosophy, and his description is highly influenced by this experience, however his description of Lean does not contain any thoughts connected to how to treat workers introduced by Sugimori et al (1977). Kracik’s (1988) main argument is that Lean/TPS is not restricted to a Japanese environment but fully possible to implement in USA or Europe.

The view that TPS and Lean is only about eliminating waste dominates in many writings as well as industrial applications. In “The machine that changed the world” (Womak & Jones, 1990) Lean is defined as doing more and more with less and less. Womack & Jones (1996) gives detailed descriptions on how to eliminate waste (Muda) but the human side is more or less neglected. Naylor et al (1997) define leanness as developing a value stream to eliminate all waste, including time, and to ensure a level schedule. Liker (2004) expands the view of Sugimori and regards TPS as a system consisting of a long term philosophy, to eliminate waste, respect and challenge people and suppliers and continuous problem solving (Liker 2004). The levelled schedule (Mura) is now seen as a prerequisite to be able to reduce waste, this is in line with Naylor (1997). In Liker (2004) the concept of true north is mentioned but not explained. This concept clearly shows the importance of both focusing on elimination of Muda and fair treatment and development of employees. The organisation is to provide safe working conditions, job security and professional challenge for everyone; every minute; every day.

Narasimhan et al (2007) define leanness as the efficient use of resources through the minimization of waste. The thoughts of Sugimori (1977) and Liker (2004) show great similarities. The thoughts/definitions of Krafcik (1988), Shingo (1984), Naylor et al (1997) and Narasimhan et al (2007) also show great similarities. The only problem is that these groups although consistent within the group are not consistent between groups. It is interesting to note that it is not a phenomena of evolution since the elimination of waste definition is represented from 1981 (Shingo) to 2007 (Narasimhan et al) and the elimination of waste and respect for people is represented from 1977 (Sugimori) to 2004 (Liker). So we have two different complementary set of definitions of Lean/TPS that has been inexistence in parallel for almost 30 years. It is then not a surprise that there have been difficulties to define Lean as one concept (Pettersen, 2009) because there are two concepts. Since respect for people is what divides the groups then what is respect for people? As mentioned Sugimori et al (1977) describes it is treat them as human beings but does not go into detail about what that means in practice. Liker (2004) is more specific and connects the technical and social system, the technical methods has to be supported by the social system. A number of central definitions are presented in table I.

Table I Lean definitions

Author	Definition of Lean	Focus
Womak & Jones (1990)	Doing more and more with less and less	Efficiency, ratio between output and input
Naylor et al (1997)	Developing a value stream to eliminate all waste, including time, and to ensure a level schedule	Waste reduction and levelled production
Liker (2004)	A system consisting of a long term philosophy, to eliminate waste, respect and challenge people and suppliers and continuous problem solving	Long term systems view with waste reduction, problem solving as actions and people and suppliers as stakeholders
Shingo (1984)	To eliminate all waste	Waste reduction
Sugimori (1977)	Reduction of cost through reduction of waste and to make full use of the workers capabilities	Waste reduction and fair treatment of employees

As can be seen waste is implicitly or explicitly mentioned in all definitions, but only Liker (2004) and Sugimori (1977) mention how to treat the employees. Since “The machine that changed the world” has had a major influence on how Lean is interpreted many organisations has seen Lean as more or less as a set of tools (cf Pettersen, 2009). This view however is troublesome, to focus only on reduction of waste greatly limits the amount of improvements that can be achieved (Emiliani, 2006). So for at least 29 years (and still counting) one of the definitions of Lean has substantially reduced the possible outcome.

Two Types of Lean

As indicated above, several influential writers (Krafcik, 1988; Shingo, 1981) focused only on the reduction of waste part. The concept of respect people was not in line with the existing culture of many American companies (cf Emiliani, 2006). Even though the TPS (or Lean) concept was available through academic journals many US firms relied on Japanese sensei (master) (Emiliani, 2006). The sensei often started working with (physically) moving machinery to establish better flow, such issues were acceptable for company management, but on issues such as how to treat individuals (such as not fire anybody based on the improvements) there was a “don’t teach me how to run my company” attitude (Emiliani, 2006). The apparent part of a Lean system, and what is described in “The Machine that changed the world”, is the tools and techniques for eliminating waste and with the before mentioned attitude that is all there is to describe. The Purpose of “The Machine That Changed The World” was to present a benchmarking study, this showed that TPS was superior compared to American and European production systems. The purpose was not to understand or describe TPS in detail. As a result common knowledge concerning Lean was only partly correct there existed false Lean Champions, organisations that was regarded as excellent examples of Lean but compared to a truly Lean organisation they were merely beginners (Liker, 2004).

So a scattered picture of what Lean is among academics combined with a limited scope of influence for Lean sensei resulted in organisations that thought they were Lean, called themselves Lean and were regarded among others as Lean but in practice they were not Lean. This situation was problematic since if the organisation regards itself as Lean there are no incentives to become more Lean apparently there two final stages as a result of the two Lean definitions (as discussed above). The type of Lean that focuses only on waste will be termed Scientific management Lean (SM-Learn), because of its close relation with scientific management and the type of Lean that incorporates the social system will be called human Lean (H-Learn), see table II.

Table II Characteristics of the two Lean types

	SM-Learn	H-Learn
Definition of Lean	Lean is reduction of waste	Lean is a system that eliminates waste, challenge the employees and build competence
Focus	Tools	Humans and tools
Characteristics	Result focus	Process focus
Type of Results	Reduction of waste	Changed mindset among the employees combined with reduction of waste

Another aspect of Lean is the sustainability of the change and the change system. Sustaining can be viewed in two different angles, one is that the changes sustain and the other is the sustainability of the change system, sustaining changes can be termed 1st order sustainability and sustaining change systems 2nd order sustainability. Both SM-Learn and H-Learn can be sustainable.

1st order sustainable change is achieved, when the changed components of an organisation become the standard, continue to improve over time and do not revert to the old ways that existed before the improvement program was launched. 2nd order sustainability is when not only the targeted organisational components have improved, but also attitudes, ways of thinking, behaviour and surrounding system have undergone a change (cf Poksinska et al, 2010). One indication of changed way of thinking is changed behaviour in the employee's spare time.

A multiple case study

The base for the paper was a literature study to capture the evolution of the definition of Lean and TPS. The articles were searched in the databases Web of Science and Scopus. Appendix B "The research and dissemination of Lean production-a time line" in Holweg (2007) was also helpful in finding Lean articles. The literature was used to find different Lean definitions

The empirical data consists of 40 interviews from four different cases. The number of cases is within the 4-10 span recommended by Eisenhardt (1989). The cases were deliberately chosen to represent organisations that had worked successfully with Lean. One case was described in several newspaper articles as a Lean company, another case is a Swedish Lean price winner, the two final cases have a reputation for being Lean. The 40 interviews were semi structured. In all cases operators and at least first line managers were interviewed. All interviews were conducted between summer 2009 and fall 2010. The purpose of the interviews was to capture how Lean had evolved in the different organisations, the current situation in the companies and their interpretation of Lean (research question 2). The interviews were recorded or filmed. The recorded interviews were transcribed and the material was analysed to identify the development of the Lean improvement system. The analysis consists of two parts, first in case analysis and then a cross case analysis. The empirical data were analysed from two different angles, type of lean and degree of sustainability. Since there is always a starting position and in most cases a history of earlier change initiatives the situation before the lean activities begun are described as a reference.

The empirical investigation

In this part empirical data from 4 different organisations is described and analyzed.

Type Co

The reason for choosing Type Co was that there were articles that described them as a Lean company.

In 2002 Type Co was losing money, had a reputation as being among the worst employer in the region. The products were built in a handicraft sort. The production of each unit was made at one spot and involved a lot of welding. The store was in the cellar of the building and the operators collected the materials needed. Efficiency was real low. The sheet metal department had recently been outsourced.

A new managing director saw the need for radical improvements and decided to implement Lean, since she was familiar with this concept from her previous position. There was no or limited discussion on what improvement philosophy to choose.

The first activity was a total change of the production layout, from assembly of the whole product at one spot to a paced production line. At the same time continuous improvement groups were formed and a supporting system was put in place. The production rose with a factor of 12, the company started to be profitable. The internal material supply system uses kanban. No new tools are introduced. The operator received training to increase their competence to perform several different tasks. This resulted in a chaos where it was not clear to management who made what, so they returned to previous way with a certain individual connected to a specific task.

At my visit 5 years after the changed production layout the continuous improvement work had come to a standstill, there were no meetings, few ongoing activities and for the operators Lean was a paced production line. No-one in the company saw Lean as treating the employees fair or developing the employees. The working environment was rather noisy. Focus was on meeting the production targets. There was a structure for improvement work but it was not used.

There was a clear crisis in Type Co all employees knew that the company was losing money and that work was ineffective. Everyone knew that something needed to be done. The new managing director once put on an overall and worked at the workshop floor but apart from that but no activities that affected leadership or culture was performed. Since the focus was on reducing waste Type Co is a clear case of SM-Lean. Lean was used as a kaizen blitz although a rather deep such with major changes to the product as well as the production system. The regularity of meetings is low, during my visit the most of the information on the improvement whiteboards were not updated and no meetings were scheduled. Since the human part of Lean is missing many operators sees Lean as worker hostile and just a way to increase efficiency, in their eyes Lean is synonyms with a paced production line. Although some improvements are sustainable the improvement system is not, they have 1st order sustainability but lack 2nd order sustainability. There was no indication of spare time behaviour being affected.

Municipality

The municipality was chosen since it has a reputation for being the Leanest municipality in Sweden.

In 1992 the municipality was in a deep crisis. The financial situation was so bad that they had to borrow money to be able to pay salaries to the employees. A new local government head put demands on all units that they had to reduce their costs by 15% but without firing anyone. The organisation was divided into result units with economical responsibility. During the period from 1992 to 1996 they worked with finding a consensus regarding basic values. There were lots of discussions concerning basic values, which values were not negotiable.

It is difficult to say when Lean started in the municipality, the term Lean is not used until 2004 but many activities that were performed earlier definitely had a Lean flavour. When introduced in 2004 Lean was synonym with Lean tools, but the choice of tools was based on the common value system. The Quality manager stresses the importance of not starting with tools but to choose tools

based on the value system. Within the municipality all employees have done test to find out their psychological profile and this knowledge is used when workgroups are formed.

All improvement activities are voluntary. There is no top down approach where units are told what to do, instead those who are interested turn to the improvement group to get education and support for the improvement work of their choice. A large majority of the changes survive even though there are examples of one change that has reverted to the old way of working. The improvement system is being developed and new more visual concepts are introduced.

All interviewed regard Lean as a system for both reducing waste and improve the situation for both the personnel and the user of the services. Six of eight interviewed had changed their spare time behaviour.

Since value system form the base for all activities and one part of the value system is that it is important with personal development and continuous learning in a nice and healthy working environment it is reasonable to conclude that the Municipality is an example of H-Lean. Supporting that conclusion is that all development work is bottom up and that tools only play a supportive role. Further confirmation is provided by the high amount of individuals that had changed their spare time behaviour. Since both a vast majority of the changes (all but one) survived and the improvement system is both in use and being improved it is reasonable to conclude that the municipality is an example of both 1st and 2nd order sustainability.

Drug manufacturer

The drug manufacturer was chosen since it recently won a Lean price.

This company has a long success story with one of the worldwide top three selling drugs. The profits were substantial and the rewards within the profit sharing system were so that “you could buy a car cash without thinking”. There was anyhow a threat to the production in Sweden in terms of moving production to low wage countries.

External recruitment of managers was an enhancing factor for getting the need for improvements on the agenda. Through different recruitments the company got access to individuals with knowledge within Lean and other operation development techniques. The initial activities was discussing among a smaller group of managers in order to understand Lean and how Lean could fit in the context. It was decided to go for a Lean implementation, although it could have been six sigma or something else.

The first activity was measuring of muda (waste). Lean work developed real slow in the beginning, the first years there were only a few operational activities. Measuring of muda contributed to increased awareness about different kinds of waste and had in itself an effect on efficiency. Measuring of Muda had however been done before but these measurement had earlier never resulted in any changes. So the difference this time was the degree of expressed commitment for sustainability from management. The role of the managers changed completely, from project leaders in investment projects to supporting and coaching the operators. There was a clear focus on safety-health-environment issues and respect for individuals.

There has been deep changes in how activities are performed and there is a commitment from most (80%) of the operators concerning that their work is both to produce and improve. As mentioned earlier the management style has changed completely from absent to coaching. There

are monthly attitude surveys where the employees can identify themselves as green (=OK) yellow (=so-so) or red (bad). If there are several individuals that identify themselves as red then this is seen as a starting point for improvements concerning the operator's situation. It can also be added that the total change of the production planning, continuous improvement and project control systems contribute to that there is no reverse. The operators request more responsibility. Ergonomic improvements and mandatory pause gymnastics contribute to the picture of caring for the needs of the operators. The factory manager describes Lean as a way of acting and thinking, definitely not a set of tools. The production manager describes Lean as a way to work smarter, a never ending journey and that the power has to come from below. One of the first line managers describes Lean as common sense combined with always question how things are done, while another ads using the creativity of the operators. Among the operators one defines Lean as continuous improvements for ourselves, another as creating value, improving efficiency using safety, health and environment as a basis.

There were some elements of crisis but to a far less extent than at Type Co. It is difficult to say whether the threat of moving production to a low wage country was real or not among the operators. One of the key changes is the dramatic change in leadership, this in turn affected culture since leadership behavior is a prime factor for changing culture (Bruselius & Skärvad, 2004). The activities were both aimed at reducing waste and increase safety-health-environment. The managers spoke about seeing the operators and supporting them, so the drug manufacturer is a case of H-Lean. Concerning sustainability there were several examples of changes not just sustaining but being the base for further improvement. Improvement meetings were regularly taking place every week and level of engagement among the operators high, approximately 80 % were active in the improvement work. So there was both 1st and 2nd order sustainability. Among half of the interviewed had changed their at home behavior.

Care centre

The Care Centre was chosen due to being one of first care centres that work with Lean in Sweden.

The case of the care centre is interesting since focus was on the problems, the unacceptable work situation with high levels of stress. So the goal of the improvement work was simply to improve the work situation and at the same time have fun at work. When Lean was introduced it was as a set of tools, process mapping etc, to aid the ongoing work with improving the workplace situation. Lean is seen both as elimination of waste and the participation of everyone, quality, efficiency, patient focus, philosophy and long term thinking is also mentioned. Improvement work is done by three groups that meet on a weekly basis. A year ago the meetings were not so regular but since then things have improved and now there are regular meetings. There is a high level of standardisation of work through work instructions. Once established these instructions are scrutinized by the employees on a yearly basis. The new procedures are followed by all personnel. All interviewed mentioned the changes in work climate, now all employees co-operated and supported each other regardless of position and education. Lean at this care centre was seen as minimizing the amount of work needed and do things once. There were regular attitude surveys' and drops in motivation were analysed and countermeasures taken. Six out of seven interviewed had changed their behaviour at their spare time as a result of the improvement activities at work.

There was definitely a crisis situation although of a different type than at Type Co. At the care centre the crisis affected the situation of the employees rather than the situation of the organisation. Since the crisis at the care centre affected the personal it was probably more tangible than the crisis at Type Co. Initial work consisted of two managers and one consultant that searched for solutions to the problem with a hectic work situation. The consultant made a suggestion that Lean might be suitable and the managers attended a Lean-seminar. It was after that seminar it was decided to go for Lean. There is definitely a change in culture since the co-operation between different groups has increased and all perform their work the same way. The activities were improvement of differ flows but also regular attitude surveys. Six of seven interviewed had changed their behaviour at their spare time. This case is interesting since it started out as improving work conditions and later added Lean so the H-part came first and then Lean was added to form an H-Lean approach. Since the improvements survive and improvement system is operational they have both 1st and 2nd order sustainability although there have been a dip in the 2nd order sustainability a year ago.

Cross case analysis

Lean can be regarded as consisting of two major parts the elimination of waste and the development of knowledge and willingness to use this knowledge (competence) among the employees. For the latter part to be achieved it is important to fulfil the needs of the employees in terms of safety, security and fair treatment. From the cases we can see that Type Co has implemented only the tools part, SM-Lean, and as a result have limited sustainability. The municipality has introduced some Lean tools which ought to make them an example of SM-Lean but the since employee centred thinking was already in place both parts of Lean are evident and they are an example of H-Lean. The drug manufacturer worked with both tools and changes in management style, affecting culture, simultaneously and both parts of Lean are visible. At the drug manufacturer Lean has been combined with ergonomic improvements and mandatory pause exercise this indicates an interest for employee health. The care centre based their improvements on a need to improve working conditions combined with striving for having fun at work. This is clearly based on seeing the needs of the employees. Lean and other tools are used as means to achieve the goal. An overview of the cases is shown in Table III.

Table III Overview of cases

Case	Lean Journey	Comments	Type of Lean
Type Co	Introduction of tools such as kanban, 5S and a paced production line. How employees are treated is not an issue	The main issue is to increase production levels	SM-Lean, tool focus, very limited effort to develop competence
Municipality	Started with values and later introduced tools such as value stream mapping and 5S	All improvement activities are done bottom up	H-Lean, the employees were in focus early Lean tools came later
Drug Manufacturer	Started with measurement of Muda and changes in management style,	Changed the culture of the	H-Lean massive changes in the role of

	introduced tools such as standardized work and single minute exchange of dies later.	organisation for a period of many years	the operators and management style combined with tools
Care Centre	Started with improving work situation and making it more fun to go to work, introduced tools such as value stream mapping later	Improvement work based on the needs of the employees	H-Lean focus on less stress and developing employees tools used as support

Conclusions

There are two different groups of definitions for Lean/TPS. They differ mainly concerning the aspect of how to treat and use the individuals within the organisation. Practical examples show that both groups of definitions are used in practice and that H-Lean penetrates deeper into basic assumptions of the individuals often affecting the behaviour at their spare time. When Lean thinking has become a part of the individual basic assumption then Lean will be self-drive and the chances for sustainable change dramatically increase. An indicator of changed basic assumptions is changed behaviour in the spare time. The momentum for change is within the employees and there is little or no need for drive from managers etc. SM-Lean does not seem to change the basic assumptions of the employees and the result is a need for an external drive which makes sustainability more troublesome since it depends on a constant drive from managers. All three cases of H-Lean use different paths to implement H-Lean. The municipality worked with basic assumptions and values within the organisation and sees Lean as a set of tools which ought to make them SM-Lean, but since the improvement work is based on the problems experienced by the employees and the employees take the initiative and run the improvement work it is not only fair treatment but the employees are empowered concerning improvement work. The care centre based their improvement work on the needs of the employees, the goals were to reduce stress and increase joy at work, so the improvement work was aimed at improving a work situation regarded as problematic/unfair. The drug manufacturer introduced changes in management style affecting culture and changing the role of the employee from producing to improving and producing. This new role implied increased possibility for the employees to influence their work situation. In parallel with the changes in they also introduced different tools so if the before mentioned cases were more sequential this was more parallel.

Taking the easy Lean-road and implementing tools for eliminating waste might seem as a quick and trouble free road to increased efficiency, and yes it works but only to a limited extent and (in many cases) for a limited period of time. The trick is not to implement tools but to change the attitudes of the employees (Hughes, 2006). Until now there has not been any relevant indicator for if a change has changed employee attitudes but the as the interviews has shown changed attitudes at work spill over on the spare time of many employees. So changes in spare time behaviour show changes in attitudes at work. So maybe it's time to worry less about tools and think more about what actually changes behaviour both at work and at home.

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Benefits of the ISO 9001 and ISO 14001 standards: a literature review

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Introduction

Quality management (QM) and environmental management (EM) are business practices that may benefit companies. As several empirical studies have shown, implementing QM effectively can influence firm performance positively (Powell 1995; Samson and Terziovski 1999; Huarng and Chen, 2002; Kaynak 2003; Parast *et al.*, 2011). Similarly, EM may affect firm performance positively (Klassen and McLaughlin 1996; King and Lenox 2002; Al-Tuwaijri *et al.* 2004; Moneva and Ortas, 2010).

In this context, management system standards (MSSs) have enjoyed enormous success over the last years, both in the sphere of QM (ISO 9001) and in that of EM (ISO 14001). Over the last years, both standards have experienced a great international growth (Marimón *et al.*, 2010). By the end of 2008 over 980,000 ISO 9001 certificates had been granted in a total of 176 countries worldwide, which doubled by far the number of certificates at the end of 2000. Similarly, by the end of 2008 the number of ISO 14001 certificates was 188,815 (ISO, 2009).

As various authors have pointed out (e.g., Delmas, 2001; Braun, 2005), the ISO 9001 and 14001 standards do not refer to the compliance with a given goal or result. In other words, they are not performance standards measuring the quality of a firm's products or services or a firm's environmental results; rather, they are standards setting out the need to systematize and formalize a large number of corporate processes within a set of procedures, and to document such implementation. It must also be remembered that the implementation of this type of standard is a voluntary one, although in some sectors it has *de facto* become an obligatory measure, given the coercive influence of customers (Braun, 2005; Mendel, 2006).

Given this “non-performance” orientation of standards, a large number of studies have analyzed the benefits that may be obtained through ISO 9001 and ISO 14001 certification and implementation. However, to the best of our knowledge no systematic review has been made of the empirical studies analyzing the benefits arising from these two standards in one single study. As various authors have pointed out, both standards have many similarities in terms of their

structure and dissemination processes (Corbett and Kirsch, 2001; Corbett, 2006; Marimón *et al.*, 2006). The purpose of this paper is to carry out a review of the empirical literature which has examined the benefits that may be attained through the ISO 9001 and 14001 standards. In addition to identifying the most analyzed benefits in each of the standards, the main similarities and differences in these benefits will be pointed out. Moreover, some ideas will be proposed that may be considered in future research on the measure of certification, its interiorization and selection effect.

The paper is structured as follows. Firstly, in the methodology section, the search strategy is described. Then, the results are shown. In the discussion and conclusion section, the benefits of the two standards are compared, and some important issues are examined, such as the ISO measurement (interiorization) and selection effect.

Methodology

A literature review is made in order to identify the benefits of the ISO 9001 and ISO 14001 standards. Therefore, empirical studies related to ISO 9001 and benefits, and ISO 14001 and benefits are reviewed in order to show the impacts on performance of these standards.

Regarding the review of these empirical studies, a computer search of the ABI Inform, Emerald and Science Direct databases was conducted. In the field of ISO 9001, a search was made for works that related the expressions ISO 9000, or ISO 9001 to performance or benefits or profitability in the title or the abstract of the paper. In the field of EM, the computer search was made for works that related the expressions ISO 14000, or ISO 14001 to performance or benefits or profitability in the title or the abstract of the paper. The list of references given in the papers found in the electronic search was also reviewed. Theoretical papers and those based on anecdotal evidence or case studies were eliminated.

Based on our research method, 82 empirical papers were finally identified and reviewed regarding the benefits of ISO 9001. Out of the 82 studies, the benefits pointed out were analyzed, and the following 13 benefits were considered as those most used by the authors:

- Market share (MS)
- Exports (EX)
- Sales and sales growth (SG)
- Profitability (P)
- Improvement in competitive position/competitive advantage (CA)
- Improvement in systematization (improved documentation, work procedures, clarity of work, improvement in responsibilities) (S)
- Efficiency (productivity, savings in costs, reduction in mistakes and rework, shorter lead time, improved management control) (EF)
- Improved quality in product/service (PQ)
- Improved image (I)
- Improvements in employee results (motivation, satisfaction, teams, communication, knowledge) (EMP)
- Improved customer satisfaction (reduction in complaints, etc.) (CUS)
- Improved relationships with suppliers (SUP)

- Improved relationships with authorities and other stakeholders (STA)

Following the same criterion, 29 papers were identified regarding the benefits of ISO 14001. It is worth pointing out that the same benefits have been found as those identified in the studies on the ISO 9001 standard, but in addition to these an extra specific benefit has been identified: environmental performance (ENVP).

Benefits of the ISO 9001 standard

Many scholars have analyzed the benefits of the ISO 9001 standard in several performance dimensions as previous section shows. Table I shows which of these benefits are dealt with by the 82 studies examined.

Table I. Benefits of the ISO 9001 standard: a summary

Number of studies	MS	EX	SG	P	CA	S	EF	PQ	I	EMP	CUS	SUP	STA
82	33	20	30	35	18	34	58	23	26	38	52	16	5

Source: Summary compiled by the authors.

Table I shows that the three benefits most frequently analyzed by researchers were improved efficiency, improved customer satisfaction and improvements in relations with employees. These are followed by profitability and improved systematization. Other benefits attained by many firms, as analyzed by the studies, are an improvement in market share and sales, image, product/service quality and exports. Conversely, the three benefits least studied are an improvement in competitive position, improved relations with suppliers and improved relations with authorities and other stakeholders.

In order to analyze these benefits arising from the ISO 9001 standard, some authors have examined its effects through a list of benefits, whereas others base themselves on, or even propose, a classification of such benefits. Such is the case of Lee (1998), who classifies benefits into benefits gained with respect to internal operations (better team spirit, less staff conflict, reduced wastage, increase efficiency, shorter lead time), benefits gained with respect to customer relations (improved sales through new customers, longer contracts with existing customers, less control from existing customers, fewer complaints from existing customers), and benefits gained with respect to subcontractor relations (subcontractors to become certified, better relations with subcontractors, more stringent control over subcontractors).

Nield and Kozak (1999) show that the benefits of the standard may be the following: operational benefits (improved operating systems, enhanced operating practices), marketing benefits (improved customer satisfaction, gained competitive edge, nation-wide recognition), human resources benefits (gained more committed work force, reduction in staff turnover).

Casadesús and Giménez (2000) show that these benefits are people results (work satisfaction, suggestions system, health/safety, turnover, absenteeism), operation results (errors and defects; order processing; reliability; costs; on-time-delivery; cost savings; lead time; stock rotation), customer results (customer satisfaction; complaints; repeat purchases) and financial results (market share; sales; return on sales; return on assets).

Casadesús *et al.* (2001) classified benefits as internal benefits and external benefits. Internal benefits are the following: work satisfaction, safety at work, suggestion system, absence from work, salaries of workers, safety and reliability, on-time delivery, order processing, number of errors, stock rotation, quality costs, cost savings. As external benefits they find the following: customer satisfaction, number of complaints, number of repeat purchases, market share, sales per employee, return on assets, return on sales.

Casadesús and Karapetrovic (2005) find that these benefits may be related to financial results (increased sales, returns on investment, market share, and sales per employee), operational results (reduced logistic costs, improved supplier relationship, increased inventory turnover, fewer non-conformities, compliance with delivery dates, and shorter lead time) and customer-related results (loyalty purchases, customer satisfaction, and fewer complaints).

Similarly, other scholars use two general groups of benefits related to operational performance and financial performance (Naveh and Marcus, 2004; Briscoe *et al.*, 2005). For example, for operational performance Naveh and Marcus (2004) show defect rate, cost of quality, productivity, on-time delivery and customer satisfaction, while Briscoe *et al.* (2005) list defect rate as a percent of production, cost of quality, productivity, and on-time delivery. For financial performance both studies shown market share, sales, and export growth.

As regards benefits found by scholars and the classifications proposed, in general terms, the ISO 9001 standard creates benefits related to customer satisfaction (for instance, fewer complaints and improved customer satisfaction) (e.g., Casadesús and Karapetrovic, 2005; Singh, 2008), improvement in staff management issues (for instance, more training for employees) (e.g., Gupta, 2000; Renuka and Venkateshwara, 2006) and improved efficiency, documentation and clear knowledge of tasks by employees (e.g., Chow-Chua *et al.*, 2003; Magd, 2008). These results indicate that most firms have experienced improvement in these issues, due to the fact that the ISO 9001 standard allows them to reduce mistakes and rework, save on costs and improve the management of the firm. Many firms also attain these benefits because ISO 9001 allows for an improvement of the documentation and work procedures, and a greater clarity of work. Other benefits obtained by many firms are an improved image and an improved service or product quality, because the fact that they possess a certificate enhances their image in the eyes of their customers. In turn, the greater control exercised upon their internal processes allows them to improve the quality of the product or service.

Similarly, several studies have provided evidence of certified firms outperforming non-certified firms (Heras *et al.*, 2002; Corbett *et al.*, 2005; Sharma, 2005). This improvement is attributed largely to improvement in internal business processes. In this context, other studies also show that ISO 9001 certification is not associated with significant financial performance in the longer term, or that there is no significant difference between the impacts of quality management on financial performance for firms with and without ISO 9001 certification (Häversjö, 2000; Singels *et al.*, 2001; Tsekouras *et al.*, 2002).

These ideas indicate that, although there are firms that do succeed in improving their financial results (for instance, their market share and their sales, because the quality certificate opens the door to certain customers), there are many others that do not manage to attain any improvement.

Therefore, as the studies have shown, there is not such an unquestionable relationship between the standard and the financial results.

Consequently, the impact of ISO 9001 on firm performance was more mixed compared with the impact of QM on firm performance, which was much more unanimous (Martínez-Costa *et al.*, 2008). Therefore, the clearest benefits are those influencing the internal performance or operational results, and customer results.

Benefits of the ISO 14001 standard

As in the ISO 9001 standard field, the benefits associated with the implementation and certification of the ISO 14001 standard have also been extensively analyzed in the academic literature. The main benefits identified in the empirical literature are presented in Table II.

Table II. Benefits of the ISO 14001 standard: a summary

Number of studies	MS	EX	SG	P	CA	S	EF	PQ	I	EMP	CUS	SUP	STA	ENVP
29	5	6	1	16	10	9	16	4	14	13	14	7	10	23

Source: Summary compiled by the authors.

Table II shows that the three benefits most considered by the studies identified are environmental performance, efficiency and profitability. Other benefits which have also merited great attention are improved image, improvement in customer satisfaction, improved staff results, improved competitive edge and improved relations with stakeholders. Conversely, the benefits least considered in the empirical studies analyzed are improved sales, improved product quality and increased market share.

As was the case with the studies on ISO 9001, some studies analyzing the ISO 14001 norm have also proposed several groups of benefits. For instance, Poksinska *et al.* (2003) pointed out three groups of benefits: internal performance benefits (cost reductions, environmental improvements, increased productivity, increased profit margin, improved internal procedures, improved employee morale), external marketing benefits (improved corporate image, increased market share, increased customer satisfaction, increased on-time delivery to customers) and relations benefits (improved relations with communities, improved relations with authorities).

Hillary (2004) distinguished between internal and external benefits. In addition, this author divided internal benefits in several groups: organisational benefits (quality of management, quality of training, working conditions and safety, quality of environmental information, legal compliance, encouragement of innovation, improved procedures, strategic overview of environmental responsibility), financial benefits (cost savings from material, energy and waste reductions), and people benefits (increased employee motivation, enhanced skills, better company image among employees, forum for dialogue between staff and management). External benefits may also be divided in different groups: commercial benefits (gaining new customers/business and satisfying existing customers, gaining competitive/marketing advantage, staying in business, developing more environmentally friendly products), environmental benefits (improved environmental performance, assured legal compliance, increased energy and material efficiencies, reduced pollution), and communication benefits (positive public image, better

customer relationships, better cooperation and relationships with regulators and administrative bodies, improved communication with stakeholders, set an example for other companies in a sector).

Zeng *et al.* (2005) also considered several groups of benefits: internal operations (enhanced efficiency, well-defined responsibility, enhanced environmental awareness, standardization of environmental management), corporate management (fewer complaints, improved profitability, savings in resources and reduced wastage, increased social recognition), marketing effects (enlarged market share, confidence from customers, improved corporate image), and supplier relations (better relations with suppliers, more stringent control over suppliers, promoting ISO 14001 certification to suppliers, enhanced environmental awareness of suppliers).

Link and Naveh (2006) distinguished between environmental performance (pollution emission, use of recycled materials and other environmental aspects) and business performance (annual gross profit margin, investment in R&D, sales, sales per employee and business with foreign organizations).

Gavronski *et al.* (2008) emphasized four groups of benefits: productivity benefits (resource usage reduction, optimization of process flows, production costs reduction, better employee motivation), financial benefits (opportunity to obtain investment funds from governmental organizations, access to special credit with reduced interest rates, reduction of insurance premia), market benefits (competitive advantages, positive effects on the market and with customers, opportunity to set an example for suppliers) and societal benefits (improved corporate image for society in general, reduced environmental liability, improved cooperation from environmental authorities).

As in the case of the ISO 9001 standard, in general terms the studies show that ISO 14001 standard had a significant impact on a high number of benefits. However, some studies have found no positive relation between the implementation of ISO 14001 and performance. For example, Cañón and Garcés (2006), through an event study, found that ISO 14001 certification had a negative impact on stock price. Besides, Link and Naveh (2006) found that, although a greater management standardization in environmental issues does lead to better environmental performance, such environmental performance does not have an influence upon business performance.

Discussion and conclusions

This paper has reviewed the literature on the ISO 9001 and ISO 14001 standards and their benefits, in order to examine the benefits analyzed and the similarities and differences regarding these benefits in these two standards. On the basis of this analysis the paper suggests several ideas about similarities and differences, classification of benefits, interiorization, integration, and the selection effect.

First, Tables I and II show that the benefits most analyzed by researchers, both concerning ISO 9001 and ISO 14001, are improved efficiency and profitability, improved customer satisfaction, improved relationship with staff and image.

Other benefits analyzed for ISO 9001, although to a lesser extent, are market share, sales and product quality. These three benefits are those least analyzed for the ISO 14001 standard. Moreover, the environmental performance, the most common benefits in the ISO 14001 standard, has not been examined by the ISO 9001 standard. In addition, relationship with stakeholders is considered by a high number of studies in ISO 14001 but is the least studied by the ISO 9001 works.

Second, in general terms, the benefits of ISO 9001 and ISO 14001 may be classified into internal and external ones. Other studies propose a wider classification, including people-related, operational, customer and financial benefits, which in turn could be then divided into internal and external. According to these studies, internal benefits include improvements in corporate processes having positive effects on operational and people issues (e.g. increase in productivity, improvement in efficiency and reduction in costs and waste, training). External benefits relate to effects on customers and society in general (e.g. customer satisfaction, better relationships with stakeholders, improved image). In this context, some studies classify financial results as external benefits and other as internal benefits.

Consequently, in this context, both standards show clear benefits on certain issues, such as efficiency, employees, systematization, customers and other stakeholders, which indicates that, in general terms, certified firms improve people, operational and stakeholder performance. Nevertheless, only some certified firms do better than non-certified firms regarding financial performance. As was pointed out in the previous section, both for ISO 9001 and for ISO 14001, studies can be found showing that there is no impact on financial performance. Therefore, although the standards do create internal and external benefits, and therefore many of them have positive effect upon people, operational issues and stakeholders, the relationship between these standards and financial performance is not so clear.

Third, several scholars show that more internally motivated firms saw better performance outcomes, for both internal and external performance, both for ISO 9001 (Lee, 1998, Jones *et al.*, 1997; Singels *et al.*, 2001; Boiral and Roy, 2007; Martínez-Costa *et al.*, 2008) and for ISO 14001 (Boiral and Sala, 1998; Rondinelli and Vastag, 2000; Kitazawa and Sarkis, 2000). This indicates that certification in itself leads to few benefits. However, when a firm really applies the quality system underlying the standard, and there is a real commitment to quality and to the environment, that is, when the standards are interiorized, there is an increased possibility of attaining the benefits listed, including the financial ones.

In this context, an important issue in the works identified is the measurement of certification. Most of the studies analyzing the benefits of ISO 9001 and 14001 consider a dichotomic variable to see whether the firm is certified or not, but do not analyze the degree of commitment, implementation, or internalization of, the ISO standards. In this respect, many studies measuring QM have used a number of practices in order to measure it as a multidimensional construct (Powell, 1995; Kaynak, 2003; Prajogo and Sohal, 2006). For instance, those works measuring QM as a multidimensional construct use practices like the following: leadership, people management, customer management, relationships with suppliers, process management and information and analysis. Each of these constructs is measured through a set of items. In this way, the authors may analyze the QM level, and thus examine if a higher level in QM leads to increased results. In the field of EM there are also studies measuring the degree of environmental

proactiveness using various practices and critical factors for implementation (Quazi, 1999; Kitazawa and Sarkis, 2000; Lin *et al.*, 2001; Govindarajulu and Daily, 2004; González-Benito and González-Benito, 2005; Wee and Quazi, 2005).

These issues have been little analyzed in the case of ISO 9001 and ISO 14001. Thus, for instance, only a few authors measured the variable ISO 9001 as a set of dimensions made up of various items, in order to examine the degree of interiorization of the variable. This indicates that few studies used ISO 9000 key management practices to assess ISO 9000 and then analyzed their effects on firm performance, as many studies about QM have done measuring QM as a multidimensional construct. For example, Naveh and Marcus (2004) used several measures to examine the adoption of the ISO 9001 standard (e.g. going beyond; used in daily practice; applied to solving problems; integrated; kept current; externally coordinated). Their results show that the impact of ISO 9001 on performance depends on the level of assimilation (i.e. the degree to which the practice makes its way into various aspects of the organisational life) and the degree to which the organisation goes beyond the minimal practice requirements. More success is achieved if there is both thorough assimilation of the practice and the firm goes beyond what the practice requires. Then, though the ISO 9001 standard itself is homogenous, the way a firm implements it introduces variations that can distinguish the organisation from its competitors in operating performance and in this way gives the individual organisation an advantage (Naveh and Marcus, 2004, 2005). Similarly, Singh (2008) identified a validated framework for effective implementation of ISO 9000. The author used six constructs to measure management practices associated with the standard: management policies, plans and actions; focus on customers; capable employees; reliable suppliers; sound communication system; and steady processes. These ideas suggest that quality certification may be important for competitiveness, but it is the way such certification is implemented and internalized that makes it possible to derive the benefits described by the literature. Thus, when certification is used in daily practice and as a catalyst for change, the organisation could achieve a distinct operating advantage from implementation (Naveh and Marcus, 2005).

Studies on ISO 14001 that emphasize this idea can also be found. Link and Naveh (2006) point out that, for this standard to be really effective, it must be made a part of daily work. These authors measured the degree of standardization, considering the degree to which ISO 14001 rules, policies, and procedures govern the managing of organizational environmental issues, using six items from Naveh and Marcus (2004). Schylander and Martinuzzi (2007) pointed out that, in order to develop an ISO 14001 environmental management system into a sustainability management system, the two most important challenges are to improve coordination between the EM and the organization's strategies and to synchronize the EM with central value chains. Quazi (2001) emphasized that environmental management should be integrated into the organizational strategic planning process. Yin and Schmeidler (2009) indicated that standardized management systems may be implemented very differently in different organizations. According to these scholars, this variability in implementation may be responsible for the heterogeneous performance of these standardized systems, and they emphasize that the current literature on the environmental impacts of ISO 14001 certification has largely neglected this phenomenon. These authors considered the integration of ISO 14001 standards into daily operations, and the inclusion of performance management elements in the ISO 14001 standard.

Four, many similarities exist between QM and EM systems. For example, their purposes and implementation-related factors are very much alike. Considering these parallels, and since research on QM is more fully developed than that on EM, significant benefits can be expected from applying the knowledge acquired about QM to environmental issues (Klassen and McLaughlin, 1993; Curkovic, 2003). Moreover, an integrated system adds a number of benefits to those achieved by each of the systems alone. Among these benefits, the literature highlights the following (Wilkinson and Dale, 1999a,b; Poksinska *et al.* 2003; Zeng, Tian and Shi, 2005; Zutshi and Sohal, 2005):

- An improvement in the efficiency and effectiveness of the organisation, avoiding the duplication of effort,
- A reduction of bureaucracy by eliminating duplication of policies, procedures and registers,
- The alignment of goals, processes and resources,
- A reduction in the costs of internal and external audits, and
- The availability of joint training and improved communication between all organisational levels.

Finally, it was considered that an important issue regarding benefits is the analysis of whether there is a treatment effect and a selection effect. For instance, in the case of financial benefits, it would be interesting to know if the implementation of the standards leads to an improvement in these financial benefits (treatment effect) or if, on the contrary, it is precisely those firms with relative financial benefits over the average in the sector that are most likely to obtain certification (selection effect). In this respect, there a number of studies in the field of the ISO 9001 standard (Heras *et al.*, 2002; Dick *et al.*, 2008) which have verified the existence of both effects. In our opinion, new studies should be carried out regarding this issue for the various indicators of firm performance reviewed.

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Product Flow vs. Data Flow. A discussion of the need for harmonizing the material and data flow in a manufacturing environment.

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Category: Case Studies

To develop an outstanding enterprise, particularly in the manufacturing sector, a company must have an equally strong understanding of both the material flow and information flow collective processes that define its operations. Often in the effort to implement Lean Six Sigma initiatives many companies have lost focus of the fact that data flow and material flow are two sides of the same coin. This short-coming starves the Six Sigma methods of the data required for its mathematical rigors which in turn causes the overall enterprise to run at a suboptimal level.

Management in any organization is charged on a daily basis with making choices from a multitude of options. The type and manner of these decisions vary from day to day and enterprise to enterprise. In aggregate, these decisions define the success or failure of a project, team, division or enterprise. To be a successful organization, these decisions are motivated by data not management style, yet data alone in the abstract has little value. Data begins to add value to an enterprise when it is sourced at elemental points in the organization's processes and effectively communicated from the ground level (the manufacturing floor, restaurant dining room, brokerage sales desk etc) to top management. Only then can "numbers on a screen" translate directly to better decisions which ultimately affect an enterprises' bottom line.

Many companies employ "process discipline" and "standard operations" concepts in their attempts to control variation in processes and the quality of their final products. Their approach is valid insofar as it recognizes that production results cannot be entirely stochastic. Clearly, "God does not throw dice" on every step in a process. The aim is for a more systematic approach for identifying the measurable process parameters that differentiates between production success and failure. It is only through the process of taking measurements, recording the data and then using the tools of Lean Six Sigma that causal relationships are discovered. With this information efforts can be focused and resources allocated to controlling this measurable variation to impact final quality. The alternative in the absence of adequate information is to institutionalize the current state of reduced expectations and results.

Historically the cost of collecting data has been quite high relative to the perceived benefits derived. Nowhere is this more apparent than in a manufacturing environment. If a Lean Analysis were performed on traditional data collection systems, the entire process would be identified as non-value added and hence "muda". In the past, typically all data was collected about a product or process either by diverting material to a quality lab for inspection or doing painstaking time studies of operator actions and then auditing the results. These methods may have been the only practical implementations available, given the cost and technological limitations for the time. Fortunately the cost and flexibility of current technology which allows for process and product specific data to be collected in line, by the existing operators without increasing cycle time or

incurring great expense has significantly shifted the data collection paradigm. There are many current examples of cases where traditional constraints are now easily overcome with modern inline measurement systems.

In one example from the Less than Truck Load (LTL) industry, a shipper would contact a shipping company and negotiate a rate to ship based on the weight, dimensions, and class of the subject freight and the shipping distance. Based upon this conversation the shipping company would transport the parcel for the agreed upon rate, never confirming the accuracy of the weight and volume parameters. Shippers eventually discovered that underreported weight usually went undiscovered so deliberately misstating weight and volume emerged as a strategy to reduce transportation costs.

The response of the shipping companies was to divert ~30% of their freight to a “re-weighing re-dimensioning station”. At the station an operator would physically move the item to a designated scale station, measure the volume of the parcel and write the results as well as the “PRO Number” (identification number) on a sheet of paper. At the end of the shift these chits of paper were then handed in to a data entry person who would enter the information into the billing system. A person without the tools and techniques of Lean or Six Sigma can clearly identify this as an inefficient process that is both failing to inspect 70% of the items and requiring more time and labor than is necessary.

The solution to this problem was to integrate a mobile weighing system on the forklifts used at the terminal to stage the palletized cargo for transport. As the material is being conveyed to a shipping bay, the pallet is identified by an RFID tag printed on the shipping label, and the weight is captured in transit. The information is then wirelessly transmitted directly to the existing billing system in real time.

Another transportation example comes from the food industry. This manufacturer received its raw materials (flour, grain etc) on rail cars; traditionally an order was placed to the supplier based upon the rail car size. It was assumed that a particular rail car was able to hold a certain amount of material, however the exact amount was never known and there was suspicion that other “fill” was being used to alter the volume of the cars.

The solution to this system again involved RFID and required the installation of weighing sensors underneath the train rails. All freight rail cars traveling in the United States are required to have RFID tags installed, which allows for the system to uniquely identify each car. When the full rail cars entered the facility, the RFID tag was read, and the weight was recorded. The car was then decoupled and unloaded. The cars then exited the facility in a random order over a different scale where the car was identified and the empty weight captured. The difference between the full weight and the empty weight represented the amount of material collected. As a further control, if weight were detected by the scales without a prior RFID read, a picture of the car was captured and automatically emailed to the project manager. The entire system was designed to operate completely autonomously with no consequent impact on labor costs or cycle times and provided critical new data to the manufacturing and procurement processes.

The common practice of sampling for quality assurance is the focus of this next example from a manufacturer of specialty chain products. A highly automated machine adroitly transforms coils

of raw steel input at one end into continuous finished chain at the other. Every “n” number of meters, an operator stops the machine, cuts off a sample, transports it to the quality lab, and then waits for up to 90 minutes. Once the material has passed the inspection, the operator restarts the machine and the process repeats. The problem was to design a method by which the operator could perform the test without delay directly on the production line.

The solution used a simple touch screen interface. From the type and size of chain in his hand, the operator visually identifies its onscreen match from a matrix of graphics presented, touching the same to affect their selection. An implementation using graphics in this way addressed a myriad of language/ literacy barriers that existed with some of the operators. The operator was then shown an onscreen demonstration of how to load the sample in the automatic test fixture and perform the test at the bench. If the test resulted in a passing mark, then the result was automatically stored in the quality system; if the result indicated a defect, then the quality manager and downstream managers were automatically emailed, alerting them to the error condition. Again this system was implemented without increasing labor or cycle times.

An example that is common in high volume manufacturing relates to the miscounting or loss of pieces. In this instance, a manufacturer of hand tools could not account for discrepancies of 300,000 parts per facility per month. The problem was the result of material not being properly recorded in the ERP system as it flowed through the manufacturing process. If information were not entered, then the ERP would respond by scheduling more production of the piece. If a wrong number were entered, then the ERP would fail to schedule the part for production. Furthermore managers lacked sufficient information as to the whereabouts of the material or which manufacturing stage it was in.

The solution to this problem involved a simple counting scale, a barcode scanner and a printer. The system enabled the operator to scan a barcode to identify the product and download its associated average piece weight from a database. Placing items on the scale then instantly yielded the correct number of pieces, with the operator then pressing a button to indicate a finished count. The part was then flowed from one WIP state to the next in the ERP system and a label was printed to confirm that the transaction was received. The number of misattributed parts of this manufacturer was reduced to less than 300 while the cycle time increased by less than 15 seconds.

A final example illustrates the ability to obtain process information about a step in the manufacturing process. A producer of sanitary ware applies a glaze and an antimicrobial coating to a piece in what looks like a common spray booth. Detailed work instructions specified the amount, the pattern, and the duration of application of the glaze and the antimicrobial coating respectively. Operator conformance to the specification was infrequently audited. Furthermore, it was noted that improper application of glaze resulted in defects detected later in the process where adequate analysis was confounded by other variables.

The solution implemented allowed for the amount of time and quantity of materials to be recorded for each of the steps. The system consisted of a load cell and two air flow switches. The load cell was installed underneath the turn table on which the piece to be sprayed was placed. When the operator began to spray the piece with the glaze, the airflow switch closed and the weight was recorded. Once the piece was sprayed and the operator released the trigger, the

weight was recorded again, permitting an accurate calculation of the amount of glaze applied to the piece. The same process was repeated for the antimicrobial. In this case, critical quality data was able to be collected without changing the operator behavior or incurring an increase in cycle time.

These examples demonstrate methods of collecting data *once the critical factors have been identified*. The identification of what to measure is just as important as the conclusions that are drawn from the data. Both Lean and Six Sigma provide tools for identifying what parameters are critical to quality.

In a non cost constrained environment, a solution alternative would be to measure everything, but clearly this is unrealistic in economic as well as practical terms. Yet an effective initiative toward that ideal is to start with a map for the entire process recognizing that technology now allows for greater data collection “saturation” inexpensively, without increasing labor or cycle times. It is now possible for significant information to flow in real time from the production floor directly to all levels of management, fostering more effective data driven decisions.

The problem of decoding physical observations into usable data is easily overcome in the modern era, a luxury not available in the prior period. Historically, the solution was to have a quality technician or auditor register their observations and take measurements from analog gauges and record the data on a paper check sheet. As illustrated in the preceding examples, a vast array of sensors is now available, allowing for physical observations to be encoded and transmitted without the labor intensive and error prone journalizing practiced in the past. Though there is a wide range of communication protocols for communicating with sensors, the most common are +-5V, 0-40ma, RS232 and Ethernet. The technical rigor and subtle differences between the communication methods belies the ease with which each allows transmission of the data from the sensor to a computer and subsequent storage in a database.

In many enterprises, Information Technology (IT) departments, concerned with security issues and infrastructure support, unfortunately become “gatekeepers” restricting management’s access to information. Rather, IT must reevaluate their function and deploy their resources to best serve the needs of management by providing cogent information in a coherent manner. Functioning as “information agents”, IT must ensure that data economically created and collected on the product floor be efficiently stored in a database and meaningfully retrievable. Properly accomplished, the objective is for the data flow map to effectively encapsulate the process map, enabling the simultaneous flow of material and all the relevant data about it (in real time) through the enterprise enabling operational excellence through data driven decisions.

There exists a spectrum in decision making, ranging from “shoot from the hip”, where decisions are made by experience and intuition and not supported by empirical data to “analysis paralysis” whereby little is accomplished while complex often inconclusive statistical tests are performed on increasingly large data sets. The previous examples highlight the ability to accurately and efficiently collect potentially excessive amounts of data about virtually any process. This capability has the effect of shifting the paradigm towards the numerically rigorous statistical methods of the Six Sigma methodology. In aggregate, this shift has a positive impact on the quality of decisions made. The organization also benefits from the Quantum Mechanic like Hawthorne Effect, where the mere act of observation and measurement improves results.

However, organizations are presented with two classes of problems, those that have a macro effect caused by a large underlying deficiency and those whose macro effect is only observable as a result of a collection of smaller events. The analytical data methods are ill equipped in many cases to handle the second class of “just get it fixed” problems. These common deficiencies are addressed by less mathematically rigorous methods (such as the 5S of Lean) which allowed for improvement to be realized immediately without the need for the long project cycle times often associated with the formal statistical methods. The challenge of management is to provide adequate resources to solve both classes of problems ensuring that simple problems are fixed and the complex are provided with a sufficient amount of data to be solved. Common sense judgment and modern data analytics packages make this once difficult tradeoff effectively manageable.

Data drives an enterprise, from the production floor to the balance sheet to ultimate sales to the final customer. Getting enough of the right data, at the right time, to the right people is the constantly evolving challenge that must be met. Technology now facilitates the real time flow of this information through an enterprise allowing for timely data driven decisions to be made.

Operational Risk Management for an Electric Utility based on Basel Accord

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Key words: Operational risks, Basel Committee, Electric utilities, Value at risk, Total Quality Control, Crisis Management.

Category: Research Paper.

Introduction

Global economy has been greatly affected by extreme events such as Enron downfall and the twin towers terrorist attack. These as well as other events have clearly shown that operational risks shall be analyzed not only from a purely financial point of view but from a broader perspective, specially for strategic companies among which energy utilities play a crucial role (Jorion, 2007).

(IEA¹, 2009 - 2011), shows how energy and oil prices fluctuate in relation with international crises such as that of the middle east and northern Africa instabilities. These crises are of relevance for the company under study as its primary role is to save self consumption of oil barrels in Venezuela to increase the export ratio.

(TEPCO², 2011a,b), shows the results for a company similar to this under study here. This company has been affected by 9.0 earthquakes and tsunamis with a huge impact on environment and the global economy.

A number of reasons, among which are political, economical and strategic reasons, as well as some sort of basic operational risk analysis, have led to the creation of the nationalized Corpolec⁴ out of CVG-EDELCA³. EDELCA is now just one out of 12 companies belonging to the holding (Corpoelec – EDELCA, 2007-2009).

In the preset analysis, operational risks within Corpoelec-EDELCA are studied according to the Basel accords and metrics, as well as the already existing procedures of Corpoelec-EDELCA and the company in charge of quality control (PDCA). The fact that Corpoelec-EDELCA is together with PDVSA⁵, the biggest company in Venezuela makes the present analysis more relevant due to the high quantity of sources of operational risk affecting the company.

Structured Abstract

Purpose

The aim of this paper is to systematically analyze the primary sources of operational risk in the electricity industry. The analysis is based on questionnaires handed over to both management and operational workers.

It also establishes a methodology for diagramming processes in order to define, stratify and quantify operational risks based on the Basel principles and adapted to the consequences and lessons learnt from the global financial crisis.

¹ IEA: International Energy Agency. ²TEPCO: Tokyo Electric Power Company. ³ CVG – EDELCA: Corporación Venezolana de Guayana – C.A. Electrificación del Caroní. ⁴Corpoelec: Corporación Eléctrica de Venezuela. ⁵PDVSA: Petróleos de Venezuela S.A.

Preliminary results presented herein are primarily based on qualitative methods for identification and risk assessment by experts engaged in electrical utilities.

Another aim is to establish a measure of risk assessment expressed in electrical terms (MWh), not affected by macroeconomic values over time.

Design and Methodology

The model follows this logical sequence:

- (i) Interviews with managerial and technical staff.
- (ii) Techniques for collecting and analyzing information to identify critical process areas.
- (iii) Flowchart design for critical processes.
- (iv) Identification of activities and operational risk assessment.
- (v) Top-Down and Bottom-Up Risk Analysis. See Figure 1.
- (vi) Compound Operational Loss Models and Derivation of Operational Value at Risk.

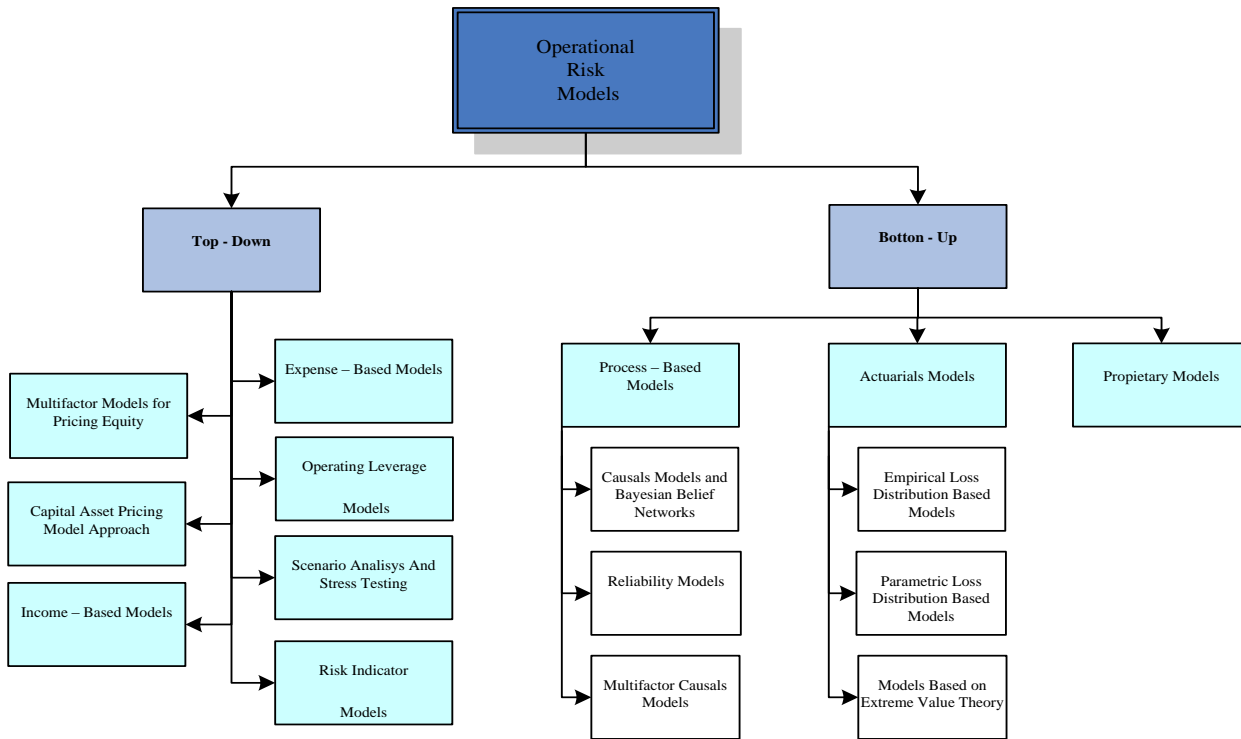


Figure 1. Topology of Operational Risk Models.

Source: Chernobai (2007)

The figure 2, shows how the authors manage to fuse the quality control model based on the Deming cycle (PDCA) that is establish on the company just as it found in the section 4 y 5 of this document along the proposal of the Basel Committee.

Preliminary Results

From the interviews and the brainstorming, it is detected that there is a crisis management plan (CVG – EDELCA, 2001), with which it seeks to manage operational risk, but mainly the patrimonial security, labor, equipment, and others of this nature; however, does not show how to

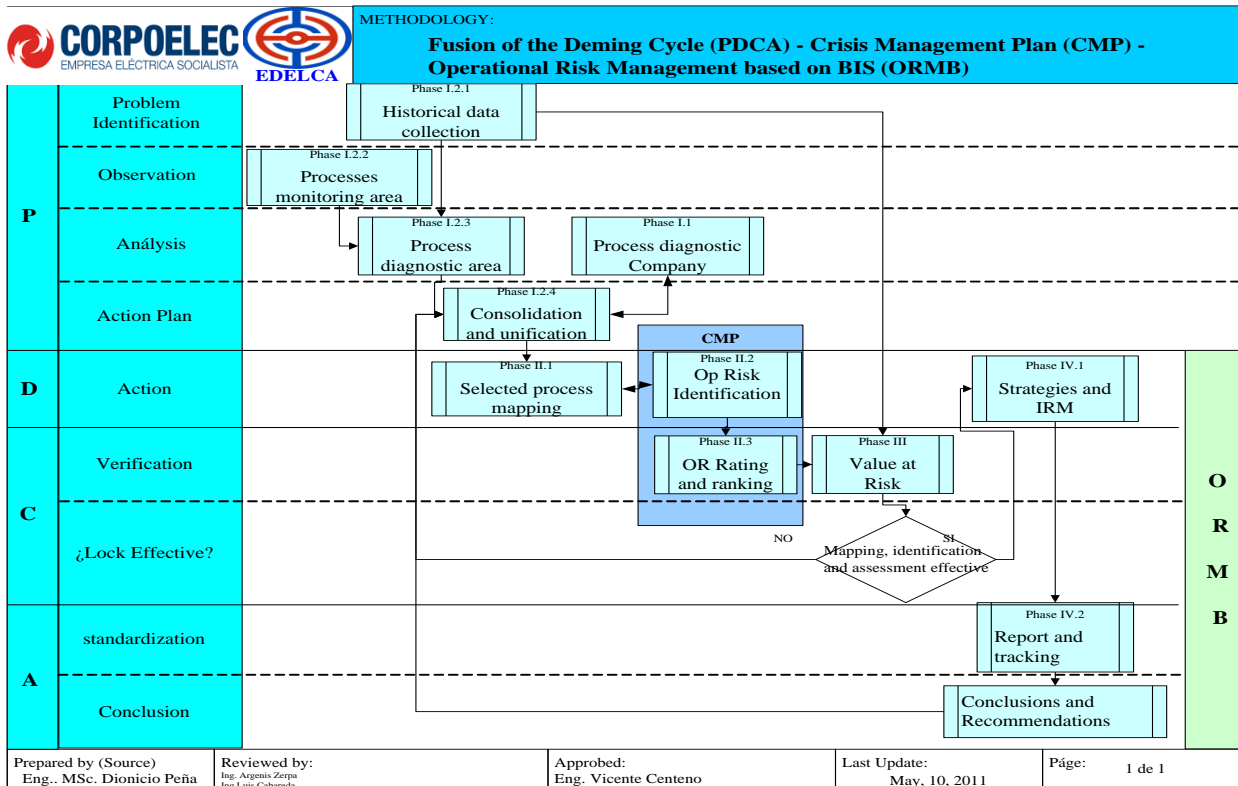


Figure 2. Fusion of the Deming cycle, mayor crisis management plan and the operational risk management’s model propose by BIS adapted for Electricity Utilities.
Source: The Authors (2011)

perform risk assessment and/or economic impact in the organization, so the expert staff considered it a manual and not an effective means of risk management.

The quality management system of the company which is certified with the ISO⁶ 9000 Standard are found to be very effective for organizing, controlling and managing processes, however, it cannot detect the critical points of operational risk processes.

On the interviews and surveys realized from the Basel II & III criteria, between the company’s management, professional and technician staff it considered feasible the implementation of the Basel Committee guidelines for the assessment of the operational risk, and allowed to study various sources of risk to the company (CNG⁷, government policies, terrorism, floods, decreased rainfall, reduce driver flow, contractors, processes, human resources, other), and complement the quality management systems and crisis management already in place, thus achieves a prerequisite for the implementation of methodologies supported by the BIS, product of the high investments that the company made on quality management systems and that is undesirable to reject.

The authors transform the metrics of the banking industry into energy parameters that enable to determine the maximum amount of loss that is expected to occur over a pre-specified time horizon at a pre-specified confidence level.

⁶ ISO: International Organization for Standardization

⁷ CNG: Centro Nacional de Gestión de Sistema Interconectado del Sector Eléctrico Venezolano

In applying the methodology proposed by the authors to the company under study, it was obtained as a result of the paired comparison analysis and grid analysis that maintenance processes have an estimate by the experts that have a high percentage of operational risks, so that the calculation of value at risk approach in this field.

We complied with the commitment to identify random variables that imply the likelihood of potential damages and losses in the research unit (EDELCA) and for their most critical process "Run Maintenance" according to the summary of sources of risk shown in the Figure 1 and described in Section 3 of this document.

In the electricity utility under study, it is found that the nature of operational risk is crucially linked to people and systems and external events but internal processes seem to have little impact.

Furthermore, the authors have fully integrated the quality processes already developed by the company together with the complementary assessment of operational risk arising from the Basel II & III financial framework, to yield a unified model for the whole operational risk monitoring of the company.

Practical and Social implications

It was obtained a set of principles of disclosure of information that will enable energy market participants (Government, retailers, consumers, regulators, shareholders, investors, banks and others) to evaluate and estimate, on an ongoing basis, the operational risk profile and capitalization.

Originality/Value

Until the events of 2001 (Enron, world trade center's attack); the operational risk were not considered by any agencies, for lack of importance against market risks, liquidity and credit. Since that date, the BIS has published continuously suggestions for applying the methodology that may decrease the impact of such risk. However, since then these risks have been with some exceptions considered only by the global financial sector, as part of the contribution of this paper is to present the versatility to be implemented in other non-financial sectors, in our case in the in the field of electric power companies, where even though in some countries has been implemented there is little or no information about.

The model manages to merge methods commonly used in engineering or technical firms with a model originally designed for financial firms (PDCA, PMC with ORMB).

Another value that this paper have, is that allows to work the value at risk with a variable that is function of the electricity (MWh), and because it is normally strictly regulated by the government which provides the research unit, is considered "exempt" or "somewhat affected" by effects such as inflation, deflation or other macroeconomic variables, so when generating the time series of operational risk will be easier to study.

At the time the analysis was done according to the time series of risk variables. This paper considers the existing time series (if any), but mainly based on the study of qualitative methods based on expert decision; which just started to be implemented in the financial system, from the World Crash of 2008, which is put on par with electricity companies.

It is prove the versatility of the Monte Carlo method in the calculation of value at risk, when the data comes from qualitative variables.

It is used expertise's decision matrix (Mind Tools) for through the principle of Pareto quickly detect conflicting areas and processes of the research unit, thus easily handles conflicts of interest generated by the business areas in which the expertise work.

It is establishes certain financial indicators of non-financial risks, which is achieved by direct personal interest in high-tech electric companies, which prior to this study was not even considered.

It is designed a software that allows the study of randomly variables more easily and the handling for the use of statistics and forecast software.

Operational Risk

The formal definition of operational risk that is currently accepted was proposed by the *Bank for International Settlements* (BIS, 2010) as follows:

Operational risk is the risk of loss resulting from inadequate or failed internal processes, people or systems, or from external events.

Under the advanced measurement approach of the Basel II & III Accord, banks are required to measure their total annual operational risk exposures (Gregoriu, 2009; BIS, 2010).

The topology of Operational Risks, adapted from BIS definitions for an electricity utility, is summarized in Figure 3.

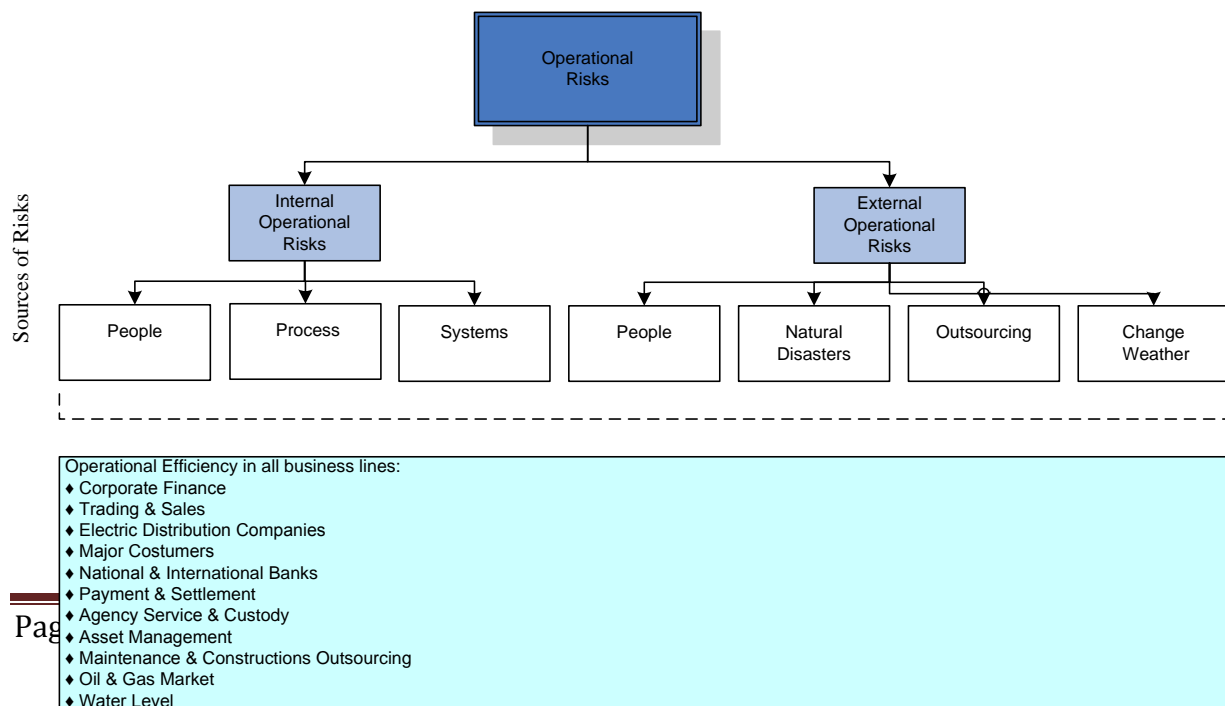


Figure 3. Sources of Risks

Source: Adapted for Authors from Chernobai (2007)

Figure 4 is proposed by the authors as the main framework helping define the adaptation of sources of operational risk from Basel to the energy industry, integrating them into the family of financial risks (BIS, 2010; BIS, 2011a, BIS, 2011b; Chernobai et al., 2007; Jorion, 2007 y Gregoriou, 2009).

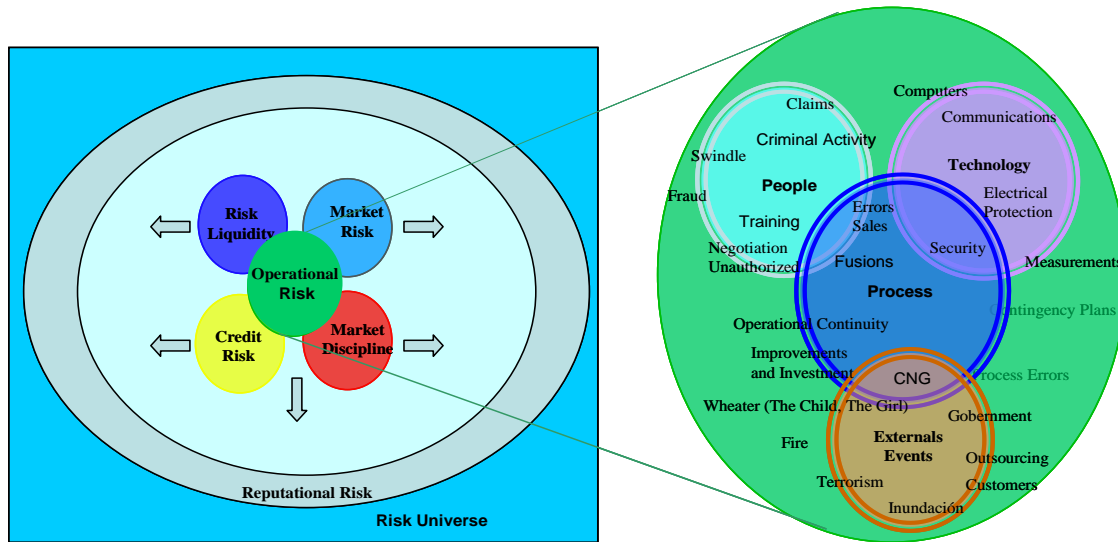


Figure 4. Risk Universe
Source: Adapted for Autors from BIS (2001)

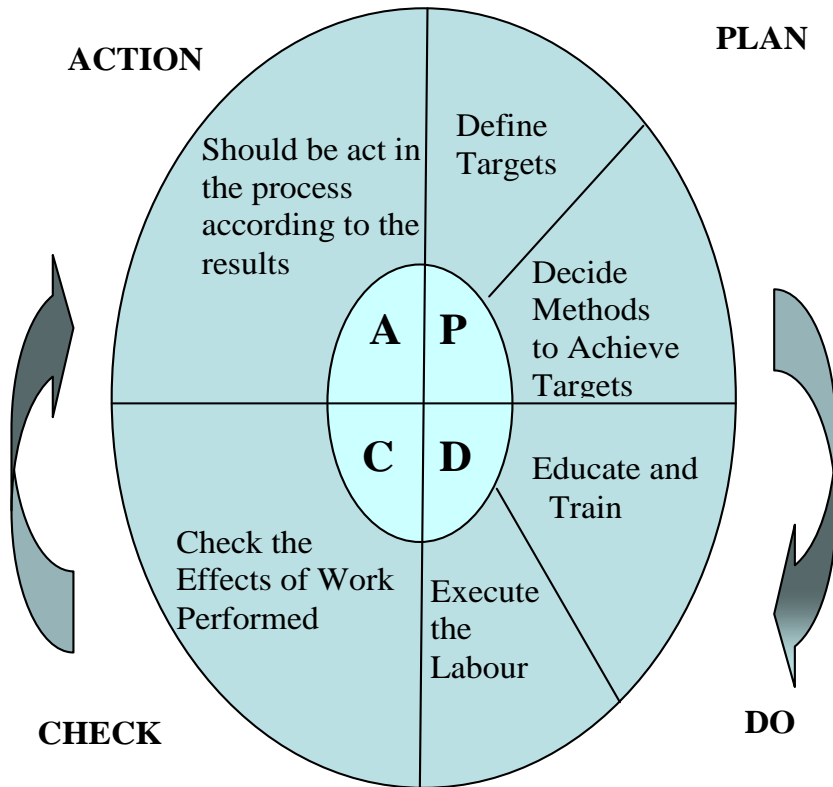


Figure 5. Deming Circle (P.D.C.A.)
Source: Falconi, (1994)

Total Quality Control and Deming Circle

The term quality, defined by (Juran, 1990) as "Fit for Purpose" and (Crosby, 1990) as "conform to specifications" or, as simply proposed by (Soin 1997) "Products and services that meet or exceed customer's expectations ". According to the ISO9000 (2000) "The degree to which a set of inherent characteristics fulfill certain requirements. "According to (Falconi, 1992), the method that should be used for total quality control on a daily basis should be the PDCA cycle or Deming cycle. This cycle is shown in Figure 5.

Mayor Crisis Management Plan (MCMP)

The mayor crisis management plan of the EDELCA was designed to react to any hazard and emergency caused by the following risk of social origin, technological or natural, as it seen on Table I.

Tabla I. Risk Sources on MCMP

SOURCE			
NATURAL	TECHNOLOGICAL		SOCIAL
Loss caused by factors a) Geological b) Atmospheric c) Biologics	Accidental a) Fire b) Explosions c) Transport d) Failure and Collapse of equipment and / or structures e) Pollution f) Intoxication and Poisoning	Claims: Accident	Intentionally generated Claims: a) Crime b) Internal Staff c) Contractors d) Suppliers e) Clients f) Community g) Subversion h) Actors War

Source: The Authors and CVG - EDELCA, (2001)

Statistical Universe, Population and Sample of Corpolec – EDELCA

The statistical universe (Seijas, 2006) is made by 4.271 people; the organization is shaped in 4 hierarchical levels of the EDELCA worker's population as shown in the Table II, and the tested population (Lohr, 2000) is made by all the working personal on the executive committee, managers, supervisors, professionals and technicians made by 2.390 of EDELCA's employees.

The sample unit (Lohr, 2000; Seijas, 2006) is constituted by the EDELCA's working personal from both genders of each one of the departments, (EDELCA, $n_D = 45$), in which one where selected randomly on the departments with most employee and deliberated on the managers and executive committee. So it was designed an intentional uncomplicated deterministic sampling (Lohr, 2000; Namakforoosh, 2006; Seijas, 2006). To obtain the size of the sample it was applied the following formula of the quantitative age variable of EDELCA's company's working people. (Buendia; et al., 1998; Sampieri, et al., 1991).

$$n_0 = \frac{Z^2 * N * \sigma^2}{E^2 * N + Z^2 * \sigma^2} = 87$$

Where: N: Size of the population (2390). σ : Standard deviation of the age performance from the EDELCA's employees (7.99). E= sampling error (3.91% = 1.647144 years). Z= assurance level ($\alpha/2 = 0,05 = 1,96$).

Table II. Statistical universe distribution, population and sample of Corpolec – EDELCA

	Personal Description	Universe		Population		Sample	
		N	%	n	%	N_M	%
1	Executive Committee	17	0,40	17	0,71	1	1,15
2	Managers	35	0,82	35	1,46	11	12,64
3	Professionals, supervisors and technicians	2338	54,74	2338	97,82	75	86,21
4	Employees and workers	1881	44,04				
	Total:	4271	100,00	2390	100,00	87	100

Source: The Authors and Corpolec – EDELCA (2007 – 2009)

Detection of the perceived impact on the operational risk by the Corpoelec –EDELCA employees

Brainstorming with the company's expert (managers, professionals and technicians)

On the interviews and surveys made from the Basel's criteria and from (Corpoelec – EDELCA, 2007), the FODA arrays was extracted (Table III), in wich shows the scenarios for the start study.

Surveys to establish the critical areas of the company and establish the sources of greatest risk

Procedurally, the study consisted on the designed, validation and application of an survey meter type, with the Lickert's scale on a interview way structured on each one of the companies links (directions, managers and divisions), in wich it was compared and estimated the possible impact in the risk operative organization. These surveys are denominated paired comparison analysis and considered expert decisions arrays (Mankletlow, 2004).

The comparison was stable on a risk indicator (risk factor), in wich it was realized a normality test, and a Kolmogorov – Smirnov coefficient =0,110404 was obtained, with which normality indicator is prove.

From the software SAS 9.1 (2004), it was obtained the charts shown in Figure 6, to define the normality of the risk indicator.

On the Figure 7, is observe how the Guri Plant, was identified as the higher operative risk area inside the company, when is applied the paired comparison analysis. (Manktelow, 2004).

Table III. Corpoelec – EDELCA`s FODA array

STRENGTH	WEAKNESS
<ul style="list-style-type: none"> • “Good quality and service reliability” • Trained and experienced workers in the electricity business. •Respect for the environment and fulfill the rules. •Credibility and acceptance by the financial institutions. •availability of vanguard technologies. • Self excellence technical representation within the sector. • Clear policy on social business responsibilities. •Experience in social projects. •Good client relationship. 	<ul style="list-style-type: none"> • Difficulties in apply effective mechanisms to charge in debt customers. •High concentration of sales in few big sized clients. • High percentage of sales with regulated rates lower than the production cost. • Limitations to contros illegal minery on the Caroni basin. • the exploitation of the production's quality is limited by the hydrology, element that escape from the corporation management.
OPPORTUNITIES	THREATS
<ul style="list-style-type: none"> • The country values the companies that combine high performance with corporate social responsibility. Higher relevancy to corporate social 	<ul style="list-style-type: none"> • Unavailability or obsolescence of national thermal power generation facilities • High pressure over the generalization of the

responsibility.

- Growth on the country's demand of new electric intensive companies.
- Growing oil sector. A high oil price favors sector investment.
- Possibility to participate on the installations of a thermoelectric generation.

company.

- Deterioration over the quality of service on the distribution in many regions of the country.
- Increase on the drop of energy on the distribution companies.
- Unavailability on a short terms of natural gas to the thermo electric generalization
- Delay applying tariff schedule can conclude in lower revenue.
- Difficult access to financing electric infrastructure power.

Source: The Autors and (Corpolec – EDELCA, 2007)

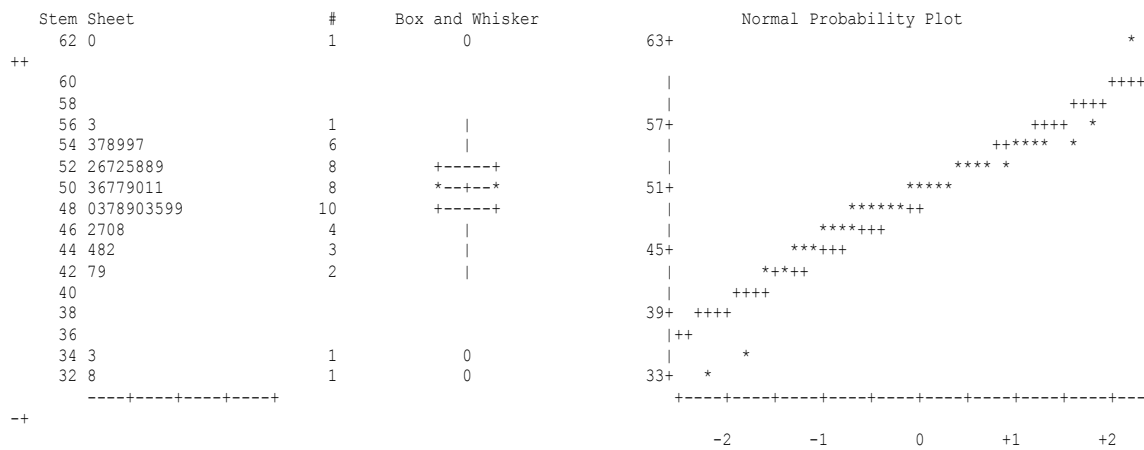


Figure 6. Normality test from the indicator weight factor of the Operational Risks.

Source: Authors

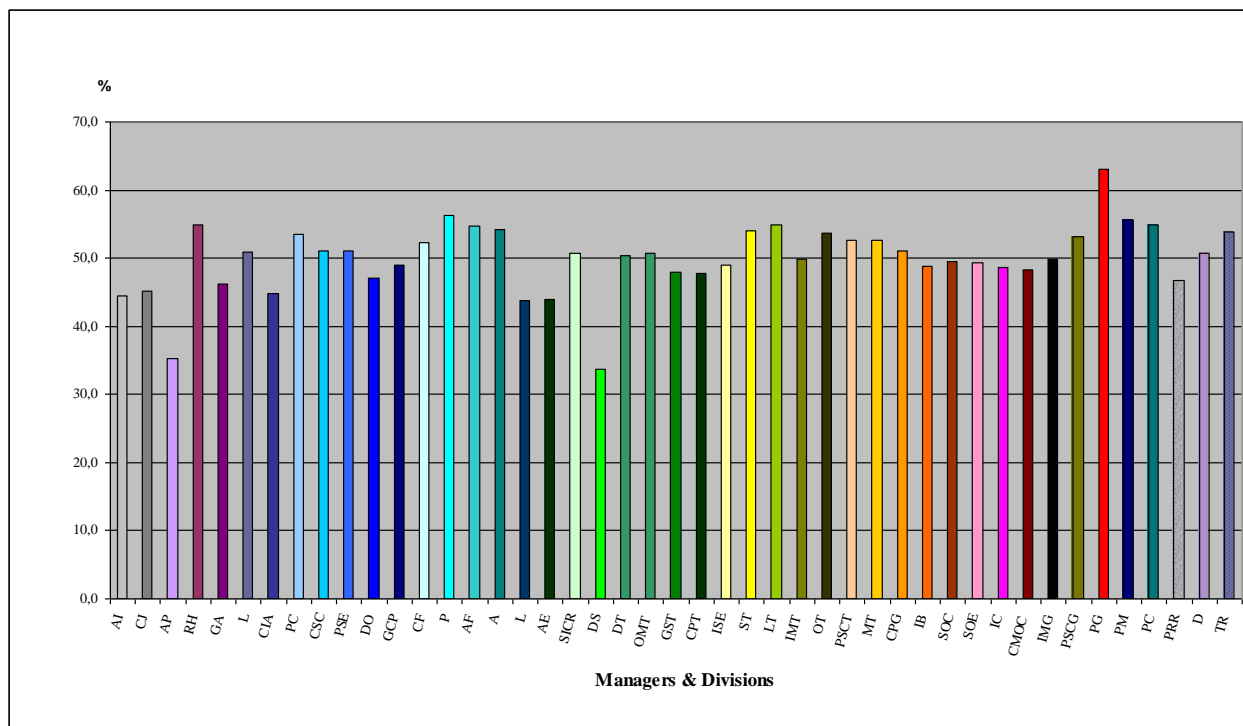


Figure 7. Results from Paired Comparison Analysis for Corpoelec - EDELCA
Source: The Authors

Statistical universe, population and sample of the Gurí Plant

After it was detected that the area of the company that it was estimated is the higher to impact on the operative risk of the company (panta guri); it was once again determinate the statistical universe, the population and the sample for the Planta Gurí. The chart IV summarizes the procedure:

Table IV. Statistical universe distribution, population and sample of Gurí Plant

	Personal Description	Universe		Population		Sample	
		N	%	n	%	N _M	%
1	Executive Committee	0	0	0	0	0	0
2	Managers	1	0,33	1	0,52	0	0
3	Professionals, supervisors and technicians	190	63,33	190	99,48	58	100
4	Employees and workers	109	36,33	0	0	0	0
	Total:	300	100,00	191	100,00	58	100

Source: Taken from the interview with the Gurí Plant Human Resources management staff and authors.

Detection of the perceived impact of operational risks by the Gurí Plant’s staff.

It was realized an analogue procedure to the 7.2 section of this document. For which was tested through the Shapiro – Wilk coefficient = 0.905768, in which was proved the indicator normality. Additionally was obtained, that the departments of electrical and mechanical maintenance were the most weight in the paired comparison analysis of the Guri Plant as it is seen in the figure 8.

Subsequently implemented the grid analysis (Manktelow, 2004) to determine which is the process of greatest impact on operational risk, in this survey, in a similar way to the paired comparison analysis it was established a Lickert's scale, but in this case to determine the operational risk attributes, in which was equally established an index of risk weight. This way was set the process: "Execute the maintenance" as the highest criticality with a 60% risk factor, although in interviews it was estimated would be those related to operations.

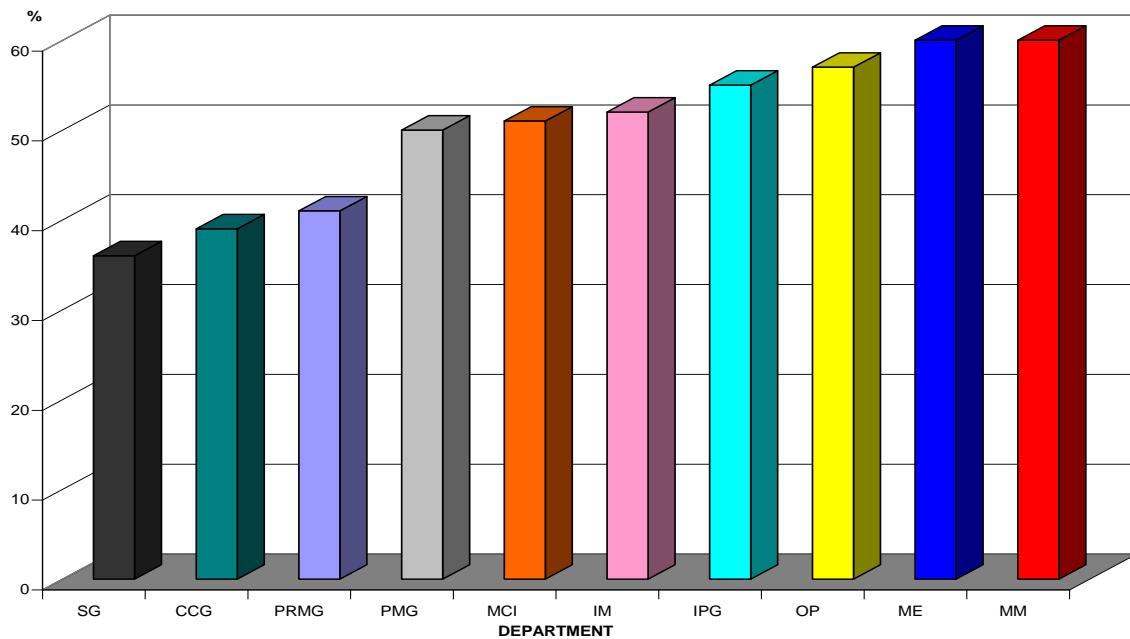


Figure 8. Paired Comparison Analysis for Guri Hydroelectric Plant

Source: Authors

Detection of the sources of risk

There were carried out cross-functional diagram, in which it was established the most critical flow charts of the process based on the interview with the experts and the information of the quality management system, where it was explained the risk, the associated activities and finally it is proposed a chart with the expert qualitative estimate of the frequency range and impact of operational risks according to the proposed by (Gregoriou, G., 2009).

(Chernobai et al., 2007) proposes the distributions of typical probabilities both for frequencies as to the impact; the bonded test of calculated adjustment according to (SAS, 2004), permitted to confirm what (Gregoriou, G., 2009) proposes, for most of probability distribution of frequency behave to a distribution of Poisson and the impact or severity belongs principally to the weibull and lognormal distribution.

Additionally, (Gregoriou, G., 2009) states that having a qualitative analysis, the risk value is possible to determinate through the convolution of probability distribution, which is plotted in Figure 9.

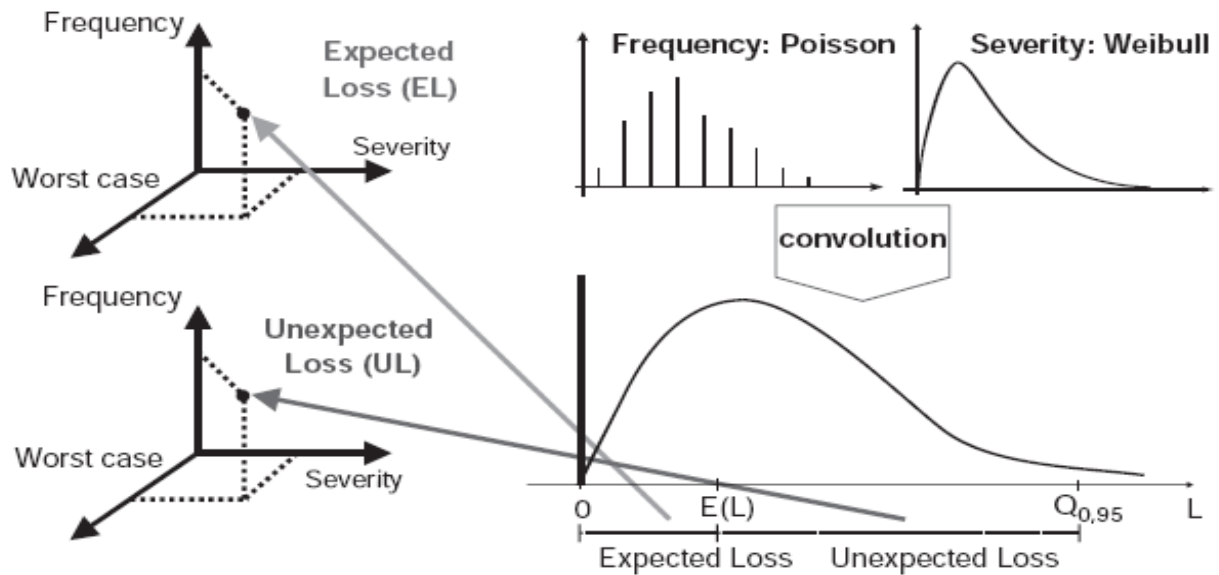


Figura 9. Value at Risk Calculation

Source: (Gregoriou, G., 2009)

For the calculation of convolution described above Monte Carlo method is implemented among others (Jorion, 2007), proposes it as the most effective method for calculation of Value at Risk. This method is widely explained by (Hillier & Lieberman, 2001; Sobol, 1976).

The VaR calculation was realized through the SAS 9.1 software, in which was introduces as input random variables the frequency and impact, later to simulate the role of risk assessment according to the Monte Carlo method. The Figures 10 and 11, summary the obtained data and how they behave in the organization risks considering the studied process.

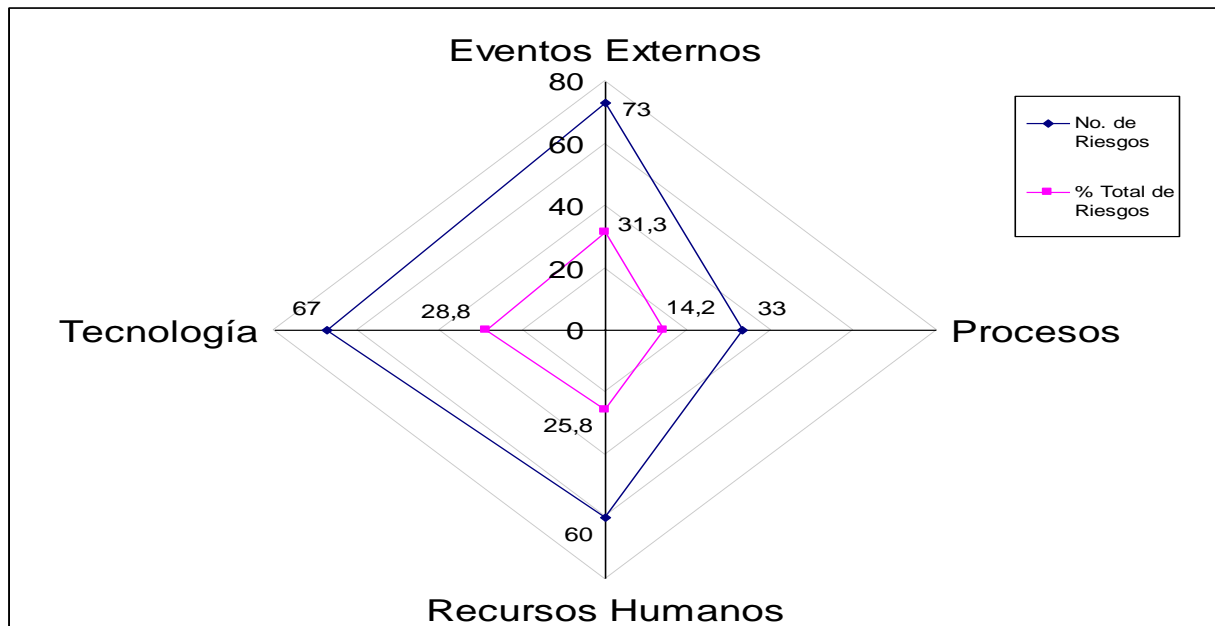


Figure 11: Risk Imagogram

Source: The Authors

In the preliminary study of risks, the imamogram in the Figure 11 shows that operational risks are equitably distributed among the human resources, technological and external events.

The risk radar on Figure 12 (next page), shows that the presentation of this study, is estimated that overall operational risk has a medium-high value, however, these are baseline estimates.

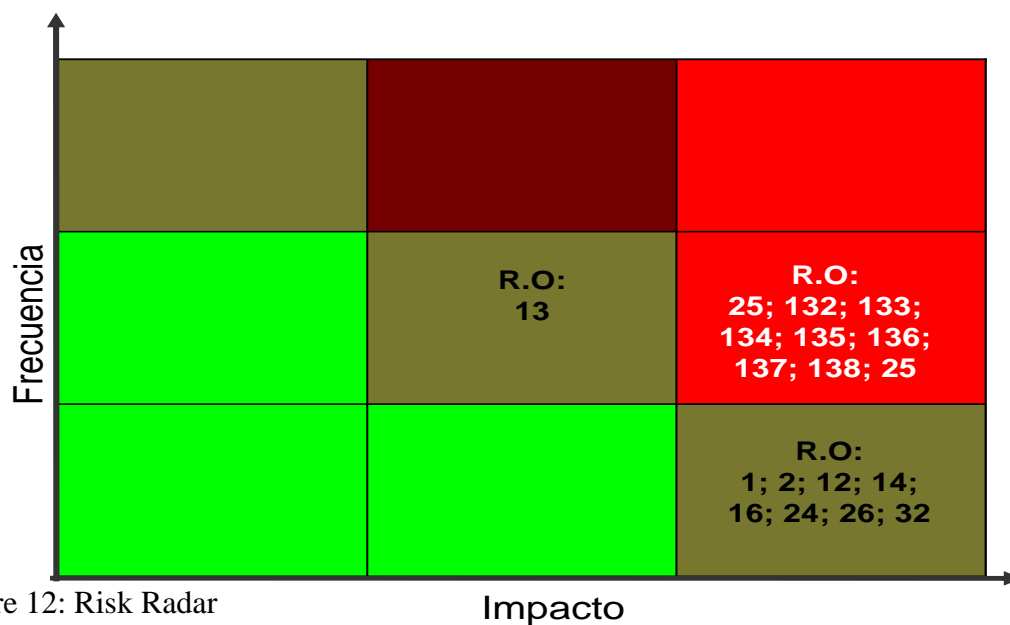


Figure 12: Risk Radar

Source: Authors

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Separating the measurement and evaluation of intellectual capital elements

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Key words: intellectual capital; scorecard methods; measurement; evaluation; evaluator functions; utility

Paper type: research paper

Introduction

IC is recognized as a key strategic asset for organizational performance, so the management of IC based on its measurement and evaluation has become critical for the competitiveness of organizations (see e.g., Brooking 1996, Kaplan and Norton 1996, Edvinsson and Sullivan 1996, Edvinsson 1997, Edvinsson and Malone 1997, Roos et al. 1997, Stewart 1997, Sveiby 1997a, Drucker 2000, Andriessen 2001, Marr et al. 2003a, Kaplan et al. 2004, Zambon and Marzo 2007). The existing IC measuring and evaluating methods offer different advantages, serve diverse purposes and stand fast in particular situations and at particular types of organizations (Sveiby 1997a, Bontis 1998, 1999, Sveiby 2001-2010, Marr et al. 2003b, Andriessen 2004). Figure 1 shows the four measuring model categories according to Sveiby's (2001-2010) classification by right of applied measuring methodology approach.

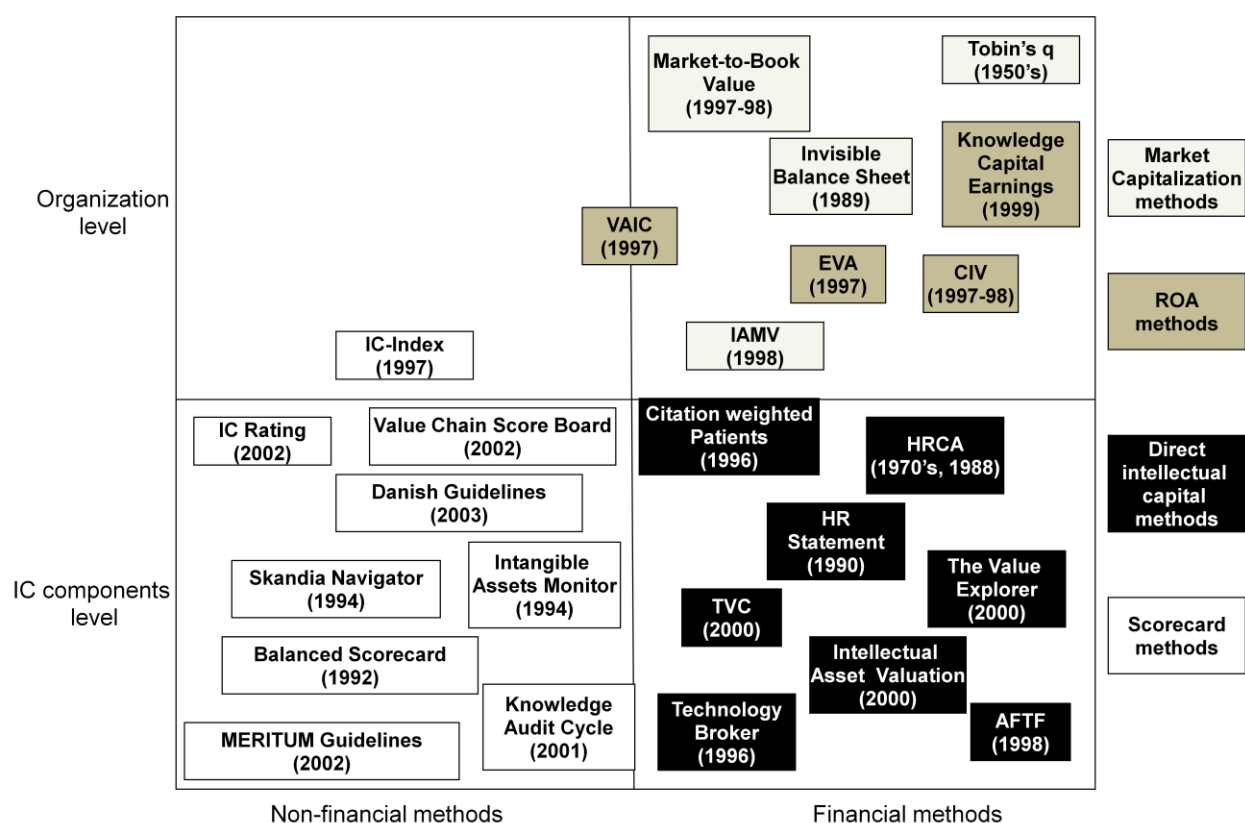


Figure 1. Intellectual capital measuring models (source: www.sveiby.com)

Bontis (1999) and Sveiby (2001-2010) had already attempted to collect and evaluate all the available measuring techniques. According to the chronological order of the measuring initiatives since 2000, SC and DIC methods have already come to the front even on the regional and national level of measuring efforts (e.g. Andersen and McLean 2000, Andriessen and Tissen 2000, Baum et al. 2000, Sullivan 2000, Lev 2001, Edvinsson 2002, MERITUM Guidelines 2002, Bounfour 2003, Mouritsen et al. 2003, Bontis 2004, Sanchez-Canízares et al. 2007, Schiuma et al. 2008, Sanchez et al. 2009). The advantage of DIC and SC methods is that they (would) give a more comprehensive picture of individual IC elements; therefore they could result in deeper knowledge. A further advantage of SC methods is that these indicators have a more direct relation to the IC element being evaluated as they are more accurate than pure financial measures (Sveiby 2001-2010). SC methods are inevitable as developing IC is possible only in parts, it is not enough to measure the whole IC of a corporation, its parts should be grasped as well, but it is more difficult to apprehend IC elements one by one, than to measure the whole. It is caused by the fact that market feedbacks, from which we can make deductions about the size of IC, measure it as a whole and do not say anything about the parts.

To understand the difference between IC measuring and evaluating practices the following definitions should be taken into consideration (Andriessen 2004). If the criterion of value is defined in monetary terms, the method to determine value is *financial valuation* (see MC, ROA and DIC methods). We can use a non-monetary criterion and translate it into observable phenomena, in which case the method is *value measurement* (see some SC methods, e.g., Balanced Scorecard, Intellectual Capital Audit). If the criterion cannot be translated into observable phenomena but instead depends on the evaluator's personal judgment, then the method is *value assessment* (none of the existing IC methods can be classified here). If the framework does not include a criterion for value but does involve a metrical scale that relates to an observable phenomenon, then the method is *measurement* (see some SC methods, e.g., Skandia Navigator, Intangible Asset Monitor, Intellectual Capital Index). To conclude a measurement method is not a method for valuation.

The later on presented methods tend to aggregate the value of IC elements on organizational level where the valuation and measurement of IC elements are based on scorecards. With our quantitative methodology not only the reliability of scorecard based IC measurement can be enhanced by transforming the measured values into evaluation, but also the aggregation of IC values becomes possible regardless of the measurement scale of the single IC indicators, in which sense our method open up new vistas. Doing so, our method points at defining the value of intellectual capital at organizational level based on assigning appropriate non-financial indicators to the strategically relevant IC elements. By assessing the value of IC elements the evaluator function interpreted as utility function makes the joint use of financial and non-financial methods possible (see Figure 1).

Customer satisfaction as part of intellectual capital

Customer satisfaction as a current measure for customer capital in use can be commonly found in IC literature (Eccles 1991, Malone 1997, Roos and Roos 1997, Roos et al. 1997, Sveiby 1997b, ICM Group Study 1998, CMA 1999, Allee 2000, Duffy 2000, Liebowitz and Suen 2000). Of all the unobservable customer metrics, customer satisfaction has been the most widely studied by

researchers and used by firms because the construct is generic and can be universally gauged for all products and services. Customer satisfaction is clearly understood by respondents and easy to communicate to managers (Gupta and Zeithaml 2006). Moreover, the measurement of customer satisfaction gives an understanding of the customer-perceived quality. According to Grigoroudis and Siskos (2004) the most important customer satisfaction measurements can be categorized into the following classes:

1. statistical and data analysis techniques consisting of traditional statistical methods (see Vavra 1997);
2. quality approaches giving major importance to the linkage with the main principles of TQM and not focusing on the CS measurement process;
3. customer behavioural analysis consisting of the expectancy disconfirmation model and other behavioural theories which explain and analyze the customers' behaviour rather than evaluate a satisfaction measure (see Oliver 1997);
4. other methodological approaches serving special purposes like the efficiency analysis of a business organization or the determination of attractive quality characteristics.

Our study analyzes the nature of typical customer satisfaction measurement methods used by Service Provider (SP) companies, particularly by Electronics Manufacturing Services (EMS) providers. EMS companies are special from the point of view of CS measurement, because they are involved in the whole product lifecycle beginning from the design, through the manufacturing and aftermarket services to joint services like e.g. logistics and distribution. A common characteristic of EMS companies is that they do not have direct contact to end users and customers of the services they provide. EMS companies have only a few tens of customers, whom the services are provided to. They are commonly not individuals (end customers) but other organizations that sell goods to their markets. Grigoroudis and Siskos (2002) identify four measurement approaches which focus on the evaluation of an overall satisfaction measurement. The approach we introduce here uses the scorecard based measurement and an evaluation technique that is based on the so-called evaluator functions, and as a method, falls into the fourth one of the enumerated four categories.

Scorecard based measurement of customer satisfaction

The common way of CS measurement, which typical SP companies follow, is based on scorecard methods. The customers give regular feedbacks by using pre-agreed scorecards. The ultimate goal is to quantify the performance of the SP in areas such as quality, supply chain management, delivery accuracy, flexibility, customer communication etc. Finally, an aggregated artificial number characterizes the level of each customer's satisfaction. The company interprets this aggregated figure (i.e. its performance) in its own preference system. For example, an EMS company uses a scorecard that measures CS on a scale that goes from 0 to 100 and every time a customer company expresses its satisfaction the answer is a number between 0 and 100. This number and the company's preference system give the interpretation of CS similarly to the example given by *Table 1*.

Table XXXI. An example for CS evaluation

Score	Level of Customer Satisfaction
<20	Very poor
>=20 and <40	Poor
>=40 and <60	Meets expectations
>=60 and <80	Above expectations
>=80	Excellent

Certainly, the content of scorecards and the scoring criteria may vary from customer to customer but fixed at one particular customer. Let us focus only on one customer and its scorecard to understand the above shown measurement and evaluation. At first sight it appears that if the scorecard is well defined and the customer has the right interpretation of scoring criteria, the measurement is accurate and consistent, the evaluation reflects the real level of customer satisfaction. Unfortunately, this is not necessarily so as there is a number of factors that may influence both measurement and evaluation and cause uncertainties.

Uncertainties around the measurement

Individual differences, product category differences, customers' expectations, customers' perceptions of supplier's performance all contribute to customers' satisfaction and to its behavioral consequences (Johnson and Fornell 1991). Our study investigates how scorecard based assessment methods can capture the enumerated contributors of customer satisfaction and how reliably these methods are able to reflect the customers' perceived satisfaction to SP companies.

Measurement and valuation roles

The typical role setup of a scorecard based customer satisfaction measurement and evaluation at SP companies looks so that the customer provides the scores (does the measurement) and the service provider company evaluates them. With other words, the company receives numbers and believes that comparing these numbers to the evaluation criteria reflects how much the customer is satisfied. It means that the customer instead of giving feedback about its perceived satisfaction level quantifies the level of performance provided by the SP company.

Scaling

Is it really true that a customer is double satisfied when it gives 80 points (as customer satisfaction score) compared to giving only 40 points? Thinking about this question may make us worried about the consistency of this method, although SP companies widely use similar methods. The cause of this problem is the withheld assumption that a customer expresses its satisfaction on a linear scale (proportional scale), that is the score given by the customer is proportional to its perceived satisfaction. If it is not so, using linear evaluation regarding the level of customer satisfaction may be questionable.

Subjectivity

The customer organizations represent themselves by individuals, who may have influences on the feedbacks given by their organizations, even if they try to be objective with their best intentions. Unfortunately, their subjectivity is somehow always in the scores they give. If we consider the scorecards as measurement systems, the repeatability and reproducibility of these systems can be disputable (Burdick et al. 2005).

Evaluator functions

Our ultimate goal is to propose a solution by using evaluator functions that can mitigate the highlighted problems of CS measurement and evaluation. Evaluator functions are mathematical functions that translate the scorecard based CS measurement scores to an evaluation scale. Let variable m be the measured CS scores in the $[m_S, m_E]$ interval, where m_S and m_E is the start- and endpoint of the measurement scale. Using these notations an E evaluator function assigns the $E(m)$ CS value to every m measured CS value and meets the following basic criteria.

1. The $E(m)$ function is monotonously increasing, that is higher measured values correspond to higher perceived satisfaction level, even if the relationship between them is not linear.
2. The range carrier of $E(m)$ is the (0, 1) or [0,1] interval.
3. $E(m)$ represents the perceived satisfaction that the customer would assign to the measured m satisfaction.

These criteria determine just a loose frame for an evaluator function, but taking other experiential properties of customers' behaviour and satisfaction perceptions into account, particular evaluator functions can be derived.

The $E_{\omega}(m)$ evaluator function

In this study, we use the

$$E_{\omega, m_S, m_E, m_0, E_{m_0}, E_L, E_H}(m) = E_L + (E_H - E_L) \frac{\left(\frac{m - m_S}{m_E - m_S}\right)^{\omega}}{\left(\frac{m - m_S}{m_E - m_S}\right)^{\omega} + \frac{E_H - E_{m_0}}{E_{m_0} - E_L} \left[\frac{m_0 - m_S}{m_E - m_0} \left(1 - \frac{m - m_S}{m_E - m_S}\right)\right]^{\omega}} \quad (1)$$

function as evaluator function. Function (1) is a linearly transformed version of Dombi's κ function (Dombi 1990) The reason for this selection is that this function is a good approximant of the

$$E(m) = \frac{1}{1 + \frac{1 - E_{m_0}}{E_{m_0}} e^{-\lambda(m - m_0)}} \quad (2)$$

logistic function, if

$$\omega = \frac{\lambda (E_H - E_L) (m_E - m_0) (m_0 - m_S)}{m_E - m_S} \quad (3)$$

and $E_L = 0$, and $E_H = 1$. Function (2) is known as logistic or sigmoid function. The logistic function – in several forms, with various parameter denotations – has a number of various applications. From this point onwards the simplified $E_\omega(m)$ notation will be used instead of the $E_{\omega, m_S, m_E, m_0, E_{m_0}, E_L, E_H}(m)$ long form. The topics discussed in the following chapters are based on our previous studies related to the valuation of intellectual capital.

Methodology

Practical use of the $E_\omega(m)$ function

One of the problems with the commonly used CS evaluation is that the measurement (done by the customer) and the evaluation (done by the service provider) are separate process steps. This separation in itself would not cause any problem, if the evaluation could adequately reflect the customer's perception. In practice, there is a disconnection between customers' and service providers' evaluations. Now we have a mathematical tool that the customer can use to evaluate its satisfaction using the CS scorecard, but first the customer needs to set the parameters of the evaluator function so that it reflects the customer's satisfaction perception of the measured CS scores.

The study presents a method here how to use the $E_\omega(m)$ evaluator function for customer satisfaction evaluation. The $E_\omega(m)$ function is a tool that corrects and improves the reliability of the scorecard based measurement. We call this method *reliability-based customer satisfaction evaluation (RCSE) method*.

Step 1

At first the customer is asked to measure its satisfaction based on a common scorecard system used for all customers.

Step 2

The customer needs to set the window parameters for the $E_\omega(m)$ function, which determine the domain of variability (the $[m_S, m_E]$ interval) and the lowest (E_L) and highest (E_H) satisfaction values of the $[0, 1]$ evaluation scale.

Step 3

Three further parameters: m_0 , E_{m_0} and ω have to be specified to unambiguously determine the evaluator function. For this purpose the customer specifies two satisfaction levels on the

evaluation scale in the (E_L, E_H) interval and assign them to two arbitrary chosen (but different both from m_S and m_E) points of the original CS measurement scale. Either of these two pairs can be directly used as the (m_0, E_{m_0}) pair, so one point of $E_\omega(m)$ is explicitly given. In practice, the selection of m_0 as the midpoint of the measurement scale is suggested since half of the maximum reachable score is a good characteristic point of the scale.

Step 4

Let (m_a, E_{m_a}) note the other arbitrary chosen (measurement value, evaluation value) pair. As (m_a, E_{m_a}) is a point of the $E_\omega(m)$ curve, the $E_{m_a} = E_\omega(m_a)$ equation needs to be met. From this equation parameter ω can be calculated as

$$\omega = \frac{\ln\left(\frac{E_H - E_{m_a}}{E_{m_a} - E_L} \frac{E_{m_0} - E_L}{E_H - E_{m_0}}\right)}{\ln\left(\frac{m_E - m_a}{m_a - m_S} \frac{m_0 - m_S}{m_E - m_0}\right)} \quad (4)$$

Which point of the measurement scale is worth to be chosen as m_a ? Each customer has a kind of a threshold value for the measured CS score. Certainly, these threshold figures vary from customer to customer. Basically that is why the standardized scorecard based measurement has limited capability to express the customer satisfaction appropriately. The customer specific evaluator functions allow the customers to assign their values of perceived satisfaction to the scores measured by a standardized scorecard method. Hence, setting m_a as the customer specific threshold value for the measured CS score for each customer is recommended.

Aggregated evaluation

Scorecard based measurement lays the foundation for evaluating the reliability-based customer satisfaction evaluation method. This is already an aggregate approach as its input variable is an aggregate score. Actually, a service provider company has multiple customers whose expectations may vary in a wide range. Even if the same service at the same performance level is provided, different customers may perceive very different satisfaction levels. The typical approach to handle this situation is the use of customer specifically structured, customized and weighted scorecards to measure the CS level. It means that different scorecards measure the performance of the same operation as different customers have different preferences. The SP company rightly wants to understand each customer and have an overall picture both about its performance and the customers' satisfaction level. How to aggregate and quantify the customer satisfaction levels in such cases? The aggregation of satisfaction levels has an extensive literature both on organizational and on industrial and national level (see e.g. Anderson and Fornell 1991, Anderson and Sullivan 1991, Johnson and Fornell 1991, Anderson 1994, Fornell 1995, Siskos et al. 1998, Grigoroudis et al. 1999, Siskos et al. 2001, Grigoroudis and Siskos 2002, Siskos and Grigoroudis 2002).

The greatest advantage of using evaluator functions is that their range carrier is the same (0,1) interval regardless what their domains of variability are. Different scorecards with the same measurement scale can be used for different customers, but the evaluated CS is always expressed on the (0, 1) scale (or in one of its subsets). The evaluation scale is unified and the use of $E_{\omega}(\cdot)$ functions can be interpreted as a common basis transformation. It allows us to aggregate the evaluated CS of multiple customers. The starting point is that each customer follows the same way of thinking and satisfaction perception as function of the CS score. Each of them can evaluate the CS by a suitably calibrated $E_{\omega}(\cdot)$ function. Providing this, we can assume that the aggregated satisfaction has the same nature. The only remaining question is the calibration of the aggregated $E_{\omega}(\cdot)$ function.

Let us assume that a SP company has n customers and there is a CS scorecard defined for each of them. Then by applying the $E_{\omega}(\cdot)$ function every customer calibrates it according to the *reliability-based customer satisfaction evaluation* method. As discussed earlier, the $E_{\omega}(\cdot)$ function has seven adjustable parameters: ω , m_S , m_E , m_0 , E_{m_0} , E_L and E_H . In case of multiple clients there is an $E_{\omega}^{\mathcal{C}}(\cdot)$ evaluator function with $\omega^{\mathcal{C}}$, $m_S^{\mathcal{C}}$, $m_E^{\mathcal{C}}$, $m_0^{\mathcal{C}}$, $E_{m_0}^{\mathcal{C}}$, $E_L^{\mathcal{C}}$ and $E_H^{\mathcal{C}}$ parameters for each customer, and

$$\omega^{\mathcal{C}} = \frac{\ln\left(\frac{E_H^{\mathcal{C}} - E_{m_a}^{\mathcal{C}}}{E_{m_a}^{\mathcal{C}} - E_L^{\mathcal{C}}}\right) \frac{E_{m_0}^{\mathcal{C}} - E_L^{\mathcal{C}}}{E_H^{\mathcal{C}} - E_{m_0}^{\mathcal{C}}}}{\ln\left(\frac{m_E^{\mathcal{C}} - m_a^{\mathcal{C}}}{m_a^{\mathcal{C}} - m_S^{\mathcal{C}}}\right) \frac{m_0^{\mathcal{C}} - m_S^{\mathcal{C}}}{m_E^{\mathcal{C}} - m_0^{\mathcal{C}}}} \quad (5)$$

where the $(n_0^{\mathcal{C}}, E_{m_0}^{\mathcal{C}})$ and $(n_a^{\mathcal{C}}, E_{m_a}^{\mathcal{C}})$ pairs are the inputs of the i th customer to calibrate its evaluator function $\mathcal{C} = 1, 2, \dots, n$.

When the company is about to figure out the aggregate CS evaluator function, inputs of different customers can be considered with different importance and the company may consider the customer responses with different weights. Let w_i be the weight assigned to the i th customer, that is the contribution of this customer to the aggregate CS level, where

$$\sum_{i=1}^n w_i = 1.$$

Without compromising the generality, assuming that the same measurement scale is used for all customers, the aggregate $m_S^{\mathcal{A}}$ start- and $m_E^{\mathcal{A}}$ endpoints of the measurement scales are the same for each evaluator function, that is $m_S^{\mathcal{C}} = m_S^{\mathcal{A}}$, and $m_E^{\mathcal{C}} = m_E^{\mathcal{A}}$ $\mathcal{C} = 1, 2, \dots, n$.

The $\omega^{\mathcal{A}}$, $m_0^{\mathcal{A}}$, $E_{m_0}^{\mathcal{A}}$, $E_L^{\mathcal{A}}$ and $E_H^{\mathcal{A}}$ parameters of the aggregated evaluator function can be calculated as the weighted averages of the corresponding parameters:

$$\omega^{(C)} = \sum_{i=1}^n w_i \omega_i^C, m_0^{(C)} = \sum_{i=1}^n w_i m_{0i}^C, E_{m_0}^{(C)} = \sum_{i=1}^n w_i E_{m_0i}^C,$$

$$E_L^{(C)} = \sum_{i=1}^n w_i E_{Li}^C, E_H^{(C)} = \sum_{i=1}^n w_i E_{Hi}^C.$$

We call this construction *parameter weighted aggregate customer satisfaction evaluation* (PWACSE) method.

Utility point of view: assessing the value of IC elements

The evaluated customer satisfaction represents the level of performance that our customers perceive. From the SP company's point of view customer satisfaction is a measure of performance, from the customer's perspective the level of satisfaction is the measure of the utility of services provided by the company. Therefore, the CS evaluator function can be interpreted as utility function as well. Since customer satisfaction can be considered as a specific element of intellectual capital, our aggregation results in the aggregated utility function of the chosen IC element.

The aggregated utility function as function of a measured m score gives a good overall indication of the utility (value) that a service provider gives to its customers. The aggregate utility function is invertible, therefore, a particular utility level can be translated to the m metric. Keeping in mind that the scorecard measurement has a known structure, the management can identify the actions required to achieve the necessary level of metric m . Doing so, the customers' inputs can be used for setting intellectual capital improvement goals.

Using the RICEE and PWAICEE methods

The approach of the RCSE method can be applied to any IC element and this generalized method is called *reliability-based intellectual capital element evaluation* (RICEE) method. Similarly, the logic of PWACSE method under the name of *parameter weighted aggregate intellectual capital element evaluation* (PWAICEE) can be used as a possible way to aggregate multiple utility (evaluator) functions for the same IC element, if the same scorecard metric is used as independent variable for the various utility (evaluator) functions. By this means, in case of multiple IC elements as many aggregated utility functions can be derived as many IC elements are chosen. For this the individual utility (evaluator) functions are to be calibrated one by one following the same way introduced earlier.

Evaluator functions and the aggregate evaluator function are tools that can correct biased scorecard based measurements on an IC element in order to express its utility to the organization more reliably. Having an actual (aggregated) measured score the (aggregated) evaluator function determines its value on the evaluation scale. This latter is a number from the [0,1] interval representing the actual utility of the examined IC element to the organization. Following this approach, one utility figure can be assigned to each IC element and all these figures are from the [0,1] interval. It means that by *giving importance weights to IC elements it allows us to aggregate the current utility figures into one utility value*. Figure 2 illustrates the generic use of the RCSE and PWACSE methods for n IC elements.

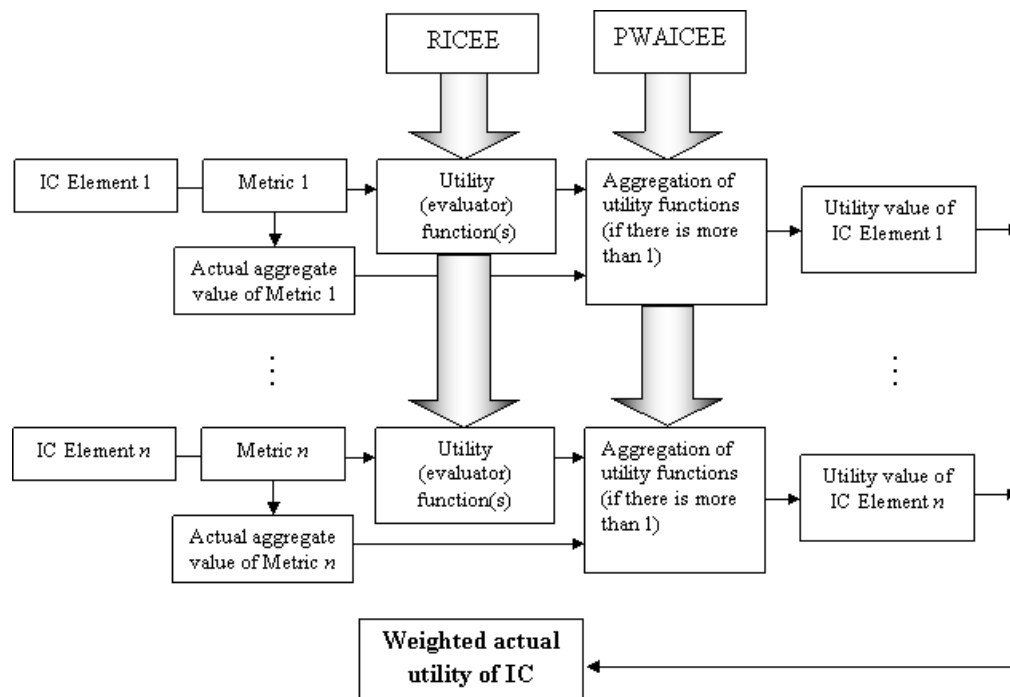


Figure 2. The scheme of aggregated utility of IC by using the RICEE and PWAICEE methods

Discussion

Our focus is on the organizational ability to separate the measurement and valuation of IC elements presenting the example of customer satisfaction as a widely-used non-financial indicator of customer capital. As a kind of organizational resource the perceived values of IC are of great importance, which are then compared to the measured values. The heart of the matter is how and to what extent IC can contribute to the execution of strategically relevant goals which means the evaluation of IC elements on one hand and the assessment of their utility in the company's own preference system on the other hand. Expressing the value of an IC element through scorecard based measurement may result in distorted information and so it is not able to reflect the real utility of the examined IC element to the organization correctly. Based on the scorecard based measurement of customer satisfaction the main objective was to verify that our methods by accepting the distortions built in scorecard based IC models are able to separate measurement and evaluation by giving a more comprehensive picture of the perceived value of customer satisfaction. The proposed method can easily be extended to separate the scorecard based measurement and evaluation of any intellectual capital element and can be similarly used in the case of e.g. employee satisfaction, supplier performance evaluation, human resource performance or partnership evaluation just to mention a few scorecard based indicators in case of which our method have been tested before (see e.g.,).

The adequately calibrated $E_{\omega} \left(\cdot \right)$ evaluator functions are suitable tools to assign perceived customer satisfaction to its scorecard based measured values, and thus the application of these functions mitigates the distortion effects of scorecard based measurement methods. Besides customer satisfaction the reliability-based intellectual capital element evaluation (RICEE) method can be generally applied to any IC element.

An $E_{\omega}(n)$ evaluator function can be interpreted as a utility function reflecting the utility of measured intellectual capital values derived from a scorecard based measurement method. The parameter weighted aggregate intellectual capital element evaluation (PWAICEE) method can be used for aggregating multiple utility (evaluator) functions for the same IC element, if the same scorecard metric is used as independent variable for the various utility (evaluator) functions. Using the utility functions, the current utility of each identified intellectual capital element can be expressed on the common [0,1] scale and having importance weights given to the elements their current utility values can be aggregated into one utility value.

These methods allowed us to aggregate the evaluated customer satisfaction of multiple customers and the values of any other scorcard based intellectual capital elements by offering a new approach to aggregate than the afore referenced researches. The advantage of our approach lies in the method how the individual customer satisfaction evaluation functions are constructed. The reliability-based customer satisfaction evaluation reflects how much an individual customer deems the service provider's performance satisfactory based on the measured figures. The evaluator function represents a membership function to the fuzzy set of "satisfaction", and this membership function is parameterized by the customer.

Managerial implications and further research directions

By choosing key success indices from human, structural and customer capital aligned to strategic goals, the presented approaches can be used for setting measurement against evaluation, enhancing the reliability of measurement, and expressing and aggregating the utility of IC elements to the organization. The importance of these methods lie in their ability to aggregate both financial and non-financial indicators regardless of the measurement scales and measures of the chosen indices. The approach is unique as scale transformation becomes possible.

Utility functions can convert the figures derived from financial valuation and scorecard based measurement, the methods presented here allow the joint use of these two approaches in the same performance management system. Our method supports the combined use of financial and non-financial indicators by allowing the use of integrated performance management systems. As the current utility of each IC element can be expressed on a common scale the aggregated perceived value of the strategically relevant IC elements can be expressed irrespectively from the nature of the indicators (i.e. financial or non-financial).

Based on the available IC measuring models represented in Figure 1, the RICEE and PWAICCE methods can be placed in the middle of the figure as they make it possible to aggregate non-financial indicators in a more comprehensive way from the point of view of measurement. The methods also can be considered as a 'bridge' between SC and DIC methods by allowing the joint use of financial and non-financial indicators. This feature is regarded to be especially important as both SC and DIC methods have recently come to the front in IC literature.

One implication of this research relates to the application of RICEE and PWAICCE methods for other intellectual capital elements such as employee satisfaction, technology transfer, labor recruitment or training programs. The findings of this study also contribute to an improvement of awareness of how the measurement and evaluation of intellectual capital elements as an input can

be built into organizational decision making processes. In addition, future lines of research could be geared to establish how the targeted value of intellectual capital elements could be deducted from organizational strategic goals.

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Service quality, Job Satisfaction and Organizational Commitment in Higher Education. An Empirical Study of Faculty and Administration Staff.

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Introduction

Building on the premise that education, science and human resources may become the foundations for the economic growth and social progress, quality assurance in higher education has been shifted as one of the most important priorities for educational institutes in the European Union. Almost six years ago, a legal framework was activated aiming at the adoption of necessary metrics and processes in order to assure and improve the quality of services provided by Higher Education Institutions (HEIs) in Greece. Nowadays, economic crisis in Greece has stimulated cutback, downsizing, and decline at unprecedented levels in the public sector, preparing a similar wave of downsizing and retrenchment of higher education. Unfortunately, a consequence of resource scarcity and decline is the deterioration of organizational effectiveness and the emergence of various institutional dysfunctions leading to low morale, dissatisfaction, lack of innovation, rigidity, conflict, reduced quality and turnover, unless HEIs adapt to the current environmental conditions and fiscal distress (Cameron & Smart, 1998).

Organisational commitment as well as job satisfaction has been the focus of much empirical and theoretical effort in the field of organizational behaviour, human resource management and organisational psychology, mainly ignited by its potential benefits to individuals and organizations. This is attributed to the notion that committed and satisfied employees are in general highly productive who believe in organizational values and goals, leading to enhanced organizational effectiveness and customer satisfaction (Lok and Grawford, 2004; Snipes et al. 2005; Brown and Lam, 2008).

In particular, job satisfaction has been found to be related to employee perceptions of service quality (Schlesinger and Zornitsky, 1991) and customer ratings of service quality (Reynierse and Harker, 1991; Snipes et al., 2005; Brown and Lam, 2008). This rationale lies on the service-profit-chain theory developed by Heskett et al. (1994), which put forth the notion that organizational performance is stemming from customer satisfaction, which is obtained from employee performance, which, in turn, is emanated from employee satisfaction (Yee et al. 2008).

In higher education, most researchers consider students as “customers”, and assess their level of satisfaction with the educational curricula delivered (Comm and Mathaisel, 2000),

ignoring both academicians and administrators satisfaction. Despite the fact that several job satisfaction studies have been conducted, few are focused on academics in general (Ward and Sloane, 1998). Thus, research on higher education quality has shifted its attention on academic satisfaction (Comm and Mathaisel, 2003) based on evidence that employee satisfaction is as crucial as customer or student satisfaction (Oshagbemi, 1997; Chen et al., 2006; Snipes et al. 2005; Brown and Lam, 2008).

This paper addresses these issues as well as problems identified in literature examining service quality, job satisfaction and organizational commitment in the case of the Technological Educational Institute of Larissa (TEIL), which is currently involved in the implementation of a Quality Assurance System. More specifically, the current study aims: (1) to investigate the relationship between higher education service quality, and organizational commitment, and (2) to explore the association of job satisfaction and organizational commitment for both faculty and administration staff.

Another contribution of this study is the more accurate assessment of variable relationships, since we explore the specific effects of different job satisfaction facets (job enrichment, management style, rewards, recognition and promotion opportunities, working conditions and safety) and higher education service quality on two organizational commitment components (affective and continuance). Most previous studies have adopted global or summed composite scales to study job satisfaction and organizational commitment producing conflicting results and preventing researchers and managers from gaining in-depth information on the true relations between job satisfaction, commitment and their antecedents (Snipes et al., 2005; Yousef, 1998; Joiner and Bakalis, 2006).

After this introductory section, the next section presents definitions of higher education service quality, job satisfaction and organizational commitment and formulates the hypotheses. This is followed by the research methodology and the statistical analysis sections. In the end, conclusions and management implications for higher education are drawn.

Literature Review

Service Quality in Higher Education

Despite the debate on quality definitions and the different perceptions of quality which are both inevitable and legitimate, and subject to continuous change, there is some consensus that quality has to be determined by stakeholders (Harvey and Green, 1993; Lindsay, 1994; Koslowski, 2006). Higher education, sharing many characteristics with other organisations of the public sector, has a number of stakeholders such as students, their parents and family, academic and administration staff, and society, all of whom experience different aspects of the higher education institutions.

For example, betterment of service quality requires a sustained improvement in the clarity, accuracy and reliability of services delivered, with no particular aspect standing out. Improvements that would meet only external customers' perceptions, leaving out internal customers would almost certainly provoke a negative reaction among the latter. The

fulfilment of all stakeholders' criteria is not inherently incompatible but, given limited resources, it may not be possible to simultaneously accomplish them. For example, in educational organisations, it is difficult to improve appearance and responsiveness, and at the same time the task-based service given to staff (Galloway, 1998).

Several scholars confirmed that employees' satisfaction is associated with customer-perceived service quality, providing supporting evidence to the definition of service quality as a perceived judgment (Snipes et al. 2005; Brown and Lam, 2008; Schlesinger and Heskett, 1991). In this study, we adopt the view of employees' perceived judgement as employees' personal perceptions of the service quality they provide. This approach in the investigation of service quality from an employee perspective was espoused also by other researchers (Slatten et al. 2011; Dabholkar et al., 2000).

The majority of the studies in higher education service quality have focused on student's view of quality, while little attention has been paid on the perspective of academic and administration staff. In a similar vein, few researchers have empirically tested measurement instruments of service quality referring to teaching processes as well as administration services.

Several measuring instruments have been developed aiming to capture and explain service quality. There is little doubt that among these, SERVQUAL (e.g. Parasuraman et al, 1991; 1994), has proved to be the most popular, as acknowledged even by its critics (e.g. Asubonteng et al, 1996). The 22 items of this instrument are categorised into the reliability, tangibles, responsiveness, assurance, and empathy service quality dimensions.

In this study, two frameworks of service quality measurement based on SERVQUAL were adopted referring to quality of teaching and administration quality: (1) Owlia and Aspinwall's (1996) theoretical framework of quality dimensions with an emphasis on teaching aspects of education (academic resources, competence, attitude, content), and (2) Waugh (2001) model of administrative and supportive services quality (reliability and responsiveness, assurance and empathy).

Due to the fact that academic and administration staff was the respondents in our survey, the dimension *tangible* was synthesised with *academic resources* according to the Owlia and Aspinwall framework and it was used as tangibles in the measurement of administration quality. Waugh's (2001) instrument for the quality of administrative and supportive services was based on SERVQUAL, which was revised and adapted for its application in higher education. His final model was based on two main aspects, (a) *Reliability and Responsiveness* and (b)

Assurance and Empathy.

Our final tool for the measurement of higher education service quality is described in table 1.

Table I. *The survey instrument of teaching and administration quality*

Quality dimension	Sample items	Items	Source
Academic Resources/ tangibles	Sufficiency of academic equipment e.g. laboratories, workshops and supporting infrastructure Ease of access to information sources e.g. books, journals, software, networks	5	Owlia & Aspinwall (1998)
Competence	Theoretical (relevant) knowledge of academic staff Practical (relevant) knowledge of academic staff Expertise of academic staff in teaching/communication	4	Owlia & Aspinwall (1998)
Attitude	Extent to which academic staff understand students' academic needs Degree of academic staff's willingness to help Availability of academic staff for guidance and advice	3	Owlia & Aspinwall (1998)
Content	Extent to which students learn communication skills Extent to which students learn team working skills Relevance of curriculum to the future jobs of students	7	Owlia & Aspinwall (1998)
Reliability and Responsiveness	Administrative contact Confident and dependable administrative advice Early notification of administrative changes	9	Waugh (2001)
Assurance and Empathy	Courteous and confidence in contact Personal contact and understanding Contact with caring	8	Waugh (2001)

Job satisfaction

Job satisfaction has stimulated much research interest, mainly because it is argued that either as an individual outcome or as an important interrelated factor plays a crucial role in HRM literature. In this line, institutions can only excel building on the views, attitudes, and perceptions of their human resources (Witt and Beokermen, 1991; Jenkins, 1993; Judge and Watanable, 1993). Although most of the research in this field has been focused on profit making industrial and service organizations, there has been a growing interest in employee satisfaction in higher education, especially in relation with quality management. The reason for this increasing interest is that higher education institution is "labour intensive", since a vast amount of resources are allocated to employees and their effectiveness is largely dependent on the human factor. Across this line of reasoning, Kusku (2003) states that employee satisfaction of higher education institutions is very important factor in order to reach university accountability and quality. In particular, employee satisfaction is related positively to increased quality levels of HEIs.

Employees' satisfaction can be defined as a set of cognitive and affective reactions to the judgments of what an individual wants to receive in comparison to what eventually gets from the organization. In other words, employee satisfaction reflects an individual's perceptions and evaluations of a job, and this perception is in turn affected by their circumstances, including needs, values and expectations (Buitendach and deWitte, 2005). In this regard, Locke (1976, p. 1307) considered employees' job satisfaction as an emotional reaction that "results from the perception that one's job fulfils or allows the fulfilment of one's important job values, providing that and to the degree that those values are congruent with one's needs".

Job satisfaction has been conceptualised as a unidimensional as well as multi-dimensional measure. The latter view has the advantage of a more elaborate metric resulting in several facets such as satisfaction with pay, promotion, co-workers, nature of work in comparison with global measures (Snipes et al., 2005).

Organisational commitment

Despite the plethora of studies examining the nature, antecedents and consequences of organizational commitment (OC), there is little consensus on its definition and conceptualisation. OC represents the binding force that inspires individuals to take part in a course of actions that are relevant to both the organization and the individual. Committed individuals are expected to believe in and accept organizational goals and values, with the desire to remain within their organizations, and to struggle on their behalf (Mowday et al., 1979; Bou and Beltran, 2005). In this regard, organizational commitment acts as a "psychological bond" to inspire individuals to take part in a course of actions that are relevant to both the organization and the individual.

The goal congruence view proposed by Porter and his colleagues (1974) operationalized OC as a unidimensional construct reflecting the relative strength of an individual's identification with, and involvement in, a particular organisation. On the contrary, Allen and Meyer (1990) put forth a multidimensional OC measure, a three-component model comprising: affective (employee's emotional attachment to, identification with, and involvement in the organisation), continuance (the cost associated with leaving the organisation), and normative (employee's feelings of obligation to remain to the organisation). These three dimensions proved to be conceptually and empirically distinct and Iles et al. (1990) demonstrated that different types of commitment have different relationships to organizational behaviour. The concept of affective commitment dominates in the relevant literature, followed by the continuance component, whilst normative commitment have not received wider acceptance due to its weak internal reliability in comparison with the rest (Suliman and Iles, 2000; Karim and Noor 2006). In line with this reasoning, we adopt in our model only affective and continuance dimensions.

Hypotheses

Job satisfaction and organizational commitment

A number of previous studies investigated the relationship between job satisfaction and organizational commitment. The dominant view in the literature reports a positive association between the two variables (e.g. Fletcher and Williams, 1996; Bhuian et al. 1996; Fu et al., 2009; VanDam, 2005) and assumes the causal precedence of satisfaction over commitment (Mowday et al., 1982; Mueller et al., 1994; Wallace, 1995) though there is ambivalence about the causal direction. This approach implies that employee orientations toward a specific job necessarily lead up to orientations toward the whole organization. Following this argument, a latent assumption emerge that job satisfaction varies more directly with shifting working conditions in comparison to organizational commitment (Mowday et al., 1982). Yet, empirical research has not always verified this causal ordering, and scholars have advanced alternative arguments. Other researchers have concluded that job satisfaction is a consequence or effect of organizational commitment (e.g. Vandenberg and Lance, 1992; Bateman and Strasser, 1984). Based on the lack of establishing any relationship between satisfaction and commitment, other studies have put forth the notion that their relationship may be spurious due to their multiple common causes (Curry et al. 1986). Several other studies have found a reciprocal relationship between satisfaction and commitment (Lance, 1991; Mathieu, 1991; Mottaz, 1988). Notwithstanding, a meta-analytic review by Brown and Peterson (1993), based on 59 empirical studies, concluded that "organizational commitment is primarily a consequence, rather than an antecedent, of job satisfaction".

Regarding control variables, empirical studies have confirmed the association of demographic variables such as gender, age, level of education and tenure with organisational commitment (e.g. Lok and Crawford, 2004), though they yield mix results. Thus, the following hypotheses are developed:

H1: The higher the level of job satisfaction, the greater the level of organizational commitment, controlling for gender, age, education and institutional tenure.

H1a: The higher the level of job satisfaction, the greater the level of affective commitment.

H1b: The higher the level of job satisfaction, the greater the level of continuance commitment.

Service Quality and organizational commitment

Previous research has proposed that loyal employees are more eager to and more capable of delivering a higher level of service quality (Loveman, 1998; Silvestro and Cross, 2000). Employees' willingness to perform a service in conformance with the requirements set, is expected to work harder and provide better services (Zeithaml et al., 1990). The eagerness to put "discretionary effort" by employees reflects their attempt to be more involved in their employing organizations and more dedicated to delivering services with a high level of quality. Hence, service quality provided is influenced by employees' eagerness to espouse institutional values, to support organisational goals, and to be engaged in behaviours toward their achievement (Boshoff and Tait, 1996, Unzicker et al., 2000; Congram and Friedman, 1991).

Though, a wealth of researchers have reported a positive relationship between the affective component of commitment and service quality (Zeithaml et al., 1990; Boshoff and Mels, 1995; Boshoff and Tait, 1996), service recovery performance (Boshoff and Allen, 2000) and capacity to satisfy customers (Sergeant and Frenkel, 2000), there are hardly any attempts to explore the role continuance and normative commitment play on service quality. This may be attributed to the lack of attention to the concept and the poor construct validity (Malhotra and Mukherjee, 2004). Yet, the two constructs have been studied in relation to job performance yielding mixed results. Some scholars have concluded to a positive relationship between continuance commitment and job performance (Suliman and Iles, 2000), some failed to obtain any relationship with job performance (Meyer et al., 1993; Malhotra and Mukherjee, 2004), while others have established a negative relationship (Meyer et al., 1989).

The rationale behind the association of employee satisfaction, organizational commitment and service quality is grounded on the theory of equity in social exchanges (Blau, 1964; Organ, 1977). Social exchange theory advocates converge that social exchange involves a series of interactions to generate obligations (Emerson, 1976; Cropanzano and Mitchell, 2005) on a bidirectional transaction basis (Blau, 1964; Yee, Yeung and Cheng, 2008; Cropanzano and Mitchell, 2005). This exchange also has the potential to produce high quality relationships among the stakeholders involved (Cropanzano and Mitchell, 2005).

Equity in social exchanges is based on the premise that most people expect social justice or equity to prevail in interpersonal transactions (Organ, 1977; Cropanzano et al., 2003) in order to generate positive reciprocal relationships. Then, they may evolve over time into trusting, loyal, and mutual commitments (Cropanzano and Mitchell, 2005). In the context of social exchange theory, if an organisation provides good working conditions and employee benefits that make employees satisfied, the latter will cause in return them to be committed and to put extra effort to their performance as a means of reciprocity for their employer (Wayne et al., 1997; Flynn, 2005), leading to a improved service quality (Yee, Yeung and Cheng, 2008). Thus, the following hypotheses are proposed:

H2: The higher the level of teaching quality, the greater the level of organizational commitment, controlling for gender, age, education and institutional tenure.

H2a: The higher the level of teaching quality, the greater the level of affective commitment.

H2b: The higher the level of teaching quality, the greater the level of continuance commitment.

H3: The higher the level of administration quality, the greater the level of organizational commitment, controlling for gender, age, education and institutional tenure.

H3a: The higher the level of administration quality, the greater the level of affective commitment.

H3b: The higher the level of administration quality, the greater the level of continuance commitment.

Research Methodology

Sample and Questionnaire Design

The field research was conducted at the Technological Educational Institute (TEI) of Larissa (equivalent to Technical Universities), Greece. The resulting sample comprised sixty six (66) faculty and sixty eight (68) administration members (response rate about 85%). The research instrument was a structured questionnaire based on a seven-point Likert-type scale, which was developed to measure organizational commitment, job satisfaction and the quality in services and internal processes. Gender, age, level of education, and institutional tenure serve as control variables.

Higher education service quality was operationalised by adopting both the quality dimensions emphasised on teaching aspects proposed by Owlia and Aspinwall (1996), and Waugh's (2001) measures of administration quality.

The Three Factors Model proposed by Allen and Meyer (1990), was adapted to measure organizational commitment. Only the affective and continuance components of this scale were used, because the third one (normative) has been strongly criticized for its anemia to provide validity and to embrace psychological aspects compared with the rest. This construct has been validated from numerous researchers (e.g. Karim and Noor 2006).

Job satisfaction construct was built upon Warr et al. (1979) recommendations. This scale consists of 15 items, reflecting the satisfaction level of the respondents both in extrovert and introvert dimensions (sample items: task variety, skills and competences employed, task responsibilities, management style, colleagues, supervisor, rewards, recognition, promotion opportunities, security, physical environment, working hours). Several academics have confirmed its validity in different environmental contexts (e.g. Patten, 2005; Lok and Crawford, 2004).

Statistical Analysis and Results

Principal component analysis

Principal Component Analysis (PCA) was conducted to identify latent factors within higher service quality. Four factors with eigenvalues greater than one (Kaizer criterion) were extracted from the data related to quality of teaching, as it is shown in table 2. These principal components accounted for over 84% of the total variation. A cut-off of 0.50 was used for item scale selection and it was adopted a normalized varimax rotation to bring about simple and interpretable structure. Following an inspection of the items' loadings on each factor, four distinct principal components were identified, corresponding to: *Academic Resources, Competence, Attitude and Content*. Regarding quality of administration, three principal components were extracted, accounting for over 79% of the total variation. *Academic Resources (tangibles), Reliability and Responsiveness and Assurance and Empathy* were the labels of the three resulting components of administration quality.

Also, four principal components were extracted (Kaizer criterion), explaining approximately 74% of the overall variance for the job satisfaction scale. Applying normalized varimax rotation, the dimensions of *job enrichment* (e.g. task variety, skills and competences

employed, task responsibilities), *management style* (e.g. relations with colleagues, relations with supervisor, management style), *rewards, recognition and promotion opportunities* (e.g. rewards, recognition, promotion opportunities), and *working conditions and safety* (e.g. security, physical environment, working hours) were assigned to the aforementioned construct. Preceding PCA, the Bartlett sphericity testing on the degree of correlation between the variables ($p < 0.001$) and the appropriateness of the sample according to Kaiser–Meyer–Olkin (KMO) verified the appropriateness of the sample (Norusis 1990).

Inter-item analysis is used to verify organizational commitment, job satisfaction, and higher education service quality scales for internal consistency or reliability. Specifically, Cronbach’s coefficient alpha is calculated for each scale, ranging approximately from 0.706 through 0.957. Thus, all sub-scales exhibited well over the minimum acceptable reliability level of 0.7 (Nunnally and Bernstein, 1994).

Table II. Descriptive statistics and internal reliability analysis of all scales

	mean	Std. dev.	items	Cronbach alpha:	KMO*
Higher education service quality					
<i>Quality of teaching</i>^a					0.888
<i>Academic Resources</i>	3.92	1.385	5	0.854	
<i>Competence</i>	4.41	1.340	4	0.928	
<i>Attitude</i>	4.11	1.427	3	0.939	
<i>Content</i>	4.18	1.336	7	0.960	
<i>Quality of administration</i>^b					0.834
<i>Academic Resources/tangibles</i>	4.33	1.191	5	0.814	
<i>Reliability and Responsiveness</i>	4.13	1.288	9	0.957	
<i>Assurance and Empathy</i>	4.21	1.362	8	0.951	
Job satisfaction^c					
<i>Management style</i>	5.03	1.382	4	0.868	0.836
<i>Rewards, recognition and promotion opportunities</i>	4.17	1.481	4	0.830	
<i>job enrichment</i>	4.86	1.375	3	0.799	
<i>Working environment and security</i>	5.60	1.205	3	0.706	
Organisational commitment^c					
<i>Affective</i>	4.70	1.087	6	0.776	0.656
<i>Continuance</i>	5.40	1.177	6	0.751	

*The Kaiser–Meyer–Olkin (KMO) indicator was calculated to assess sample size adequacy. The minimum acceptable level is 0.5. Bartlett’s test of sphericity is significant at $p < 0.001$ for all scales.

^a Valid N=66 (faculty),

^b Valid N=68 (administration staff),

^c Valid N=134 (No significant variations of reliability indices between faculty & administration staff).

Multiple Regression Analysis

Four multiple regression analyses were conducted in order to test the hypotheses put forth for both faculty and administration staff, controlling for gender, age, level of education and tenure. However, three analyses were found to be statistical significant, since continuance commitment was failed to be associated with administration quality and job satisfaction of administrators.

Results show that the predictor variables (higher education service quality and job satisfaction) have captured a rather significant proportion of change in the dependent variables, explaining 64.5% of variance in affective commitment and 37.3% of variance in continuance for faculty, while 38.4% of variance in affective commitment for administrators. The main reason for the high proportion of attributed variance for teaching quality and job satisfaction as perceived by faculty, was that they were important predictors of variance in affective commitment.

Table III. Multiple regression analyses results (faculty).

<i>Independent variables</i>	<i>Affective Commitment Std. beta</i>	<i>Continuance Commitment Std. beta</i>
Control Variables		
<i>Gender</i>	-0.048	-0.173
<i>Educational Level</i>	0.233*	0.326*
<i>Age</i>	0.394**	0.513**
<i>Tenure</i>	0.036	-0.645***
Job satisfaction		
<i>Management style</i>	0.213	-0.150
<i>Rewards, recognition and promotion opportunities</i>	0.327*	-0.183
<i>job enrichment</i>	-0.036	0.357
<i>Working environment and security</i>	0.064	-0.182
Quality of teaching		
<i>Academic Resources</i>	0.091	0.406*
<i>Competence</i>	0.326	0.561**
<i>Attitude</i>	0.410***	-0.070
<i>Content</i>	0.050	-0.033

Adjusted -R² **0.645***** **0.373****
 * Significant at the 0.05 level, ** significant at the 0.01 level, *** significant at the 0.001 level, N=66.

No serious problems of multi-collinearity exist between the independent variables as Variance Inflation Factors (VIF) is far below the 10 points limit Gujarati (2004). The results of regression analyses (standardized betas, adjusted R square, significance levels) are exhibited in tables 3 & 4.

Findings provide support for H1a, as satisfaction issuing from rewards, recognition and promotion opportunities has a significant positive relationship with affective commitment for both faculty (stand. b= 0.327, p<0.05) and administration members (stand. b= 0.378, p<0.05).

Table IV. Multiple regression analyses results (administrators).

<i>Independent variables</i>	<i>Affective Commitment Std. beta</i>
Control Variables	
<i>Gender</i>	0.123
<i>Educational Level</i>	0.087
<i>Age</i>	0.313
<i>Tenure</i>	-0.304
Job satisfaction	
<i>Management style</i>	-0.058
<i>Rewards, recognition and promotion opportunities</i>	0.378*
<i>job enrichment</i>	-0.005
<i>Working environment and security</i>	0.222
Quality of administration	
<i>Academic Resources/tangibles</i>	0.278
<i>Reliability and Responsiveness</i>	0.706**
<i>Assurance and Empathy</i>	0.323
Adjusted -R ²	0.384**

* Significant at the 0.05 level, ** significant at the 0.01 level, *** significant at the 0.001 level, N=68.

Hypothesis H1b is not supported, since job satisfaction has no direct relationship with continuance commitment.

Consistent with H2, teaching quality has a significant relationship with organisational commitment. In particular, teaching quality attitude (stand. b= 0.410, p<0.001), is strongly

associated with affective commitment, while competence (stand. $b = 0.561$, $p < 0.01$), and academic resources (stand. $b = 0.426$, $p < 0.05$), are linked with continuance commitment.

In support of H3a, administration quality is related to affective commitment. Reliability and responsiveness dimension of internal and supporting services quality was the most important predictor (stand. $b = 0.706$, $p < 0.01$). On the contrary, H3b was rejected, because no relationship was verified between administration quality and continuance commitment.

Regarding control variables, age and educational level are positively associated with both affective and continuance commitment for both samples, while tenure is strongly negatively related to continuance commitment.

Discussion and conclusions

The extant OB literature has extensively investigated the associations between job satisfaction and organizational commitment. However, the role that service quality play on organizational commitment has rarely been examined. On the top of that, this study adopts multi-facets instruments in the context of higher education and draws from a sample of both faculty and administration staff.

This study aims to investigate the perceptions of faculty and administration staff of a HEI in Greece regarding service quality and job satisfaction, and their association with organizational commitment.

Generally, our study provides supporting evidence that job satisfaction is strongly related to affective rather than continuance commitment (Yew, 2008; Malholta and Mukherjee, 2004). They acknowledge the importance of employee's emotional attachment to, identification with, and involvement in the organisation on employees' satisfaction. However, studies share controversial findings, since other researchers have suggested positive or even negative relationships between satisfaction and the cost associated with leaving the organisation, namely continuance commitment (Alhawary and Aborumman, 2011; Namasivaya and Zhao, 2007). In particular, satisfied employees with their rewards, recognition and promotion opportunities tend to develop strong psychological attachment and loyalty to their HEI in line with other studies (Yew, 2008; Snipes et al., 2005; McElroy, 2001; Iles et al., 1990; Malhotra et al., 2007 ; Young et al., 1998; Kipkebut, 2010; Azeem, 2010). Given that promotion for academics is dependent on teaching, research and publications and due to financial constraints by government, the promotional procedures end up to be long, stressful and cumbersome.

Our results are in partial disagreement with those produced by Alhawary and Aborumman (2011), who found that satisfaction with respect and recognition was positively related to continuance but not with affective commitment, drawing from a sample of academics in Jordan. This may be partially attributed to national culture effects (Yousef, 1998).

Consistent with the social exchange theory, administrators and academics who are satisfied with rewards, recognition and promotion opportunities, perform their jobs with the understanding that the institution will reciprocate by providing compensation and other

positive considerations which are commensurate with their performance (Chew and Chan, 2008). Kipkebut (2010) also concluded to similar results drawing from a sample of academic and administrative employees in Kenya.

Considering teaching quality, the attitude dimension reflecting academics' eagerness to understand, help, guide, advice and empathise students is strongly associated with their emotional attachment and identification with TEIL. Furthermore, availability of academic resources as well as the level of academic knowledge, expertise and competences acquired is directly linked with the cost associated with leaving the institution.

Examining administration quality, reliability and responsiveness of internal and supporting services quality is associated with affective commitment. This is in accordance with the results obtained by Malholta and Mukherjee (2004) that service quality is related only to affective commitment in comparison with continuance commitment.

Regarding demographics, our results provide supporting evidence that level of education and age are positively related while tenure is negatively related only to organisational commitment (Lok & Crawford, 2004).

Future research could investigate the potential impact of internal factors such as organisational culture and leadership on the link between service quality, satisfaction and commitment in the context of higher education (Trivellas and Dargenidou, 2008; 2009).

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Reducing Waste in the Supply Chain Linking Shanghai to Detroit: Observations and Recommendations

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Introduction

“Without satisfied customers, an organization is in peril! To keep customers satisfied, the organization needs to meet their requirements.” (ISO, 2011)

Mature global quality management systems can fail to deliver consistent quality as defined by the customer. There is widespread belief that effective quality systems for manufactured parts can ensure that defect-free products arrive at the customer’s loading dock. Japanese competition in the late 1970s forced U.S. vehicle manufacturers to adopt quality management systems based on the ISO 9000 standards. In 1982 U.S. vehicle manufacturers (Automotive Industry Action Group, AIAG) initiated on an ISO-based quality management system. The AIAG QS-9000 system was launched in 1994 (and since superseded by TS/ISO 16949) to replace individual company quality systems. Domestic and international supply chains in the U.S. vehicle industry now have been functioning in various forms for over 30 years. Since their inception, the volume and geographical reach of these supply chains has expanded dramatically. However, the current ISO (2011) promise: “The ISO 9001:2008 standard provides a tried and tested framework for taking a systematic approach to managing the organization's processes so that they consistently turn out product that satisfies customers' expectations.” has not yet been realized.

The Value of Global Quality Management Systems

The value and operational characteristics of global management systems have garnered the attention of many academics. The intense, widespread, and long term interest in global quality systems reflects not only academic interest but also the expansion of global trade and its importance to the well being of individual countries and their citizens. Wealth is currently re-distributed from one country to another at an alarming rate. Much of this re-distribution is regulated by international quality management standards. Goods exporters such as Germany and China are prospering as are exporters of industry-critical commodities such as petroleum and metals. To some degree, the future standard of living in many countries will be tied to how well they function in a globalized world, to some extent regulated, by ISO and ISO-based quality management systems. It is more than just academic interest to assess how well these systems work.

It is well beyond the scope of this study to make any real assessment of international quality systems. These systems are here to stay. Some 900,000 firms are registered to ISO and many more are registered to TS or other ISO-based systems (Singh et al., 2011). For example, using the term “ISO 9000” in May, 2011 in the Emerald database returned 2236 journal articles and 33 books. The meta-search program *Summon* returned 3556 refereed journal article “hits” with 1219 published since 2005. A good synopsis of ISO/AIAG quality systems and their relation to the Baldrige award has been done by Kartha (2004) who concludes: “...ISO/QS 9000 and ISO/TS 16949... may be redundant in a mature total quality organization except where mandatory certification requirements are enforced for doing business especially in a global environment.” Douglas et al. (2003): “On the whole, the views of quality professionals who responded to this survey on ISO 9000 were very positive.” More recent assessment of the value of ISO –based systems, (Singh et al., 2011; and Singh, 2008), while empirically based, do not demonstrate clear and unequivocal benefits. Almost innumerable studies reveal many aspects of global quality systems and, as expected, the certifying bodies act as “cheerleaders” as to their value. “Interestingly, despite offering a number of benefits, ISO 9000 did not meet user expectations in a number of areas, including reductions in costs and waste; however, this may have more to do with the certification bodies exaggerating claims for the standard and thereby setting expectations at too high a level than with the standard underperforming.” (Douglas et al.,(2003).

Global quality systems form an important basis for expanding global trade. In the highly globalized motor vehicle, ISO-based systems are critical. Unfortunately there is some naïve hope or imprecise understanding that compliance with quality management systems removes the problem of defective parts. Recent amendments to the TS 16949 system require not only compliance with the system but also continuous improvement. Quality management systems are imperfect and evolving. Studies such as this should contribute to this evolution.

Economic Impact of Trans National Supply Chains Regulated by Global Quality Management Systems

Global quality systems are a permanent feature of the international economy and tied to expanding global trade. According to the OECD, global trade represents about 3.5 trillion US dollars per year and is increasing year by year. Except for a recessionary dips, global trade has increased steadily since the end of World War Two (World Bank, 2011). Expansion of global trade has created many winners and some losers. While trade in services is growing, the bulk of trade remains in goods and commodities. Over the past 20 years, the general trend has been the importation of goods from low-wage areas and a decline in manufacturing in rich countries. China in particular has benefited from the export of goods to richer countries. The U.S.-based National Association of Manufacturers (NAM), a major industry lobbying group, states: “In terms of global market share of manufactured exports, the U.S. share declined from 19 percent in 2000 to 14 percent in 2007, while the Chinese share rose from 7 percent to 17 percent.”

However, a recent paper released by the renowned Boston Consulting Group (2011) suggests that changes may be forthcoming. “Products that require less labor and are churned out in modest volumes, such as household appliances and construction equipment, are most likely to shift to U.S. production. Goods that are labor-intensive and produced in high volumes, such as textiles, apparel, and TVs, will likely continue to be made overseas. After adjustments are made to account for American workers’ relatively higher productivity, wage rates in Chinese cities such

as Shanghai and Tianjin are expected to be about only 30 percent cheaper than rates in low-cost U.S. states. And since wage rates account for 20 to 30 percent of a product's total cost, manufacturing in China will be only 10 to 15 percent cheaper than in the U.S.—even before inventory and shipping costs are considered. After those costs are factored in, the total cost advantage will drop to single digits or be erased entirely.” The U.S. National Research Council (1992) “Direct labor accounts for only 10% of costs in the auto industry. Even if labor costs were zero, total costs would still be reduced only by 10 percent...the attractiveness of low-cost labor is virtually eliminated in site location decisions, particularly since low-cost locations have few if any other attractors.” And NAM (2009) states: “Now, nearly 76 percent of Honda and Acura vehicles sold in the U.S. are manufactured in North America.” The current pattern of moving manufacturing to low wage from high wage countries may change.

The growth in the flow of goods across borders will likely grow unabated in the coming years. Relatively free trade has been expanding ever since the end of World War Two. China is now a member of the World Trade Organization. **Where** the value is added to manufactured goods will likely be tied to labor cost, labor intensity, labor productivity and the effectiveness of quality systems. The model of the last 20 years has been challenged by rising labor costs in China and the increased cost of transportation tied to energy costs. Companies, whatever their location, will have a big advantage if they can provide their customers with world-class quality (zero defect/JIT) manufactured parts within the auspices of ISO-based systems.

Human Error and Quality Systems

Organizing factory work using “scientific management” was pioneered by Fredrick Taylor in the late 1800s and formed the basis of rapid expansion of U.S. manufacturing (especially the auto industry) in the early 20th century (Locke, 1982). One of Taylor's key concepts was a complex division of labor which separated the physical work from the mental work in the factory. Thus, inspection was “after the fact” and separated from the physical processing of the part. Operators were not trusted to inspect their own work; a job done by a separate inspection department. Errors were detected after the part was made which resulted in making many bad parts and a long time delay between making the bad part and the detection of the defect. Many subsequent studies, especially in industrial engineering accept this model (Garret et al., 2001; Hou et al., 1993). Scientific management assumes that the manufacturing system will create a certain number of defective parts which may or may not be identified in later operations.

Shingo (1986) found that statistical process control- SPC- (pioneered by Shewhart and introduced into Japan by Deming and Juran after World War Two) also occurred “after the fact”. While SPC was greatly superior to scientific management, using SPC meant that defects were still created then later detected. In contrast, Shingo is credited with the “Zero Defect” or “Zero Quality Control” concept carried out by looking for systemic solutions rather than finding defects after they occur. Shingo accepted the fact that humans are imperfect and will make mistakes. It is the job of the engineer and manager, working with the operator, to ensure that human error does not necessarily translate into defective parts. Blaming people for errors, which may happen in scientific management, was replaced with an effective system to eliminate defects. Shingo was essentially correct in his estimation of the inevitability of human error, but now we have good science to support his position.

There is vast literature on the human dimensions of safety especially tied to high stakes operation such as military systems, civilian aviation, and nuclear power generation (Stephenson, 1991 and Kirwan, 1994). “The investigators applied longstanding research on human error which explained discrepancies between projected and actual defect rates. Operators and inspectors were blamed for quality defects when research consistently demonstrates that they were asked to perform inspection tasks humans find impossible.” (Kirwan, 1994)

Further, "Omission errors alone will result in defect rates as high as 100 PPM (parts per million), 80% of defects in complex systems...attributed to human error, Rook (1962) examined 23,000 production defects and found that 82% were caused by human error. 70% of 6600 observed defects were caused by assembly and handling errors. Human error is identified as the dominant cause of defects in modern production in virtually every study where this source of problems has been examined" (Hinckley, 2001). The range of human performance error rates related to inspection ranges from 1 in 5 to 1 in a 100. (Stephenson, 1991). According to Juran and De Feo. in their widely used reference, 2010's *Quality Handbook, Sixth Edition: The Complete Guide to Performance Excellence*, 100% human inspection of parts is only about 80% effective. (Cited in Robinson and Schroder, 1992)

Thus, a wide range of sources from distinct fields of study agree that, if we expect individuals to make inspection decisions, they will make mistakes. Not because they are badly trained, not because they unintelligent, not because they are lazy, but because they are human beings. Recent research brings a new dimension to assessing the role of human error in manufacturing defects. Shingo (1986), Hinckley (1991) and others have long held that “mistakes are inevitable by defects are not”. Now there is firm scientific evidence to describe what goes on in the human brain which “causes” the mistake/defect.

“Humans engaged in monotonous tasks are susceptible to occasional errors that may lead to serious consequences, but little is known about brain activity patterns preceding errors. Using functional MRI and applying independent component analysis followed by deconvolution of hemodynamic responses, we studied error preceding brain activity on a trial-by-trial basis. We found a set of brain regions in which the temporal evolution of activation predicted performance errors. These maladaptive brain activity changes started to evolve 30 sec before the error. In particular, a coincident decrease of deactivation in default mode regions of the brain, together with a decline of activation in regions associated with maintaining task effort, raised the probability of future errors. Our findings provide insights into the brain network dynamics preceding human performance errors and suggest that monitoring of the identified precursor states may help in avoiding human errors in critical real-world situations.” (Eichele et al., 2008)

We can now identify brain activity which precedes the mistake. We now have empirical evidence that relying on human judgment in repetitive inspection decisions **will** result in defects. If we are to create quality systems capable of producing zero defects, we must find alternatives to relying solely on human judgment.

Case Study: PFMEA, Control Plans, and Redundant Inspection

This project tracked interior automotive parts such as trim pieces and sun visors from raw material to installation in the completed vehicle in Michigan USA. In China, raw material, largely

polymers, may be domestically sourced or imported. China does not have a well developed petrochemical industry and most industrial polymers are made from natural gas or petroleum as raw materials. Some U.S. or Canadian -based Original Equipment Manufacturers (OEMs) specify European or US-made polymers due to their mistrust of the quality of Chinese-made polymers. Most of the processing is done on Chinese equipment such as injection molders and molds are typically also made in China. Assembly tooling and ancillary equipment may come from North America or be developed in China. All employees, managers, and engineering staff were Chinese. This was true if the company was Chinese owned or a joint venture between Chinese and North American partners. Six parts plants in China were visited and one was selected for further scrutiny. Company S agreed to permit the researchers additional assistance in this investigation.

All parts were produced on systems compliant to TS 16949 and, at Company S, the researchers were provided complete process documentation including Production Part Approval Process (PPAP), Process Failure Mode and Effects Analyses (PFMEAs), and Production Control Plans. Free access was provided to the Company S Chinese plant, the North American facility where the Chinese parts were unpacked, and to the final vehicle assembly plant area where the parts were installed in the vehicle.

Company S facilities were modern, tidy, and obviously well-managed. The final assembly plant near Detroit Michigan, owned by one of the “Detroit Three”, was similarly modern, clean, well lit, with hard working employees producing vehicles which were selling well. From the TS 16949 documentation, to the modern facilities, to the professional staff, the Company S global supply chain was impressive and clearly compliant to the audit standard.

This global supply chain was delivering very good parts to their customers in the final assembly area of the OEM factory. Once the parts arrived and were installed at the assembly plant, they were considered “perfect” by the OEM staff. However, the system itself was imperfect and did not practice the much vaunted “quality in station” practiced by Toyota (Dennis, 2006) and called Source Inspection to Prevent Defects by Shingo(1986). This supply chain consistently moved (a small number of) parts which were found to be defective at the next step. e.g. "inspection" by operator later rejected by inspector; approval by first inspector and rejected by second (redundant) inspector; shipped as "good" from the parts plant and rejected at tier one or consolidator; shipped by tier one and rejected at assembly plant. All this occurred even though inspection criteria at all points were tied to the approved part print and control plan.

Both the PFMEA and the Production Control Plan specify many points of 100% visual inspection by the operator “in station” or by inspectors at the end of a line. The typical “reaction plan”, invoked if a non-conformance was found, was to “quarantine and notify the relevant department.”

On the PFMEA, typical process control checks were given a PFMEA “Detection” ranking of 5 or 6. From AIAG (1994) the PFMEA Detection scale is:

1 - Absolute certainty: The defect is obvious or there is 100% automatic inspection with regular calibration and preventive maintenance of the inspection equipment.

5 - Moderate: Some Statistical Process Control (SPC) is used in process and product is final inspected off-line.

6 - Low: Product is 100% manually inspected using go/no-go or other mistake-proofing gages.

10 - Absolute uncertainty: the product is not inspected.

As the previously reviewed literature indicates, human inspection is only about 80% effective. (Juran & DeFeo,(2010; Hinckley & Barkan, 1995; Anonymous, 2011). This phenomenon is now better understood because of the brain research done by Eichele et al. (2008). PFMEA Detection rankings of 5 and 6 are correct for 100% visual inspection by one operator. As repeatedly shown in the literature, 100% visual inspection virtually guarantees that defects will be passed downstream. This production system ensures defects and mandates redundant inspection at each of the subsequent steps. At the subsequent steps, the same Detection number could be indicated as these steps also use 100% visual inspection by one operator. Company S personnel suggested that about 10% of the defects found when the containers are unpacked in the U.S. were due to shipping problems. Some 90% of defects occurred as a result of the predictable human error inherent in the quality system. As Deming (1986) would say - the vast majority of mistakes are a result of the system, not the people – and Shingo (1986) might chime in that people are human and mistakes are inevitable but defects are not.

World class quality might be defined as providing customers exactly (zero defects) what they want when they want it (close to just-in-time delivery). This system cannot deliver zero defects and the supply chain between the parts plant in China and the assembly plant in Detroit requires 90 days in transit. It is clear that the marketplace actually determines the acceptability of quality or defect levels. However, instituting a quality system which would yield a PFMEA Detection level of 1 or 2 would help reduce the defect level to near zero. The transit time is more difficult to reduce, but if we could approach zero defects as the parts are loaded into the container, then fewer parts need to be shipped and the time required for redundant inspection could be reduced or eliminated. Considering an investment in more mistake proofing whether mechanical or electric/electronic (Hinckley,1991 and Shingo,1986) could dramatically improve detection. Two person inspection (Stephenson, 1991) could have a similar effect. These suggestions have been communicated to the Company S quality staff.

Quality researchers should be able to apply empirical scrutiny to a supply chain, ascertain root causes of defects permitted by the system, and thereby recommend improvements to the quality system itself. Research done in neuroscience, industrial engineering, human factors in safety, and medicine can be integrated into the study of quality systems. Shingo began his work with Toyota in the 1950s and was finally published in English in the early 1980s. He was essentially correct but we now have empirical/scientific bases to justify mistake proofing and reach the level of “zero defects”.

Findings:

This project investigates and systematizes sources of waste such as redundant inspection in an international supply chain of automotive parts. Rather than ensure perfect quality by preventing defects, there are elements of the quality system which will guarantee non-conformities. Quality professionals embrace slogans like “Zero Defects” and “Six Sigma Quality”, yet little research

actually tracks and systematizes sources of defects from raw material to finished product in a multi-continent international supply chain. Since 1994, international quality systems (such as the ISO-based QS and TS systems) have been in place to ensure that customers (in this case automotive OEMs) receive defect-free products. Even when compliant to ISO or other quality systems, international supply chains are rife with waste such as redundant inspection. Adapting research from other fields of study including neuroscience can assist quality professionals in the improvement of supply chain quality in the quest for zero defects.

Practical implications: Supply chain decisions for manufactured parts have resulted in massive changes in employment, national wealth, and even diplomacy. Helping to perfect quality systems in multi-continent supply chains may help influence trade policy and clarify companies' supply chain decisions.

Research Limitations: This study describes a tiny sample of the China-USA supply chain in manufactured parts. A much larger study is needed to be able to generalize from the findings.

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QMS development towards strategic advantages

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Key words: QMS, ISO 9001, quality system effectiveness, strategic benefits.

Introduction

The ISO 9001 quality standard is popular in a wide variety of organizations, and it is employed by business enterprises as well as public organisations, offices and NGOs. The view that ISO 9001, along with ISO 14000, are the most popular management certificates all over the world is widely held (Mikulis & Ruževičius, 2009). It is significant that the number of certificates in the world has been rising year by year (The ISO survey..., 2010), regardless of the global crisis of 2008/2009. The number of certificates issued worldwide exceeded one million in 2009.

The Quality Management System (QMS) is a method which is utilized by managers for achieving particular aims. Modern economies are characterized by raising competition on a global scale. The free flow of capital, goods and investments are factors which hasten this stronger competition. The primary sources of competitiveness are definitely immanent knowledge and companies' competences (Hamel & Prahalad, 1990), but practically they are supported and facilitated by the collection of various methods and tools. From the perspective of top management, who are responsible for developing business, strengthening organizations, and achieving benefits which will be rewarded by shareholders, quality and QMS might have essential meaning.

Although QMSs are very widespread, they are also criticized by practitioners because of their bureaucracy and for not bringing many benefits, besides the fact of holding a certificate. The issue of QMS effects is the central issue of this study. However, the issue's objects are not all the effects, but only those which are particularly important from the strategic point of view, i.e. those which lead a QMS holder to a better competitive position in an industry. This study's questions are gained from practical needs. Managers want more effects from QMS, especially in times of crisis, when all activities in enterprises are being carefully reviewed just from the perspective of the advantages they bring. Therefore, the study might support quality managers in the challenge of how to achieve more from existing QMS. The typical measures of competitiveness will be considered in this study, as well the Key Success Factors (KCF).

Quality costs

The account of costs plays an important role in the basic theory of enterprises. This is also a significant component of corporate strategy, cost strategy being one of the few basic strategies according to Porter (1980). Cost level determines the competitive position in a company's sector, so this issue is very interesting to explore. There is very little evidence that a QMS significantly influences the lowering of costs. Very interesting conclusions are drawn from theoretical deliberations on optimum quality level in terms of costs' height.

The most intensive discussion of quality costs is based on costs division into just two categories: costs of poor quality (internal and external failure costs) and costs of achieving good quality (appraisal and prevention costs). A similar quality costs taxonomy is also presented in ISO 9004:2000 (par. 8.2.1.4), and it should be underlined that the newer version ISO 9004 from 2009 almost ignores the issue of quality costs. Total quality costs are the sum of the two categories mentioned above. The classic thought on the relationship between quality level and quality costs level is proposed by Juran (Juran, 1951). According to the author there is an optimum quality level which results from minimum quality costs. In other words, according to this model a certain level of defectiveness is necessary to achieve the minimum level of total costs. This model is typical for companies focused on quality control.

But the experiences of continuous improvement and aiming at excellence has brought a different view on quality costs. The new model of quality costs proves that from an economic point of view the optimum level of quality is not a certain percentage of faults, but simply perfection. The new quality costs model (proposed by the same author as the previous one: Juran & Gryna, 1993) proposes a weaker increase of appraisal and prevention of costs because of a higher prioritization on prevention and new technological solutions, which lead to a reduction in failure rate and make process monitoring feasible. The total cost curve is negatively sloped on the entire length, and the optimum level of costs is achieved at the point of zero faults - perfect quality. According to Freiesleben (2004), since a company is likely to go through several stages of improvements to approximate the point of perfection, the prime task for a company is to determine how much improvement is optimal at the current quality level. A correct assessment of this question requires that the company not only thoroughly investigates the quality problem to find root causes and remedies, but also assesses the revenue impact of the quality improvement.

Indeed, the new optimum costs point, which occurs in perfection, justifies quality systems utilization. ISO 9001 is a kind of prevention system; it offers a way of appraisal and avoidance of bad quality in the whole organization. Casadesús et al. (2005) also underline that the previous version of ISO 9001 was focused on circumscription and standardization of work procedures, as well as improvement in terms of the responsibilities and obligations of employees. The newer version leads instead to continual improvement, which yields the expected benefits only in the long term. Such a model of QMS is very supportive of the model wherein the optimum total costs are at the point of perfection.

Empirical research very rarely reports the conclusive impact of QMS on the diminishing of costs. In fact something opposite is seen. Interesting empirical evidence was presented by Han (2008). According to this research, certificated QMSs are correlated to some important variables describing companies' performance. The study suggests that there is no direct relationship between ISO 9001 registration and a company's profitability. Nevertheless, ISO 9001 helps to reduce costs, improve quality and increase flexibility, which in turn enhances profitability. The general conclusion suggests that ISO 9001 contributes to competitiveness, which in turn helps a company to gain greater profitability. With reference to costs, Singh et al. (2006), among the many benefits of QMSs, also identify a benefit defined as "lower operating costs", but this was rated by respondents as low.

On the other hand, the empirical study on certified companies by Martinez-Costa & Martinez-Lorente (2007) suggests that ISO 9001 implementation may even reduce companies'

performance. According to the study, the reason for this state is the costs of implementing and maintaining a QMS in an organization. Some potential benefits, like increased quality and market advantages, do not match the costs of the QMS. This suggests that QMSs lead to higher quality costs.

Macroeconomic viewpoint

Economists look for factors which lead economies to more intensive growth and development. There are not many macroeconomic studies on QMSs as a factor of economies' development. Perhaps the reason is that it is not easy to capture the influence from a macroeconomic perspective. There is, however, an interesting study conducted by Mikulis and Ruževičius (2009) which analyses the influence of QMSs on a country's economy. The authors mostly focused their attention on Lithuania, a relatively small country, which might have been helpful in capturing the relationships. They took as their basis data concerning the competitiveness and productivity of countries taken from international research agencies like OECD and the IMD World Competitiveness Index.

The study indicates that the general quantity of certificates of ISO 9001 (and ISO 14001) have only a slight correlation with the productivity (competitiveness) of a country. The parameters of the penetration of ISO 9001 in countries have very little correlation with productivity. Remarkably, the quantity of ISO 14001 certificates has a comparatively bigger correlation with the productivity of a country than ISO 9001. The authors explain this by the fact that companies usually reach for ISO 14001 certification after they achieve the ISO 9001 certificate, and therefore it usually shows a higher level of maturity of management (Mikulis & Ruževičius, 2009). Moreover, they advocate that the ISO 9001 quality standard does not concentrate on efficiency, but mainly focuses on effectiveness. Thanks to that, a QMS only stabilises the management system in an organization. This can be perceived as the first step of the organization's striving for efficiency and increased productivity. The authors conclude in their research that there is a decreasing value of ISO certificates, and that it mostly depends on an organization itself and how effectively the system is used; presumably more advanced methods of management have more significant and direct impacts on organizations' productivity and competitiveness.

QMS and key performance indicators

Another interesting study devoted to the influence of QMSs on companies' key performance indicators was published by Dick et al. (2008). The study was based on longitudinal data, and it indicates that firms having certified ISO 9001 achieved substantially greater cumulative average sales growth (56 per cent) than non-certified firms (40 per cent) over five years, with two out of the four years being statistically significant. A similar picture emerges for profitability. Companies which use ISO 9001 achieved better average profitability (ROA) than non-certified firms over the five-year period, with their average ROA being 8.67 per cent compared to non-certified firms' 6.89 per cent.

According to the authors, there are three possible reasons for the superior performance found prior to QMS certification. It could be that a QMS, with its certification, is costly to implement

and maintain, so only more profitable companies are more likely to be able to afford it. Alternatively, it may be that the certified companies are characterized by having a greater exposure to international trade, and to compete they may have already emulated “best practice” systems prior to seeking accreditation (Dick et al., 2008). The authors, having relatively credible evidence of the link between QMSs and business performance, also partly see the source of better business achievement in the nature of ISO 9001. High-performing companies are more likely to seek new practices/systems that can improve their capabilities, which ultimately creates their above average performance. Thus, better performance is not caused by any single system or practice but is the cumulative result of a process of continuous adoption, learning and adaptation of new management practices/systems, including a QMS (Dick et al., 2008). Finally, it might be concluded that QMSs, having a potentially positive influence on companies’ business performance, still need management efforts to continuously improve them, and relentless engagement of new methods and tools. Others also report better financial performance induced by QMSs (Benner & Veloso, 2008; Terlaak & King, 2006; Corbett et al., 2005; Casadesús et al., 2001)

Other benefits of QMS

The literature output brings different specifications of real and potential benefits that a QMS brings to an organization. Benefits are very often discussed in the context of motives that drive an organization to QMS implementation. Basically, the benefits might be internal or external (Casadesús et al., 2001; Sampaio et al., 2010). Internal benefits are related with inner organizational improvement goals (e.g. productivity, internal communication), while external benefits are related to promotional and marketing advantages. This study is mostly interested in evidence of benefits that might be treated as strategic, i.e. leading to long term business success, or being a sign of a better competitive position.

Among many benefits from QMS identified by Piskar & Dolinsek (2006) some should be highlighted. One potentially valuable benefit is the improvement of a company’s reputation. This benefit was one of a few very frequently chosen by researched companies. Less frequently respondents pointed out the increased number of innovations in business process (continuous improvement), the improvement of business results, and finally increased customer loyalty thanks to QMS. The authors tried to prove what role QMS may play in an organization as a business model, i.e. some kind of reference while taking important decisions. The conclusion was that managers must consider certain strategic guidelines for the introduction, maintenance and improvement of the quality system. In other words managers must clearly know what role they really want a QMS to play as a business model.

Casadesús et al. (2001) report the quite important influence of QMS on the market and financial affairs of companies. According to this research, ISO 9001 leads to a considerable increase in market share. Increasing market share is rightly treated as a hard sign of a company’s competitive advantage. However, according to the study, a lesser number of companies report an increase in the rate of sales per employee. Also a large proportion of respondents confirm financial results, like return on investments. Reporting a relatively optimistic view of QMS advantages the authors conclude that not all companies were able to take advantage of the opportunity which ISO 9001

brings. Better access to new clients and markets are also reported by others (Terlaak & King, 2006; Corbett et al., 2005).

Some more benefits which are crucial for long term development also appeared. These are: increasing organizational flexibility as an benefit of QMS (Han, 2008; Cua et al., 2001), and increased innovation of organizations (Prajogo & Sohal, 2003).

Negative impact

Some voices claim that QMSs do not bring positive effects to an organization; even more, that they might be a kind of handicap for their users. According to some studies, there is not enough support for assumptions that QMSs are going to have a significant positive influence on companies' results, or that companies will be able to implement a QMS in a way that will help them to take advantage of it's full potential (Gotzamani, 2010).

The weaknesses of QMSs are the particular attention of Seddon's works. The author, based on a wide survey of organizations holding certified ISO 9001, identified a number of QMS disadvantages. His research points out that it often happens that a QMS encourages an organization to perform worse for their clients (Seddon, 2000). This is due to actions implemented strictly according to procedures which may limit organizations in many cases, particularly in the implementation of unusual customer expectations. Among other charges, the author points out that ISO 9001 also imposes an excessive focus on control, while high quality cannot be achieved by control, i.e. through rigorous inspections and strictly described procedures. In addition QMSs rely too heavily on people who check and verify the system, such as auditors. Moreover, the system discourages employees from continuous learning. One more issue raised by the author concerning the disadvantages of ISO 9001 is that it strengthens the belief that the design of work processes can be separated from their implementation (Seddon, 2005); how can operators achieve quality based on a previously described procedure? Indeed, the arguments advocated by Seddon cast doubts on the effectiveness of the whole approach proposed by ISO 9001.

Some other studies report evidence of negative consequences of QMSs implemented in companies. One of them is weaker financial performance thanks to QMSs (Martinez-Costa & Martinez-Lorente, 2007; Morris, 2006); another is the blurring of economic benefits achieved initially by QMSs (Casadesús & Karapetrovic, 2005) due to stabilization of an organizational system.

Potential nature of QMS benefits

Numerous studies, including those cited above, conclude that there are some conditions which should be employed to achieve QMS efficiency and to make the system bring much more benefits. Authors discourage the lowest common denominator approach, focusing only on ritualistic implementation of ISO 9001 requirements. Correct interpretation of specified requirements depends heavily on the companies' internal motivation and willingness to improve (Gotzamani 2010). Others suggest that managers should have a broad view of ISO 9001 requirements and should be critical of the standard while implementing it, and, in doing so, it is

possible to satisfy external customers in the long-term, by satisfying the employees and the shareholders at the same time (Lambert & Ouedraogo, 2008).

Many authors came to the conclusion that the motivation which drives an organization and its managers is crucial in obtaining the benefits from a QMS. The question is for what purposes are they introducing the system and, especially, what kind of effects do they really desire? Prajogo (2008) expresses the opinion that internal motives determine not only the success of attaining certification, but also the sustainability of ISO 9001. Much depends on the expectations from a QMS in an organization. True commitment, during and after the implementation process, is indispensable to achieve sustained benefits from a system. Internal motives, in terms of willingness to implement authentic improvement in an organization, have a particularly important role (Heras-Saizarbitoria et al., 2011).

Similar conclusions came from the study by Poksinska et al. (2006), where three companies were analysed in-depth. The companies introduced and operated ISO 9001:2000 requirements with very little effort and without significant changes; the QMS was perceived not as a TQM tool but as a tool for maintenance documentation. Thus, the companies achieved only minor internal and external benefits. Beside the conclusion that the crucial issues are employees' engagement, CEOs' commitment and development orientation of auditors, the authors state that, depending on the way a QMS is implemented and operated, many opportunities for improvement might be lost. The potentiality of ISO 9001 might be exploited only under the condition of an organization's real desire to do so.

ISO 9001 as a framework

In the literature output the issue of benefits which are achieved by organizations from QMSs is investigated relatively frequently. Research usually tends to discover just the simple benefits that are listed by managers, or tries to grasp the relationships between QMS utilization and key company achievement indicators. Insights provided by the literature indicate that a QMS can bring some benefits which are crucial for a company's long term growth, Nevertheless, all the studies leave space for doubt as to whether benefits are caused just by the system itself. In addition, a number of QMS weaknesses are observed. Finally, from the studies emerged the picture that all the benefits are fairly risky, and they are determined by many factors. QMSs by themselves cannot be classified as definitely beneficial or, conversely, as definitely harmful. This is a management tool which is strongly dependent on how it is used, and what is expected from it, and it is probable that further research will not bring about a consensus qualifying QMSs to any unambiguous position.

The deliberations above lead to the conclusion that QMSs, according to the ISO 9001 standard, have to be analysed and researched as a kind of framework which might be used in many different ways. The system might provide a useful framework for achieving significant business effects, this does not happen nearly by itself. It what content this framework is precisely equipped, and what particular objectives are put before it depends on its users. Treating QMSs in that way, they definitely must not be perceived as a kind of black box, nor should we ask the question whether it gives proper results; on the contrary, a researcher should go inside a QMS investigating the elements forming this system. In the literature there are very few studies going

inside the QMS. Sampaio et al. (2010) studied the numbers of non conformities, identified during audits, divided into particular ISO 9001 paragraphs (requirements). According to the study, the chapter containing product realization requirements (Chap. 7 of ISO 9001:2000) experienced the highest number of non conformities. Other studies taking into account accurate ISO 9001 requirements were also conducted by Liebesman (2002) and Ritterbeck (2007).

Considering the potential nature of QMS benefits, and also not treating the QMS as a black box, but as a collection of precise requirements, this study tries to ask the question “how?”. The study looks for an explanation of how benefits might emerge from the QMS environment. However, the deliberations will be limited only to those benefits having significant meaning for an enterprise, i.e. strategic benefits.

Research method

This study adopts the qualitative research approach; it tries to penetrate into the depth of QMS and ISO 9001:2000 requirements. The qualitative approach allows for a better understanding of a company’s organizational system, which is the essence of the research problem. The engaged methodology has been derived from the principles of the multiple instrumental case study, which is designed to increase awareness about the broader phenomenon (Denzin & Lincoln, 2005). The used method was based on qualitative expert heuristics which, according to Kleining & Witt (2000), are applied in social research, also for the purposes of introspection. The adopted methodology tends to acquire expert knowledge. In particular workshops were used with groups of experts, and during the workshops techniques for graphic visualization of results were used. During workshops other techniques were also employed, like written forms and brainstorming.

Experts were recruited from leading Polish companies, and all of them held the position of Quality Manager and were responsible for the QMS in their organizations. Sixteen experienced managers were engaged. The companies represented by them operate in different industries. The expert panels were organised during the periodic meetings of quality managers associated in the Kema Poland Quality Managers Club. There were four expert panels with four experts in each. The panels met twice at an interval of a few months. The research was conducted during 2009 and 2010.

Researchers rarely go deeply into a QMS and its precise requirements. In most projects it is treated as one enclosed entity, so that it is difficult answer exhaustively the question why QMSs provide significant benefits or, conversely, why it does not. The approach of this study is slightly different in that it assumes that the key factor for superior benefits from a QMS lies in the way the system is exploited. So the question for the expert panels during the first meeting was how to operate in a QMS in order to achieve better benefits, especially strategic ones? The panels worked on assumed cases of an organization. The task was to show in detail the way a QMS might support particular strategic benefits. Furthermore, the assignment was to visualise panels’ proposals on drawing flowcharts and to provide further necessary explanations. The second meeting was devoted to the KSFs of the companies the experts came from, in the context of ISO 9001:2000 requirements. The experts tried to answer the question of how particular requirements support KSFs? The workshops concentrated on discussions concerning contemporary knowledge about the benefits of QMSs, and ways of achieving potential improvements. Experts were asked

to share their experiences of ISO 9001 utilizations and, besides these, the project created an opportunity for mutual learning for all participants.

How could QMS support strategic advantages?

Before expert panels started work it had been decided what might be perceived as strategic benefits. Among many proposals experts chose by voting four which were considered crucial, and these were: company profit, income, organization’s image and customer loyalty. These four were the objects of further work for the panels.

Experts proposed the paths which might lead QMS users to achieve particular benefits. Experts’ ideas are shown in Figures 1-4. Experts showed on their charts the influence of ISO 9001:2000 paragraphs in brackets. The proposal provide interesting views on how a QMS might support organisations’ efforts in achieving particular strategic benefits.

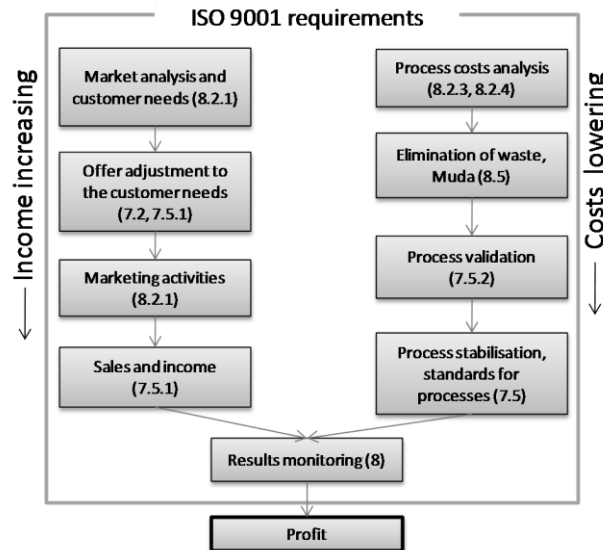


Figure 1. How QMS supports company profit

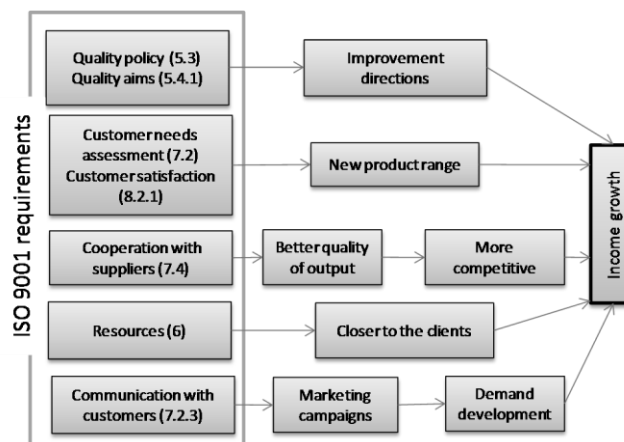


Figure 2. How QMS supports income

As shown in Figures 1 and 2 a QMS may have a positive impact on improving the company's profit and revenue growth. Both categories are similar in nature because they are financial measures of business performance. The quality system affects the profits of the enterprise in two ways, by raising revenues and lowering costs (Figure 1). Presented by the experts' panel the mechanism is, in some ways, similar to the two paths, illustrating the impact of quality on profits proposed by Maani (1989). He mentions the marketing path (similar to the path of revenue growth) and the production path (similar to the path of cost reduction). The beginnings for both paths are the operations required by Chapter 8 of ISO 9001:2000, which is focused on "measurement, analysis and improvement". On one track the measurement and analytical requirements shall be implied as identification of customer needs; on the other track as cost assessment processes. In both pathways Chapter 7 of the standard is also important, as its task is to ensure the proper execution of aimed for key business processes. This collection of requirements concerns processes of good production and/or service provision. It is very interesting that the experts pointed out not just the requirements but particular tasks which are drawn from requirements and are in their scope. What is very interesting is that the experts noticed the opportunities offered by QMSs to be opened up to new methods and techniques. The panellists mentioned muda (waste) elimination, which is the basis of the Lean Management approach.

The pathways to achieve benefits in terms of revenue growth are slightly shorter (Figure 2). They are a specific number of factors in a QMS which, through certain intermediaries, lead to effects of increasing revenue. Sources leading to greater sales are located in many different areas of a QMS, from a properly prepared quality policy and quality objectives (Chapter 5 of ISO 9001:2000), by assessing customer needs and communicating with customers as defined in Chapter 7 of the standard (implementation of core processes), to collaboration with suppliers (from the point of 7.4. of the standard). In the illustrated mechanism Chapter 6 of the standard also has an impact; this collection of requirements underlines the special role of the knowledge and skills of staff. According to the panellists, thanks to this a company can be distinctly closer to customers and achieve better results in sales.



Figure 3. Customer loyalty achievement by QMS support

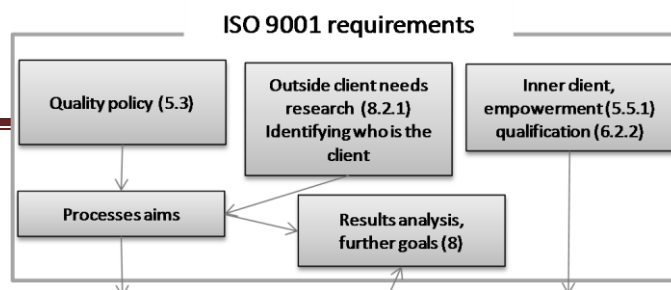


Figure 4. Achieving image by QMS support in a public organisation

Figure 3 shows the path of achieving customer loyalty using QMS. Similar to the part of previous tracks, the mechanism leading to the loyalty benefit begins with the determination of customer requirements. It should be noted that the measurement of customer satisfaction (in Chap. 8 of ISO 9001:2000) in this case is understood more widely; experts proposed to supply within it the measurement of loyalty. On the journey to loyal customers continuous improvement is important, and is an inherent element of a well-functioning QMS. Accompanying information gathering feedback from the market, and responsiveness to customer needs are very important. The proposal to achieve customer loyalty is built on the assumption that only above-average customer satisfaction can lead to loyalty, which is the opinion accepted in the literature related to customer loyalty (Reichheld, 1996).

The last result (Figure 4) of an expert panel is interesting because it concerns an organization of local government. As the desired strategic effect of such an organization the positive image among the local community was identified. On the mechanism, illustrated schematically, of the interactions within the QMS, the proper implementation of processes and wide communication of this fact to the public plays the central role. Transparency was also highlighted, which is also facilitated by the QMS.

ISO 9001:2000 requirements in the context of KSFs

Looking at all the diagrams, we see that there are only selected requirements of ISO 9001:2000 which were proposed as particularly important while tending to achieve strategic benefits. That is the way it was decided to implement the second stage of the research. In this stage experts tried to assess all the ISO 9001:2000 paragraphs as to whether they have an impact on the KSFs that exist in their organisations. The summarised results are shown in Table I. Experts were obliged to justify and to thoroughly explain the identified influences to the whole group. The other requirements of ISO 9001:2000, e.g. Chapter 4, were not taken into consideration as not having a potential for influence on strategic benefits.

Table I. Influence of ISO 9001:2000 requirements on KSFs

KSFs	ISO 9001: 2000 requirements																				
	Chap. 5						Chap. 6				Chap. 7					Chap. 8					
	1	2	3	4	5	6	1	2	3	4	1	2	3	4	5	6	1	2	3	4	
Market share		+													+						
Market share	+	+			+	+	+	+					+	+	+	+	+	+	+		
Market share / market strengthening relationships			+		+		+	+								+		+	+		
Quality of products				+			+		+				+						+		
Quick order					+	+		+					+			+					

The rate of placing products on the market	+	+	+	+		+		+	+
Timeliness of orders			+	+	+	+	+		+
Strong brand of products				+				+	+
The image of credibility with customers	+	+	+	+		+	+	+	+
Brand recognition	+						+	+	
The competence of staff and service quality	+	+	+	+	+	+		+	+
Rapid deployment of product innovations	+	+	+	+			+		+
Quality of products		+		+				+	+
Technologically advanced products	+	+	+	+			+	+	
The image of credibility with customers	+	+	+	+					
The efficiency of processes	+	+	+	+	+			+	
Frequency	2	10	1	4	11	2	12	11	6
Summary of chapter	30						29		
							4	5	8
							2	5	3
							10	3	8
							25	4	

The research shows potentially the most important areas of QMSs considering the impact on strategic benefits. Paragraph 6.1 was the most frequent chosen by experts. This concerns the provision of resources in an organization. Resources should be oriented to the continual improvement of QMS effectiveness and customer satisfaction. The next requirement, also referring to resources, is human resources (6.2). The third one is the requirement of “responsibility, authority and communication” (5.5). Also, the necessity of focusing on customers by top management, as well as the necessity to establish the process of “monitoring, measurement and analysis of improvement” are relatively frequently chosen by experts. From experts’ opinions emerges the view of human resources organised within the QMS as the most important aspect of the system, as well as the crucial role of top managers’ engagement with customer satisfaction and QMS improvement. What is interesting is that the paragraph 6.4 “work environment” was not chosen even once. This is definitely a very important requirement, but not from the strategic achievements point of view. The diversity of KSFs and different supportive QMS elements lead to the important conclusion that how the system supports the strategic benefits in a company largely depends on the specificity of the company.

Final conclusions

In concluding we might say that despite the fact that QMSs have many weaknesses, and that the achievement of significant benefits is not certain, this is a wide system with the potential of utilization in many ways. This is a system which provide management fundamentals and basic tools for achieving goals which are valuable for organizations. The whole study supports the opinion that ISO 9001 has a certain potential, but for utilization in a particular way this is nowadays a challenge for organisations. We may agree with Dick et al. (2008), who perceive quality systems as needed new management practices/systems. Also, the study supports the opinion that QMS users need to have a broader view of requirements (Lambert & Ouedraogo, 2008). The achievements are coherent with others’ conclusions underlying the motivations of an organization while introducing and maintaining the QMS (Gotzamani, 2010; Heras-Saizarbitoria et al., 2011; Prajogo, 2008; Poksinska et al., 2006). This fully supports the thesis that how much is achieved from a QMS depends on the way the system is operated (Poksinska et al., 2006). On

the other hand, this study sheds more light on the issue of “how” to achieve serious benefits from QMSs. This study is very close to the suggestions of the newest version of the ISO 9004:2009 standard. As we know, this standard provides guidelines for QMSs’ continuous improvement. The whole chapter (Chap. 5 of ISO 9004:2009) is devoted to how to put the organization’s strategy and policy into real action. This is a novelty compared to the previous editions of this standard.

Generally speaking, ISO 9001 should be perceived as a framework, and that a company must fill in the appropriate content. And it does not take away responsibility from managers to find effective strategies. Moreover, they are obliged to employ efficient tools, outside the QMS if necessary. Research findings are interesting from a managerial point of view, especially for those managers who treat their systems development seriously, and are motivated to achieve some significant results. Based on the shown proposals, a quality manager might improve his/her system by achieving benefits that are defined as important for his/her organisation.

The conducted expert qualitative research states that QMSs might be a good framework for achieving a variety of results, even competitive ones. And this is also a framework with which to integrate other management tools, especially those which efficiently support a company’s strategy. This direction of QMS improvement is also stated in the literature. Pheng (2001) suggests the 5S method as implemented in the existing ISO 9001. Similarly, Micklewright (2010) presents an improvement methodology using the concept of Lean Management as a way of improving the QMS according to ISO 9001:2000.

From a scientific point of view, it is also an important suggestion that while investigating the role of QMSs in organizations it might be valuable to go inside a system and ask the question “why?”. Finally, it should be mentioned that the study has many limitations, mostly coming from the research method. Qualitative in-depth studies allows us to explore research problems extensively but, on the other hand, many observations might appear to be misguided.

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Conditions related to the improvement of quality management systems in enterprises operating in Poland

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Category: Research paper

Introduction

Wide dissemination of the quality management system certification (more than one million organizations) makes a formal confirmation of the implementation of ISO 9001 is no longer a significant differentiator of competitiveness. In recent years we have seen in our country, many units being distinguished with a certificate. The main reasons include the binding of minor importance to them by customers and also incurred costs related to certification. Excessive formalization in implementing and verifying them is still one of the major barriers to their improvement and should also be noted. Cancellation of a certificate confirming the implementation of the requirements of ISO 9001 in many cases does not mean halting efforts related to the maintenance and continuous improvement of the quality management system. Types of activities undertaken by companies in the field of improvement of quality management systems. It can be observed that the distinguishing feature of competitiveness is not just to implement a quality management system meeting the requirements of international standard ISO 9001. Increasingly, companies focus their attention on other solutions of the system, consistent with the objectives of other organizational standards like environmental, health and safety (EHS) management systems as well as the other operational management tools based on the Toyota Production System, Six Sigma (DMAIC or DMADV methodologies), Lean Management concept. Such approach is often not only perceived as being more ambitious, but as more pragmatic. These solutions can bring companies more benefits, not only economic but also social. The implementation of these solutions is often dictated by the expectations of customers and internal determinants associated with the development of organizational culture, raising awareness and involvement of employees, as well as improving the efficiency and effectiveness of processes. Effective and comprehensive implementation of operational improvement tools contributes to the development of the organization and fulfill the expectations of stakeholders, which has affected the provision of sustainable enterprises and gives them many benefits. The most important benefits include:

- continuously improving the technical quality of tangible products and services (including the reduction of their negative environmental impact);
- raising awareness of staff and skills, especially in responding effectively to non-compliance;
- identification of risk (to take preventive action by examining the possibility of errors, which cause undesirable changes in processes and / or products);
- the possibility of optimizing the organization's operations through the effective use of resources, reduce cycle processes, avoiding wastage, and the introduction of initiatives for improvement actions);

- the possibility of employee participation in setting goals and metrics for the assessment of policies;
- improving the effectiveness of communication with stakeholders and involving them in initiatives related to improving processes and products;
- reduce the level of risk associated with safety of products, personnel, information, infrastructure, and environment.

The aim of implementing operational excellence management tools is to improve the way of quality systems and to ensure the sustained success of the organization. The guidelines in this area have been identified by the International Organization for Standards in document ISO 9004:2009 *Managing for the sustained success of an organization - A quality management*. This document indicates that sustained success of the organization requires the implementation of long-term development strategy aimed at meeting the needs and expectations of stakeholders such as customers, owners, employees, suppliers and society.

The pursuit of sustained success requires continuous analysis of the company in this field, especially in relation to the risks that may arise in the process of building relationships with stakeholders, and the dangers of the impact of the external environment influences. (Welford, Chan, Man 2007) Analyzing the guidelines contained in the standard, one can see the similarity with the idea of the concept of corporate social responsibility, which implies that sustainable development is the organization's objectives by focusing on three areas of activity: economic, environmental and social policies. (Foote, Gaffney, Evans 2010) Improvement of quality management systems, environment and safety allow enterprises to build closer relationships with supply chain partners, both customers and suppliers through joint implementation of projects related to product and process innovations as well as to ensure the continuity of operational processes (such as the achievement of the projected effectiveness and efficiency) by forming networks between the business partners (Garvare, Johansson, 2010). Companies seek to implement activities related to environmental protection in the implementation of the concept of social responsibility to reduce the negative effects of their operation on the environment. Many businesses in this area take comprehensive action focusing on the implementation of environmental management system compliant with international standards of ISO series 14000 organizations are beginning to pay attention in this respect not only for existing products and processes, but also to endeavor to this type of analysis used in developing concepts for new products and processes, using the approach of ecodesign and carrying out the product life cycle assessment. (Sakao, 2009) On the basis of improvement of quality management systems within the companies' efforts in this sphere are strictly focused on building relationships with employees, especially in investing in their professional and personal development in order to raise awareness and commitment of staff, as well as providing a safe working environment. (Kanji, Chopra, 2010) These efforts are aimed at reducing accident rate by raising awareness of the employees on occupational risks and threats. One may also be noted that especially a lot of business organizations put their efforts in building relationships with the public. Depending on the scope of the company, these relations may involve the local community as well as national and global communities like in the case of global corporations. Increasingly, businesses, especially multinationals focus on formulating guidelines for ethical conduct, referred to as codes of conduct (Rasche, 2009). They relate primarily to uphold the law and building positive relationships with stakeholders, particularly through the discharge of the obligations, respect for human dignity, fighting corruption, environmental protection, protection of information and

intellectual and industrial property rights. The guidelines in these areas have been published by the International Organization for Standards in document ISO 26000:2010 *Guidance on social responsibility*. It is intended to encourage the enterprises to go beyond legal compliance, recognizing that compliance with law is a fundamental duty of any organization and an essential part of their social responsibility. (Leire, Mont, 2010)

The results of empirical research

Study conducted in 2005 in the United States by Business Media's Industry Research, published in the World Class Manufacturing Report indicates that the main determinants of the activities related to the improvement of quality management systems are process improvements (shortening cycles, improved efficiency), improving the quality of products, improving the relationship with partners in the supply chain and improving the competence of employees. Also, the results of research conducted by the American Society for Quality (ASQ) in 2008, allowed to determine the reasons which influence the action on the improvement of quality management systems. These include:

- The growing importance of technical standardization and organization, especially in sectors aimed at minimizing risks to the safety of products and processes;
- creation of market leadership and achieving competitive advantage through the implementation of product innovations and organizational skills;
- building partnerships in the supply chain between customers and suppliers;
- the growing importance of human capital, which is an integral part of intellectual capital;
- the pursuit of companies to their economic development while taking into account respect for the environment and stakeholders.

In order to identify the conditions which shall be guided by the companies operating on the Polish market, improving its management system, surveys, which were made from January to February 2008 where carried out. Using purposeful selection of units from the base of ISO Guide Hoppensted Bonnier, companies that have been certified for compliance with the standards of quality management (ISO 9001), environment (ISO 14001), occupational health and safety (PN-N/OHSAS 18001). Questionnaires were sent to 7 045 business organizations, while 712 questionnaires were returned (at response rate 10.0%, of which 700 were qualified to analyze the questionnaires). Research results presented in tables I-VII:

Table I Conditions which guided the company improving its management system (results of study conducted in 2008, a general and comparison between the segments, depending on the sector, in responses rate)

Conditions which guided the company improving its management system	General N=700	Sector	
		Production N=377	Services N=333
Improving the of employees' competences	76.43	74.80	78,33
Improving relationship with customers	72.86	71.09	74,92
Achieving of established measurable goals	66.29	68.17	64,09
Development of technical infrastructure	63.14	68.70	56,66
Improving internal communication	63.00	63.33	62,23
Improving relationships with suppliers	60.71	64.72	56,04

Reducing operational costs	59.86	63.93	55,11
Improving of managerial competences	58.29	58.62	57,89
Increase engagement of employees	56.71	56.23	57,28
Recommendations of certification bodies	55.29	61.54	47,99
Reducing the negative impact on environmental	48.57	55.44	40,56
Improving safety and working conditions	45.00	49.07	40,25
The implementation of organizational innovations	44.57	44.83	44,27
Competition activities	43.14	44.03	42,11
The implementation of product innovations	42.29	48.81	34,67
Reducing the risks of the products	39.00	46.15	30,65

Source: own research

Table II Conditions which guided the company improving its management system (results of study conducted in 2008, a general and comparison between the segments, depending on the extent of the market, responses rate)

Conditions which guided the company improving its management system	General N=700	Extent of the market	
		International market N=467	Home market N=233
Improving the of employees' competences	76.43	77.30	75,61
Improving relationship with customers	72.86	73.45	74,86
Achieving of established measurable goals	66.29	68.52	63,98
Development of technical infrastructure	63.14	65.52	61,91
Improving internal communication	63.00	62.96	63,09
Improving relationships with suppliers	60.71	63.60	60,04
Reducing operational costs	59.86	63.38	56,47
Improving of managerial competences	58.29	61.67	55,91
Increase engagement of employees	56.71	58.89	55,16
Recommendations of certification bodies	55.29	58.46	48,93
Reducing the negative impact on environmental	48.57	52.89	46,53
Improving safety and working conditions	45.00	45.82	43,15
The implementation of organizational innovations	44.57	47.54	42,59
Competition activities	43.14	43.25	42,92
The implementation of product innovations	42.29	45.61	40,90
Reducing the risks of the products	39.00	44.11	37,15

Source: author's research.

Table III Conditions which guided the company improving its management system (results of study conducted in 2008, a general and comparison between the segments, depending on the number of employees, in responses rate)

Conditions which guided the company improving its management system	General N=700	Number of employees		
		up to 50	51-250	above 250

		N=229	N=252	N=219
Improving the of employees' competences	76.43	62.45	72.22	74,43
Improving relationship with customers	72.86	73.36	73.02	72,60
Achieving of established measurable goals	66.29	66.81	79.76	83,11
Development of technical infrastructure	63.14	56.33	67.06	65,75
Improving internal communication	63.00	66.38	61.11	61,64
Improving relationships with suppliers	60.71	58.52	60.71	63,01
Reducing operational costs	59.86	45.85	63.49	70,78
Improving of managerial competences	58.29	43.67	63.49	67,12
Increase engagement of employees	56.71	51.53	58.33	60,27
Recommendations of certification bodies	55.29	43.67	59.92	53,29
Reducing the negative impact on environmental	48.57	34.06	48.81	63,47
Improving safety and working conditions	45.00	36.68	46.03	52,51
The implementation of organizational innovations	44.57	33.19	46.03	54,79
Competition activities	43.14	45.41	42.46	39,48
The implementation of product innovations	42.29	36.68	45.63	43,84
Reducing the risks of the products	39.00	33.19	42.86	40,64

Source: author's research.

Table IV Conditions which guided the company improving its management system (results of study conducted in 2008, a general and comparison between the segments, depending on the origin of capital, responses rate)

Conditions which guided the company improving its management system	General N=700	Capital	
		Foreign N=167	Domestic N=533
Improving the of employees' competences	76.43	79.04	75,61
Improving relationship with customers	72.86	66.47	74,86
Achieving of established measurable goals	66.29	73.65	63,98
Development of technical infrastructure	63.14	67.07	61,91
Improving internal communication	63.00	64.23	59,28
Improving relationships with suppliers	60.71	62.87	60,04
Reducing operational costs	59.86	70.66	56,47
Improving of managerial competences	58.29	65.87	55,91
Increase engagement of employees	56.71	61.68	55,16
Recommendations of certification bodies	55.29	53.29	55,91
Reducing the negative impact on environmental	48.57	55.09	46,53
Improving safety and working conditions	45.00	50.90	43,15
The implementation of organizational innovations	44.57	50.90	42,59
Competition activities	43.14	41.92	43,53
The implementation of product innovations	42.29	46.71	40,90
Reducing the risks of the products	39.00	44.91	37,15

Source: author's research.

Table V Conditions which guided the company improving its management system (results of study conducted in 2008, a general and comparison between the segments, depending on the target market of products, responses rate)

Conditions which guided the company improving its management system	General N=700	Target market of products	
		B2B N=457	B2C N=243
Improving the of employees' competences	76.43	78.12	73,25
Improving relationship with customers	72.86	75.05	68,72
Achieving of established measurable goals	66.29	68.93	61,32
Development of technical infrastructure	63.14	68.93	52,26
Improving internal communication	63.00	63.46	62,14
Improving relationships with suppliers	60.71	63.24	55,97
Reducing operational costs	59.86	60.18	59,26
Improving of managerial competences	58.29	59.52	55,97
Increase engagement of employees	56.71	57.99	54,32
Recommendations of certification bodies	55.29	63.89	39,09
Reducing the negative impact on environmental	48.57	50.11	45,68
Improving safety and working conditions	45.00	47.48	40,33
The implementation of organizational innovations	44.57	46.17	41,56
Competition activities	43.14	44.42	40,74
The implementation of product innovations	42.29	42.89	41,15
Reducing the risks of the products	39.00	39.17	38,68

Source: author's research.

Table VI Conditions which guided the company improving its management system (results of study conducted in 2008, a general and comparison between the segments, depending on the possession of a certificate, responses rate)

Conditions which guided the company improving its management system	Companies with certificate			Companies without certificate ISO 9001 N=171
	ISO 9001 N=529	ISO 14001 N=253	PN-N/ OHSAS 18001 N=145	
Improving the of employees' competences	78.64	85.77	86.21	69.59
Improving relationship with customers	74.67	74.70	75.86	67.25
Achieving of established measurable goals	71.27	77.87	79.31	50.88
Development of technical infrastructure	68.24	77.08	77.93	47.37
Improving internal communication	62.76	58.49	55.95	63.74
Improving relationships with suppliers	65.03	69.96	75.86	47.37
Reducing operational costs	65.03	66.80	70.34	53.22
Improving of managerial competences	60.87	69.17	69.66	50.29
Increase engagement of employees	59.55	65.22	68.28	47.95
Recommendations of certification bodies	68.08	73.12	73.79	15.79
Reducing the negative impact on environmental	55.01	74.70	75.17	28.65
Improving safety and working conditions	49.34	60.47	67.59	31.58
The implementation of organizational innovations	46.31	52.57	54.48	39.18
Competition activities	43.29	41.11	36.55	42.69
The implementation of product innovations	43.48	47.43	53.79	38.60
Reducing the risks of the products	41.97	41.90	46.90	29.82

Source: author's research.

Table VII Conditions which guided the company improving its management system (results of study conducted in 2008, a general and comparison between the segments, depending on the operational management tool, responses rate)

Conditions which guided the company improving its management system	General N=700	Companies using the operational management tools			
		Kaizen N=69	5S/TP M N=98	Lean Management N=112	Six Sigma N=55
Improving the of employees' competences	76.43	81.16	87.76	84,82	85,45
Improving relationship with customers	72.86	72.46	70.41	75,89	70,91
Achieving of established measurable goals	66.29	79.71	80.61	83,04	83,64
Development of technical infrastructure	63.14	73.91	77.55	74,11	63,64
Improving internal communication	63.00	78.26	74.49	76,79	72,73
Improving relationships with suppliers	60.71	68.12	73.47	68,75	72,73
Reducing operational costs	59.86	81.16	77.55	80,36	74,55
Improving of managerial competences	58.29	73.91	77.55	69,64	69,09
Increase engagement of employees	56.71	73.91	70.41	70,54	72,73
Reducing the negative impact on environmental	48.57	62.32	68.37	63,39	69,09
Improving safety and working conditions	45.00	44.93	57.14	53,57	61,82
The implementation of organizational innovations	44.57	59.42	59.18	57,14	58,18
Competition activities	43.14	40.58	41.84	44,64	40,00
The implementation of product innovations	42.29	50.72	53.06	53,57	52,73
Reducing the risks of the products	39.00	36.23	44.90	51,79	45,45

Source: author's research.

The results of the study allow to conclude that the economic units operating in our country improving its quality management system, the overwhelming focus on: improving staff competencies, improving customer relationships, achieving of established measurable goals, the development of technical infrastructure, improving internal communications. Frequently indicated conditions should also include: improving the competence of managers, improving relationships with suppliers, reduce operational costs, increase employee involvement in solving problems, the recommendations of auditors of certification bodies, the introduction of product innovations, improve environmental performance, reducing risks and introduction of organizational innovation. Those conditions are determined efforts on the improvement of the organization especially in enterprises, which in addition to the implementation of ISO 9001 certification also surrendered for compliance with ISO standards 14001 and PN-N/OHSAS 18 001 They are also frequently seen in the case of manufacturers, companies with foreign capital

(especially multinationals), large and medium-sized entities as well as in the case of entities that are suppliers in the B2B market. This does not mean that the home operators, particularly small firms (employing up to 50 people) do not make efforts in this area.

Conclusions

Constantly increasing globalization of the economy makes it along with foreign investments. This often reveals a strong horizontal (mergers and acquisitions) and vertical (integration of the business partners in the downstream supply chain) concentration and the search for new local partners, followed by the gradual spread of the operational improvement tools. There has been a transfer of knowledge, continuous and inevitable, which has largely improved relations between enterprises. (de Leeuw, Fransoo, 2009) Perceived barriers in this area are possibly staff resistance (and in many cases also for executives) before progressive changes in management systems and the need to raise ever larger funds, which allow companies to create and innovate their product (the need to invest in research and development and purchase of necessary infrastructure, manufacturing), and organizational. Results of this study indicate that these entities, which in addition to the introduction of quality management system conforming to the requirements of the system 9001 to implement environmental management, health and safety tools such as elements of the Toyota Production System, Six Sigma, Lean Management is more often determined by incurring efforts to improve organizations, seeing in this specific benefits (Gupta, Boyd, 2010). These observations lead to the conclusion that the organizations undertaking the challenges of training are specifically focused on building intellectual capital through the development of human capital and process. The result of these efforts is the continuous reduction of the hazards in the logistics chain, thereby improving efficiency of operations and contributes to building trust between the companies, which often results in a synergy effect in the improvement of management systems of cooperating business partners. (Milliman, Ferguson, Grosskopf, Sylvester, 2009) Constantly increasing globalization through the expansion of multinational companies expanding their production and commercial activity on the increasing number of new markets should lead to a higher level of interest in the environmental and safety management systems from their local suppliers. This does not mean that these suppliers must demonstrate possession of the certificate system. They should focus more on the effective implementation of customer requirements relating to the requirements of normative standards of governance, often extending their scope or paying more attention to certain areas (such as control and monitoring of processes and products), providing evidence of quality assurance. Corporate customers expect suppliers to increase organizational efficiency, which is characterized by its flexibility in meeting the expectations of buyers and continuously increases, the efficiency of operations. Therefore, one could notice an increasing the level of interest of companies to improve the processes by introducing the of Six Sigma methodologies and Lean Management projects. (Aboelmaged, 2010) One can observe that the multinational companies by promoting the implementation of the concept of corporate social responsibility and the idea of achieving sustained success of the organization, bring a strong qualification of local suppliers to take note of their actions in this regard. They also require the use of ethical codes (code of conduct), strongly emphasizing the fulfillment of the obligations laid down in legislation and in the supply chain partners (especially honesty in business dealings and non-use practices), reduce the risks associated with products, protecting the environment, ensure information security, as well as providing safety and stable working conditions, and respect for human rights).

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Market orientation and the university – A review and research agenda

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An ‘epistemological perspective’ inspired introduction

Whereas recently a stream of research has been focusing on theoretical, empirical and multidisciplinary issues of marketing in higher education, very little attention has been given to understanding how the marketing philosophy has been translated into the higher education environment. With specific reference to the concept of market orientation, that is the implementation of the marketing concept (Kohli and Jaworski, 1990; Ruekert, 1992; Lafferty and Hult, 2001), the dimension of the meaning of market orientation in higher education remains unlinked to a research focus that is dominantly narrow and descriptive on “applications of marketing instruments, emphasizing a *reactive* and managerial orientation” (Henneberg, 2008; emphasis added).

Henneberg (2008) takes an epistemological perspective on research in political marketing. In the discussion on the core of a political marketing theory, he identifies two approaches to the issue: a narrow one and a wider one. The narrow approach focuses on understanding marketing activities in politics, whereas the wider approach is concerned with a more holistic attempt of achieving knowledge of politics. Inspired by Henneberg’s argument of using epistemology as a tool in political marketing research, I adopt here his viewpoint that in higher education, consistently, “marketing theory makes specific assumptions about the “fabric of reality” (ontology) and how knowledge claims can be made about this reality (epistemology)” (*ibid*, p. 153). Therefore, there seems to be no clear understanding of the ontological and epistemological implications of a market orientation perspective on higher education.

Comparative higher education research offers a disembodied view of the market; markets are conceptualized separately from the state, as being shaped by an “invisible” hand or by the rational choices of individuals in the “marketplace” (Marginson, 2002, p. 297; compare also Teichler, 2003, p. 182). What is missing is an epistemological approach to the concept market orientation in higher education, serving “as a research lens [...] for making sense” (Henneberg, 2008, p. 153) of service marketing in a higher education environment. What is needed is an investigation into the concept of market orientation in higher education with relation to the meaning and meaningfulness of the concept set in the globalizing context of higher education; both internally at the institutional level, and externally in terms of regional, national and global competitiveness. There is a lack of research into the meaning of market orientation from an intersectional perspective on marketing services in the higher education sector. In this article, I argue that market orientation in higher education can be understood as a multiple-layered construct of meaning and meaningfulness, values and belief dimensions of market-oriented culture, behaviour, managerial and value creation service processes.

I build my argument on an integrative review of recent literature and develop a conceptual structure allowing an intersectional approach to the meaning and meaningfulness of market orientation in higher education. The purpose of the integrative review is to 1) critically review the current literature addressing the issue of market-oriented culture, behaviour and process management in higher education, 2) frame the wider picture of market orientation beyond a sheer managerial interpretation, 3) embody the meaning of market orientation in higher education, and finally, 4) to identify the gaps in current research and propose an agenda for further research in the field.

Methodological approach

This paper is the result of the work by “a reflective practitioner in higher education” – classified in accordance with Teichler’s typology of higher education experts (Teichler, 2005, p. 460-461). The objective of the paper is therefore to produce structural thinking, new knowledge and understanding drawing upon theme-based research at the interplay of “a wealth of disciplines” (Teichler, 2005, p. 465). It is not the objective of the paper to propose a revised definition of the concept of market orientation applied to the higher education context.

My integrative review builds on the richness of powerful theoretical and empirical themes discussed in the literature by developing a conceptual structure for reflecting on the epistemological meaning of market orientation in higher education, with a particular focus on the university environment. The wider purpose of the review is to open up to the reader the issue of a market-oriented university operating in an increasingly globalizing higher education landscape. The review, including the proposal for research agenda, is to be integrated into the framework of my research on value creating processes at the university-industry interface in an international higher education context. It will thus be given the crucial role of ‘gluing together’ the analytical approaches and dimensions of my work into an integral piece of research.

I first identified relevant sources using key words in various search engines and electronic databases. As a result of the extensive search I selected eighteen relevant and recently (since 2000) published articles from the identified international research literature. These articles I have analysed using qualitative document analysis, which in this case is a most appropriate research method to support to process of interpretive analysis, sense-making and identifying “core consistencies and meanings” (Patton, 2002, p. 453), and to define the key themes and relationships emerging from the research. In this process, I have adapted the conventional analysis strategy described by Hsieh and Shannon (2005) to analyze the selected documents. I then have conducted an exploratory inquiry into the meaning of market orientation in the higher education context. Four broad themes were identified that accounted for factors of relevance to the concept of market orientation – that is the implementation of the marketing concept in higher education: marketing for higher education, (relationship-based) service marketing, market orientation, entrepreneurship. It is important to point out that throughout the search the focus was consequently kept on service marketing as it was the objective to exclude from the search results all labour market policy related research into higher education.

The drive towards the market

The market orientation approach

The marketing concept is considered essentially a *business philosophy*. The successful implementation of an organization's business philosophy is reflected in the overall market orientation of the organization, in that all internal and external activities and behaviours of that organization are highly market-oriented. Market orientation is thus considered a primary *business approach* that focuses on identifying and meeting the needs of the market, i.e. the customers (Kohli and Jaworski, 1990; Narver and Slater, 1990; Rueckert, 1992; Day, 1994).

Yet recently, a related stream of research has focused on the concept of market orientation within the public sector context, including the higher education sector (Lindsay and Rodgers, 1998). Not least because empirical research evidence from the business sector has repeatedly indicated a positive impact of market orientation on business performance, the marketing and market orientation concepts have started to appeal to researchers and managers in higher education. Many researchers have attempted to unpack the forces that drive higher education towards the market (Buchbinder, 1993; cf. Bugandwa Mungu Akonkwa, 2009). Along with the latest developments in higher education the role of the university system in society has changed; greater autonomy for universities has brought along new pressures on European universities to increase market responsiveness, improve efficiency and enhance competitiveness both nationally and internationally (Mora, 2001). These pressures tend to reinforce universities in their belief that the logic of market forces is becoming an integral part of the academic environment (Häyriinen-Alestalo and Peltola, 2006), and that an increase of institutional responsiveness to social demands will require an increased market orientation on the part of universities (Mora, 2001).

Drawing on the viewpoints from business research that market orientation contains elements of market intelligence generation, dissemination and response (Kohli and Jaworski, 1990), customer and competitor orientation and inter-functional coordination (Narver and Slater, 1990), Hemsley-Brown and Oplatka (2010, p. 206) define market orientation in universities as “a set of beliefs that puts customers' interests first, but at the same time raises the higher education institution's awareness of the need to obtain information about competitors and establish cross-departmental activities to satisfy customers' needs, in order to gain a competitive edge in the turbulent, competitive environment” (see also Bugandwa Mungu Akonkwa, 2009). This definition emphasizes that seeking and using market information is obviously a reactive response of the university to meet expressed customer needs, and to improve customer satisfaction through enhanced customer services. In the higher education discourse, the university is positioned in a reactive mode of adapting and responding, not explicitly to the market or the economy, but rather vaguely to ideas and challenges (Mautner, 2005, p. 107). The market orientation literature in general, and specifically with relation to the measures of business market orientation, tends to take a reactive approach to collecting, disseminating, and responding to market information (Atuahene-Gima and Ko, 2001).

Because a too narrowly interpreting of market orientation – as focusing merely on responding to and adapting offerings to a changing market – is believed to leads to incomplete understanding of the relationship between a firm's market orientation and innovativeness, the concept of market orientation has recently been refined to imply two complementary approaches to market orientation, i.e. a market-driven or responsive approach to market orientation and a driving markets or proactive approach market orientation (Jaworski *et al.*, 2000; Narver *et al.*, 2004).

Whereas responsive market orientation is the form of market orientation focusing on satisfying expressed needs of current customers, proactive market orientation seek to create value for current and potential customers through learning about their latent needs. Research evidence shows that there is a strong relationship between proactive market orientation and innovation (Narver *et al.*, 2004). It is the notion of proactive market orientation that links the concept of market orientation in higher education to the concept of innovation and entrepreneurship orientation in higher education.

The entrepreneurship orientation approach

Here again, I contrast the meaning of entrepreneurship in higher education, for which widely stands the concept of the “entrepreneurial university” as it was introduced by Burton R. Clark in his work on ‘Creating Entrepreneurial Universities’ (Clark, 1998), against the prevailing wisdom from business studies on entrepreneurship orientation and the underlying elements. It is believed that proactiveness is – together with constructive risk taking and innovativeness (Bhuian *et al.*, 2005) – one of the three underlying dimensions of organizational predisposition to entrepreneurship orientation; organizational proactiveness promotes a proactive approach to organizational market intelligence related behaviour– market intelligence generation, dissemination and organization-wide responsiveness to market intelligence are, in turn, fundamental elements of market orientation (Kohli and Jaworski, 1990) –, and responsiveness to new market opportunities seeking activities as well as to acting upon them ahead of the competition (Matsuno *et al.*, 2002). In the context of entrepreneurship, proactiveness refers to a forward-looking perspective (Matsuno *et al.* 2002), to an explicit readiness to taking initiative “by anticipating and pursuing new opportunities and by participating in emerging markets” (Lumpkin and Dess, 1996, p. 146). Organizational performance will be optimized when market-oriented and entrepreneurial behaviours are aligned (Atuahene-Gima and Ko, 2001).

While in the discourse in higher education the use of entrepreneurship related keywords such as entrepreneur, entrepreneurial, enterprise, and enterprising is identified as “ambiguous in denotation and rich in connotation” (Mautner, 2005, p. 95), Clark formulates his viewpoint on the meaning of entrepreneurship and innovativeness in the higher education context as follows: “Throughout much of [...] the research, the two terms ‘entrepreneurial’ and ‘innovative’ were used as loosely synonymous. The concept of ‘innovative university’ has much appeal. Gentler in overtone, it also casts a wider net. It avoids the negative connotations that many academics attach to individual entrepreneurs as aggressive business-oriented people seeking to maximize profit. [...] I have chosen ‘entrepreneurial’ over ‘innovative’ as the organizing conception for this book because it points more powerfully to deliberate local effort, to actions that lead to change in organizational posture” (Clark, 1998, p. 4). Mautner (2005) suggests that the various meanings of the concept of academic entrepreneurship may be roughly grouped into three layers; for the university these would be to be engaged in for-profit activity, to restructure management as to facilitate market-driven behaviour, and to promote organisational culture supporting values such as efficiency, dynamism, and innovation. Etzkowitz (2000) sees that the entrepreneurial paradigm in higher education must not be narrowed down to innovation driven or research intensive universities, but can be applied to research as well as teaching universities, e.g. through innovations in undergraduate education and continuing education. However, research on the relationship between university entrepreneurship and university market responsiveness has much focused on entrepreneurial activities in and adaptation to external markets (Marginson and

Rhoades, 2002). Davies (2001) distinguishes between adaptive and entrepreneurial responsiveness; whereas the former is simply about being “competent at recognising external opportunities and threats, and devising policies and activities to meet these”, the latter is about the ability “to generate surpluses which might be used to invest in further development” (*ibid*, p. 28-29).

The systemic view

Drawing on the different theoretical approaches to market orientation (Shapiro, 1988, Narver and Slater, 1990; Jaworski and Kohli, 1990; Rueckert, 1992; Dephandedé *et al.*, 1993; Day, 1994; for an extensive review of the contributions on the implementation of market orientation, see van Raaij and Stoelhorst, 2008), and building upon the viewpoint presented by van Raaij and Stoelhorst that business processes are crucial to being market oriented as “it is in these business processes that customer value is actually created” (*ibid*, p. 1282), and referring to Henneberg’s approach to framing the wider systemic perspective beyond an “oversimplistic managerial interpretation” (Henneberg, 2008, p. 157); three crucial elements of market orientation – intelligence generation and dissemination, customer versus competitor orientation, and service marketing – are adapted and transposed from the business context into the higher education context. Table 1 presents the paradigms (ontological perspective) and claims of knowledge (epistemological perspective) on which the concept of market orientation – that is here the implementation of the marketing concept in the context of higher education – is based and which shape the implicational meanings of market orientation in a higher education environment.

Ontological approach	Epistemological approach	Implicational meaning
Intelligence generation and dissemination	Information and product exchange processes; Market learning processes	Academic capitalism, commercialization of knowledge; Innovation- and entrepreneurship-driven stakeholder orientation
Customer versus competitor orientation	Relationship between institutional market-oriented operations and performance; Customer value creation processes; Differentiation	Massification through intensive internationalization and marketization; Global-market-driven student orientation
Service marketing	Service delivery interactions and value creation processes; Interrelationships of market-oriented management systems; Internal marketing processes	New public management and 'quasi-market' orientation; Service-driven student-customer orientation

Table 1: The ontological and epistemological approach to and the implicational meaning of marketing and market orientation

Although the literature presents a mixed picture about the meaningfulness of market orientation in the public versus corporate sector, there seems to be overall consensus that market intelligence is crucial to generating customer value (cf. Hult *et al.*, 2005). Awareness of competition and competitive intensity brings knowledge advantage over competitors and, consequently, the ability to respond to the competitive market; which in turn promotes customer-oriented product and services development activities (Narver and Slater, 1990). Customer value is created in successful internal (interfunctional) and external (relationship) service marketing. In the institutional context of higher education, market orientation is thus to be understood as the ability of a university to generate knowledge about markets and use this knowledge in its internal and external service marketing processes for the creation of superior customer value (cf. van Raaij, 2008).

There remains the fundamental question of who are the customers (cf. Bugandwa Mungu Akonkwa, 2009) to who higher education value propositions are to be communicated. Pavičić *et al.* (2009) approach the issue of (inadequate) market orientation in (Croatian) higher education from a stakeholder perspective. The authors argue that, because of the ambiguous use of the term market orientation in relation to the function of market orientation in higher education – a function which would imply “responsibility and focus of the whole organisation and its management of relations *with consumers/users and other relevant stakeholders, including forces shaping their behaviour*” (*ibid*, p. 192; emphasis added) – the meaning of market orientation might be better understood within a dimension of social orientation (compare with *societal orientation* in the non-profit context, Liao *et al.*, 2001) – which would then imply “[defining and serving] the needs, wishes and interests of [the institution’s] consumers/users, as well as to protect and enhance the welfare and long-term goals of society as a whole” (Pavičić *et al.*, p.

193). Consequently, whereas a proactive dimension is implied in the market orientation, a social/societal orientation of higher education would imply a merely reactive and responsive orientation.

The relationship between entrepreneurship, market orientation and performance

Empirical evidence from business research provides reason to believe that market intelligence activities and responsiveness are driven by and predicated on entrepreneurial orientation that encourages proactiveness, innovativeness, and risk taking (Matsuno *et al.*, 2002). It is, however, also suggested that entrepreneurship has a filtering effect on market orientation, as entrepreneurship seems to influence the way in which the organization views and directs its market intelligence processes (Bhuian *et al.*, 2005). Whereas Atuehene-Gima and Ko (2001) proposes a moderating relationship between market orientation and entrepreneurship, meaning that the latter is complementary to the former, linearly moderates the market orientation–performance relationship, and that to obtain optimum business performance both orientations related activities need to be highly market-oriented and highly entrepreneurial and aligned; Bhuain *et al.* (2005) argue that entrepreneurship is a organizational capability that has a modifying and curvilinear effect on the relationship between market orientation related intelligence processes and business performance. In other words, when the entrepreneurship orientation will increase beyond moderate levels, it will have a reduced effect on the market orientation–business performance relationship (*ibid*, p. 12).

In higher education research, the link between entrepreneurship (i.e. the entrepreneurial university's dynamic capability consisting of the three crucial elements innovativeness, proactiveness and risk taking; Bhuian *et al.*, 2005) and the market orientation–performance relationship is unexplored, undefined and unclear, or integrated into the dimensions of a larger dynamic network system. Mautner (2005, p. 96) argues that “entrepreneurship, both as activity and discourse, is one of those ‘imported’ practices [...] deployed by academic leaders and administrators as a carrier of key values that they want their external stakeholders to associate with the organisation, and their internal stakeholders both to believe in and implement”. This carrier of key values would then refer to the aforementioned values efficiency, dynamism, and innovation (*ibid*, p. 103). In their analysis on organisational antecedents of market orientation in the (Spanish) public university system, Flavián and Lozano (2006) do not include entrepreneurship associated values or measures. Etzkowitz (2000) views the role of university entrepreneurship within the triple helix of university-industry-government relations as a developmental pathway for continuous transformation – not towards the end state in the transition to market – but towards a mixed system of market forces and government incentives.

Barriers to and critique of market orientation

A number of business research studies focus on examining the influences of context on the development and implementation of a market orientation (Kohli and Jaworski, 1990; Harris, 2000; Harris and Ogbonna, 2000), and on the relationship between market orientation and business performance (Harris, 2001). One set of potential influences on the development of a market orientation is associated with environment conditions; these would be influences of market turbulence, competitive intensity, market growth, and customer behaviour (Harris, 2001). The other set is related to the organizational and managerial characteristics that might constitute

potential barriers to developing and implementing of market orientation. In the latter category, three groups of potentially hindering factors may be identified as organizational structure, strategy and systems related barriers and impediments (Harris, 2000).

In higher education research, investigations into the issue of market orientation in a university environment and the associated discourse is much fragmented and complicated, not least because of the interdisciplinary character of research in the field and therefore often unclear thematic reference (economical, sociological, educational, etc.) to higher education (Teichler, 2005). However, as a general observation emerging from academic discussion in both research streams (marketing and higher education), it might be suggested that two fundamentally different approaches to market orientation and potential barriers are offered: whereas marketing research seeks to identify and frame the complexity of hindering influences on market orientation development for purposes of making suggestions and recommendations on how to design market-oriented change and overcome barriers to market orientation, higher education research focuses on the critique related to importing of market orientation practices from the business environment into an academic environment. The discourse associated with market-oriented behaviour in higher education is basically shaped by a critical constructivist perspective and confronted with a number of dilemmas. Of these dilemmas, I wish to point to the most pertinent ones, as they are implicit in the following quotations.

The supra-national versus the national dimension:

[...] universities worldwide have certain elements in common as a consequence of the universal components of systematic knowledge and of a spread of European ideas of the university as a model for higher learning worldwide. But higher education is predominantly regulated at a national level [...]. Therefore, it is not surprising to note that most research on higher education is strongly shaped by its national setting and does not have a genuine supra-national approach. (Teichler, 2005, p. 447)

Differentiation versus imitation:

The rapidly spreading belief that higher education institutions to an increasing degree have to consider themselves as actors on a globalising higher education market reinforces the issue [of whether or not to promote diversity in higher education]. Will imitation behaviour prevail, or will a search for diverse options turn out to be viable? (Teichler, 2003)

The power of the academics” versus market forces:

While it is generally agreed that management techniques should be used more, there is also a general consensus that universities should not be governed like companies. [And further] In this case [of the entrepreneurial university], the university sees itself as a living being with an intelligence of its own, which is capable of continually re-adapting to its environment. The market is seen as a driving force from which universities gather information regarding opportunities and potential mutually-beneficial relationships. (Mora, 2001, pp. 103 and 107) [...] the distribution of knowledge appeared [...] to be extremely difficult in a university setting. This difficulty was based on the individualistic way of working common among academics. (Plewa et al., 2006)

Societal versus market orientation:

[...] a general societal pre-occupation with growth [...]; [and further] [...] the university is cast in a 'serving' role, meeting and responding to needs, rather than actively shaping them, and that the relationship with business is conceptualised as a partnership. [...] Instead, it is society that research is adapted to [...]. (Mautner, 2005, pp. 105 and 107)

Targeting the (student) customers or not:

[...] the references to taxpayers are too populists to legitimate this [decision-making] process [of profit use], and the role of the state as a financier and a customer is unclear. (Häyrynen-Alestalo and Peltola, p. 276)

As knowledge becomes a product, then the market logic dominates. If [student-] customers are willing to buy the products in sufficient numbers for the projected class size to make a profit, then the product is offered. If not, courses and programs simply disappear. (Stromquist, 2007, p. 101)

The traditional versus commercialization functions:

[...] the difficulties to integrate the two traditional university functions into the third one, i.e. commercialisation. It seems that the problem of balancing functions at the [three] universities should be solved before the programme of market-orientation will be extended. (Häyrynen-Alestalo and Peltola, 2006, p. 276)

Encompassing market orientation in a university environment

The university can be seen as an institution which emerges from the public sector. It is more and more pressured to operate according to the terms of the private sector. In fact the two sector model is "incomplete, inaccurate and misleading." The public sector is involved in supporting the private sector process of accumulation. Nevertheless, the popular mythology is otherwise. (Buchbinder, 1993, p. 338)

A framework for understanding the meaning of market orientation in higher education

Within the literature reviewed for the purposes of this study I have distinguished four different understandings of market orientation in the higher education context. In an attempt to unpack these understandings for implicit meanings, meaningfulness and underlying assumptions, I conceptualize the meaning (and meaningfulness) of market orientation in higher education as a framework constituting of four major layers (Table 2). It is clear that – within the wide range of diverse activities being organized across a multi-faculty university – these layers are partly overlapping. But they differ in their visibility and interpretability and allow for the analysis of interrelations among these layers (cf. Homburg and Pflesser, 2000). This, in turn, may contribute to a better holistic understanding of those forces that push academia, in general terms, towards a more explicit market orientation and, arguably, differentiate market-oriented strategy and behaviour in academia into four major sub-systems of constructed meaning and meaningfulness of market orientation.

Layer/ Delineation	Knowledge-based	Market-oriented	Relational-oriented	Entrepreneurial
Intra-functional orientation	Product/learning orientation	Customer/student orientation	Relational/customer orientation	Network/societal orientation
Assumptions	Research-driven educational programmes; Academic excellence and professionalism; Publication output; Isolated 'ivory tower' community	Academic capitalism; Commercialization and market competition; Market-driven service-oriented professional programmes; Quasi-market behaviour; New public management	University-industry linkages; Industry-driven interaction-intensive contract research and consulting; Skills transfer	University- industry-government linkages; Commercialization of knowledge production; Innovation and technology transfer; Spin-off activities
Drivers of competitiveness	R&D-driven output	Service-driven programme development	Value-driven relational collaboration	Innovation-driven network collaboration
Market approach	Reactive/responsive	Responsive	Responsive	Responsive/proactive

Table 2: Conceptual structure of the meaning of market orientation in higher education

The framework provides a conceptual structure as a tool for understanding the meaning and meaningfulness of market orientation in a university environment. It shows how market orientation can be understood in terms (and degrees) of reactive, responsive and proactive market approach, in terms of impact of and on the market; and mapped in a series of layers placed on a continuum defined by two polar approaches to the market: the reactive/responsive approach from within the academic environment – whereas reactive market approach is here to be understood as merely acting upon provoking market influences, responsive approach implies a notion of market awareness and taking responsible action – and the proactive approach from within a collaborative (relational or network) environment (cf. Jaworski *et al.*, 2000). It is thus proposed that the meaning and meaningfulness of market orientation in a university environment is related to a set of perceptions associated with 1) the intra-functional relationships between and interconnectedness of market-oriented activities within the complex collaborative environment of the university, 2) the epistemological assumptions in regard to being market-oriented and 3) the drivers of competition and behavioural change in pursuit of competitive advantage in the national and global market.

Dimensions of market orientation in higher education: a multiple-layer approach

In this section, I invite the reader to follow my reasoning for sense making of market orientation in the higher education context, ‘unpacking’ the dimensions of market orientation and structuring these by applying the proposed multiple-layer approach for understanding the meaning of market orientation in an academic environment. I do so in referring to the papers I have reviewed within the objectives of this study and bringing into the focus a selected set of key words and quotes disclosing the multiple-layered dimensions, assumptions and implications of knowledge-based, (student)-market-oriented, relational-oriented and society-network-oriented market orientation in the respective context of 1) a research-driven university, 2) a service-driven university, 3) a relationship-driven university, and 4) a society-network-driven university (Table 3).

The product-driven research university	The service-driven university	The relationship-driven university	The society-network-driven university
<i>[...] the management of processes of knowledge production of which human capital was the most valuable asset. The success or failure of individual actors is either determined on the basis of their quantitative performance measured in terms of ‘output’ (performance-related funding) or on the basis of the quality of suggestions (tenders)</i>	<i>Internationalization of program offerings and student recruitment have become today the new form of entrepreneurialism [...] The search for new student markets and attractive programs unleashes a need for more students, [...] and timely decisions based on constant scanning of the environment – both national and</i>	<i>The relationship marketing approach commences with a commitment to marketing orientation, which is a set of beliefs that puts customers’, i.e. students’, interests first, in order to gain a competitive edge in the highly competitive global environment. [...] This [relationship marketing] approach emphasises the importance of</i>	<i>[...] a glonacal [i.e. the complexity of global, national and local forces and influences interconnected and interacting with each other in an multi-layered context of global, national and local factors or agencies] perspective to the way universities respond to – among diverse others –market forces. [...] Entrepreneurial</i>

<p>[...] Competition is an important element of market or quasi-market structures. (Kehm and Lanzendorf, 2007)</p>	<p>international. Internationalization is [...] a search for student markets domestically and abroad rather than positioning the university's knowledge at the service of others in less advantaged parts of the world. (Stromquist, 2007)</p>	<p>developing a customer- (i.e. student-) driven organisational culture, and focuses on the quality of the service. [...] – money that can be used to enhance services, invest in facilities and support social inclusion. (Hemsley-Brown and Oplatka, 2006)</p>	<p>or capitalistic universities are not single enterprises, but are conglomerates, with some units devoting more energy to local or national activities and others more pursuing regional and global activities. (Marginson and Rhoades, 2002)</p>
<p>[...] universities are expected to become part of the innovation system where innovation stands for product making and the final goal is to contribute to the international competitiveness of the national economy. [...] an increasing governmental demand for all universities to change their roles from the servants of the welfare state to the builders of a neo-liberal state and to encourage market selection instead of the common good and equalization of opportunity. This kind of reorientation tends to create tensions between the traditional scientific aspirations and market-orientation. (Häyrinen-Alestalo and Peltola, 2006)</p>	<p>Academic capitalism (term introduced by Slaughter and Leslie, 1997) refers to both direct market activity which seeks for profit such as patents, licenses and spin-off firms, and of market-like behaviour which entails competition of external funding without the intention to make profit. [...] new public management characterized by trends towards – among diverse others – attempts to establish quasi-markets, a more competitive and market-like behaviour, the role of the client gains importance and universities start to think about service orientation. (Ylijoki, 2003, 2005)</p>	<p>Much of university-industry collaboration takes place in disciplines that have a natural affinity to the market. [...] Contributions to the social good, on which funding for public universities is based, are thus compromised when part of the investment in higher education pays off in private gain. [...] Such arguments, of course, ignore the considerable costs and risks incurred by industry in transforming the results of university research into marketable products and processes. [...] specifying what does and does not fall under the general category of academy-industry relation is complicated by continually emerging forms of interaction.</p>	<p>[...] two major trends can be identified that affect the future role of the entrepreneurial university: [...] ever greater dependence of the economy on knowledge production [...] [and] [...] the attempt to identify and guide future trends in knowledge production and their implications for society. There is a shift underway from the economics of the production function to the socio-economic processes of the contemporary innovation system — with universities part of a new knowledge infrastructure. [...] the three helices, serving to institutionalize and reproduce interface as well as stimulate organizational creativity and regional cohesiveness.</p>

What is certain is that [academic-industry relationships] have effected irreversible changes on academic institutions. What is equally certain is that new variations on [academic-industry relationships] will continue to change universities, [...] (Anderson, 2001)

A dual cognitive mode has emerged in academic science as researchers focus both on achieving fundamental advances in knowledge and inventions that can be patented and marketed. [...] emphasizing entrepreneurship, firm-formation and risk-taking. [...] the university as entrepreneur also develops capabilities to assist the creation of new organizations. [...] Active university, rather than merely formal innovation agents. (Etzkowitz et al., 2000)

Publication of research and production of graduates are held to be the most appropriate roles for an institution dedicated to the public good. (Etzkowitz et al. 2000)

[...] a university is also a place in which services are produced [...] (Mautner, 2005)

We can see, among other things, that the university is cast in a 'serving' role, meeting and responding to needs, rather than actively shaping them, and that the relationship with business is conceptualised as a partnership. (Mautner, 2005)

At least two major trends can be identified that affect the future role of the entrepreneurial university: one is the shift to ever greater dependence of the economy on knowledge production [and] the second, the attempt to identify and guide future trends in knowledge production and their implications for society. (Etzkowitz et al. 2000)

[...] superficial implementation of new managerial values did not yet bring the intended shift of [...] The meeting of student needs, and a student centred approach can be an institutional mission, as well as a Results showed a positive effect of an academic's engagement with industry on the [...] it was observed that the level of market orientation adopted by the university teaching staff is positively

<p>values; the notion of the learning and adaptive university as an organization that needs to be restructured in order to react flexibly and proactively to a dynamically changing environment, threats or opportunities in 'the market' or industry (Sporn, 2003)</p>	<p>government driven initiative imposed on universities through the introduction of a market. (Hemsley-Brown and Oplatka, 2010)</p>	<p>university's market orientation, which in turn positively influenced the industry partner's commitment to the relationship. (Plewa and Quester, 2006)</p>	<p>affected by the predisposition of the department to take account of the needs of society in terms of research, training and employment. We can therefore state that departmental prestige, achieved through the recognition of research and/or teaching activities, constitutes a stimulus for developing behaviours directed towards social needs and, therefore, is market-oriented. (Flavián and Lozano, 2006)</p>
<p>The current situation within academia is characterized by the co-existence of two value sets: market-oriented values [and] academic values [...]. [...] both traditional academic and market-oriented values and practices have long roots in academia, so that the recent change concerns a shift of the balance between them, not the appearance of something totally new. Achieving a balance between market orientation and academic orientation seems to be all the more acute. (Ylijoki, 2003, 2005)</p>	<p>Increasing competition for home-based and overseas students higher educational institutions now recognise that they need to market themselves in a climate of international competition. [...] the value, effectiveness and potential benefits of using marketing theories and concepts, which have been effective in the business world, are gradually now being applied by many universities: with a view to gaining a competitive edge, and gaining a larger share of the international market.</p>	<p>[...] to find out the needs of companies, not only in terms of human resources, but also of implementing innovations and mechanisms that will ensure [companies'] advancement. (Flavián and Lozano, 2006)</p>	<p>[...] indicating that nonprofit organisations can use different levels of market orientation toward each of their stakeholders [...] The performance of higher education institutions is, therefore, socially constructed by different stakeholders, perceiving the social role of [higher education] in varying (or even competing) ways. [...] adequate orientation toward users/clients in education presumes that the culture, structure, system and procedures are established in a</p>

	(Hemsley-Brown and Oplatka, 2006)		<i>manner which ensures the success of long-term stakeholder relations, [...], in order to ensure the long-term survival of the organisation</i> (Pavičić et al., 2009)
<p><i>Contradictorily, the notion of market-led curriculum development and initiatives is rejected, perhaps because this kind of action stands in stark contrast to fundamental beliefs about [higher education] as an arena in which the knowledge is produced for its own sake and for the sake of the society as a whole and any involvement of academics in direct marketing activities or in commercialising academic knowledge for external purposes such as the recruitment or retention of students is opposed.</i> (Hemsley-Brown and Oplatka, 2006)</p>	<p><i>[...] a framework that can assist universities in understanding what a market orientation means and how students would value their offerings. It is not wrong to view the student as the consumer or customer, but it is important to realize that universities must go all the way to understand what that means. [...] Marketization might therefore be the only way to bring about ideological changes and thereby bring about true differentiation between good universities and the rest. [...] that the service quality “delivered” by the university is dependent on students’ effort and abilities. To do this, universities screen and select students carefully, ensuring that students have the “resources” to co-create.</i> (Ng and Forbes, 2009)</p>	<p><i>When describing the concept of market orientation, respondents focused primarily on business skills and the supply of technological or knowledge outcomes to the industry. A more detailed discussion of perceived benefits and value creation, however, showed a strong focus on other factors, such as retention and human capital, as highly relevant components of value creation for industry [...]</i> (Plewa et al., 2006)</p>	<p><i>By putting emphasis on a good scientific basis as a source of new dynamism, the [Helsinki region] universities scrutinise the simple theories of actor networks and new modes of knowledge production.</i> (Häyrinen-Alestalo and Peltola, 2006)</p>
<p><i>The market is the complexity of</i></p>	<p><i>Experts and international bodies</i></p>		<p><i>[...] a general societal pre-occupation with</i></p>

influences of the external environment on the university and the meaning of market orientation in this context is incorporated as opposed to the values of academic orientation.
(Mora, 2001)

have supported the introduction of market influences as the best way of assigning resources in a mass education university system that is increasingly offering a wide range of services as well as life-long learning. [...] Marketisation of higher education is based on the belief that allowing market trends to affect the university system will provide an incentive for universities [...] in general, to improve the services the system offers society. [...] Managerialism is characterised by a greater influence of external agents, more attention to strategic management and other managerial techniques used in business, [...] [...] in user contributions to the cost of the services provided, diversification and competition for students, teaching staff and service contracts
(Mora, 2001)

growth [...] (Mautner, 2005)

[...] globalization, which brings a greater emphasis on market forces to the process of educational decision-making. As knowledge becomes a product,

[...] the UK, Netherlands, and France allocate on a competitive base funds whose aim is to stimulate the creation of professional

<p><i>then the market logic dominates.</i> (Stromquist, 2007)</p>	<p><i>programmes. Professionalization has a number of consequences, [...] it fosters the responsiveness dimension [...] institutions' viability will depend upon their ability to be effectively responsive to social and economic demands of their markets (enterprises, policy-makers, students...) [and] students are given more possibilities to choose between institutions competing within (almost) the same label.</i> (Bugandwa Mungu Akonkwa, 2009)</p>
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Table 3: A multiple-layered structure of key words and quotes from the reviewed research papers

Conclusions and research agenda

A growing body of research suggests that market orientation and performance are positively related in the diverse higher education settings of the university. It was my intention to make propositions on the complex meaning of market orientation in higher education and thus to contribute to a better understanding of the emerging issue of market orientation in higher education at large. The objectives of the paper were to critically review the current literature addressing the issue of market orientation in higher education, to document and analyze the nature and scope of empirical and theoretical research on market orientation in higher education, to identify the gaps in current research and make recommendations for further research in the field. The review primarily focused on what is the understanding of market orientation, its meaning and meaningfulness in higher education and university management. Particular attention is paid to the relationship between the ontological and epistemological dimensions of market orientation in higher education. A service marketing approach was adopted.

In the concluding section of this paper I propose to reflect on the emerging research agenda and suggest that research might contribute to the agenda by focusing on two main themes related to the meaningfulness and impact of market orientation in higher education set in a context of proactive university-environment interactions.

Market orientation in the university-industry relational space

Global forces towards a stronger market orientation for higher education institutions have stimulated research on the competitive aspects of the university-industry linkage. There is indeed a considerable amount of research on the dynamics in university-industry relationships with regard to the organizational, relational or network mechanisms supporting competitive R&D, innovation, knowledge production and technology transfer. However, the impact of the university-industry relationship on the ‘production’ of human capital, on student mobility and talent transfer in a globalizing market is left aside. This is surprising, given the growing bulk of literature on the relationship between university market orientation and competitiveness in the rapidly internationalizing student market. Consequently, this paper reflects the obvious lack of attention with regard to the concept of market orientation in research into university-industry relationships. Whilst the studies I have reviewed for this paper explore many aspects of market orientation in higher education and university management, the main focus remains on the national and international student market and associated issues of service development and student-customer satisfaction. In such a sense, research offers a fragmented and relatively narrow picture of the meaning of market orientation in higher education and higher education institutions.

Whilst much of the existing literature on the entrepreneurial university is rich on what universities need to do internally to prepare themselves for entrepreneurial endeavours, it is much more modest on the issue of creating successful partnerships with external agencies from a behavioural point of view. Yet it is clear that a university can only be entrepreneurial if it has good client relationships, and what factors lie behind effective partnerships is a topic worthy of considerable further study. (Davies, 2001)

Rather than viewing the university’s operational surroundings as a faceless environment, they might be considered as a network of inter-organizational relationships, and the university’s market-oriented strategy and activities are then to be translated to a relational level (Helfert *et al.*, 2002). The term *relational space* is used by Bradbury-Huang *et al.* (2010) and refers to “a rich context for aspirational trust and reflective learning across organizational boundaries” (*ibid*, p. 109). I propose to develop a viewpoint – beyond a student-customer focus – around the meaningfulness of market-oriented strategy and behaviour in the university-industry relational space; around the impact of market orientation on building sustainable competitive advantage in the global higher education marketplace; and – particularly – around the impact of market orientation on dimensions of validity of the emerging commercialized and rationalized concept of attracting and recruiting international students.

Academia: merely responsive and market driven or proactive and market driving, or both and to what degree?

It is believed that the current literature offers an unbalanced perspective on market orientation as merely maintaining the status quo of expressed customer needs and preferences and current market structure, and opposed to market orientation proactively shaping customer and market behaviour (Jaworski *et al.*, 2000).

We can see, among other things, that the university is cast in a ‘serving’ role, meeting and responding to needs, rather than actively shaping them, and that the relationship with business is conceptualised as a partnership. (Mautner, 2005)

As it is also believed that markets can be shaped when market needs are either manifest or latent, and that competition focuses on competitive serving of manifest needs (Jaworski *et al.*, 2000), we are then left with the question: if, consistently with the business literature, the current higher education literature proposes a distorted picture of academia – as academia merely responding to the market, and focusing mainly on competitive serving of manifest market and (student) customer needs – how does a more balanced picture look like? Can and do academia proactively shape their market environment, and if how and to what degree?

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“Reliability in early product development phases”

Using the DeCoDe+X approach for a data-based discussion of design decisions

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Key words: Reliability, Quality-oriented Product Development, Demand Compliant Design, Mean Time To Failure, Method Integration

Category: Research Paper

Purpose

Innovative product concepts and new technologies often lack experienced data especially in the early phases of the development process. Thus, requirements and design constraints resulting from reliability parameters must be considered from the very beginning, as they affect the design and functionality of the whole system. Due to the problem that reliability data is required but hardly available, given data must be used in a way that benefits as much knowledge on the system as possible. Approaches supporting the processing and interpretation of data within a defined system model are required. The research project KitVes is engaged with the development of a technical solution for energy harnessing using a kite mounted on a vessel. Within this project, such a system model is used, enabling the project partners to link findings of reliability methods with a holistic system description.

Approach

Aiming at the measurability of reliability parameters, methods for reliability estimation are necessary. Various methods in the field of reliability analysis exist, but do not include a holistic system description. They therefore do not support an interpretation of single parameters within system elements and linkages between them. Basing on these circumstances derives the idea to combine a holistic system model with a method of reliability analysis, which are the Demand Compliant Design (DeCoDe) (cf. Winzer et al., 2007) and the Weibull analysis. Application example is the research project KitVes with special focus on the lines that connect the kite with the kite steering unit on board of the vessel. According to DeCoDe, system elements (functions, processes, components) that interact with the lines are singled out and presented in a system model. Then, the reliability parameter Mean Time To Failure, abbreviated as MTTF, is determined for the lines. The gathered information is added as attribute to the reference element line in the DeCoDe model. Analyzing the dependencies of the reference element with

consideration of the attribute, leads to new approaches for system improvement, for example the specification of maintenance processes or the adjustment of components.

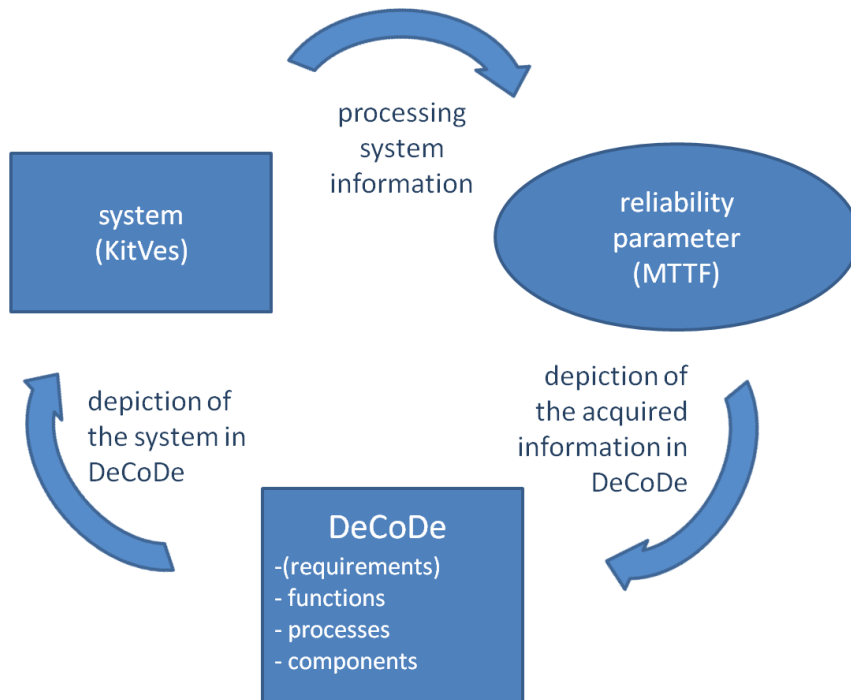


Figure 66: Concept of the DeCoDe+X approach for the MTTF

KitVes – A modern concept of harnessing high altitude winds

In the course of change in the energy industry towards renewable energies, the use of altitude winds becomes more and more reasonable. Related to the employment of on-board of vessels, the technology of pulling vessels using kites³⁰ has already become an interesting industry branch promising energy efficiency and cost effectiveness. But work on different technologies is in progress as well:

The Research Group "Product Safety and Quality Engineering" participates in the EU research project KitVes, contributing experiences in the field of risk assessment, system analysis and development support. KitVes is a research project financed by the Seventh Framework Program for Research and Technological Development³¹. The full project name is „Airfoil-based solution for Vessel on-board energy production destined to traction and auxiliary services“.

The KitVes system obtains energy from altitude winds in heights of 200-1000 meters by flying a kite sized 20 square meters (prototype), generating approx. 100kW of electric energy, which is used for auxiliary services.

³⁰cf. www.skysails.com, accessed 2011-05-17

³¹ cf. http://cordis.europa.eu/fp7/home_en.html, accessed 2011-01-10

Energy production is realized by using airfoils which move away from the vessel while flying the form of an eight. The lines connecting the kite with the on-board steering unit are pulled out and drive a generator in rotation. Consequently, wind power is converted to electrical energy.

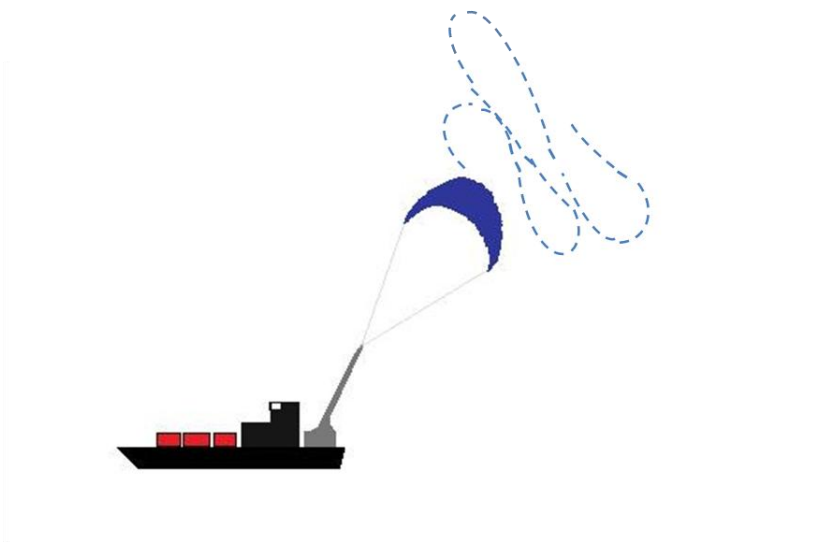


Figure 67: The KitVes system

Precise steering of the kite is being facilitated by sensors on the kite measuring speed and position constantly and transmitting the data wirelessly to the steering unit.

For an energy-efficient restart of the flight loop, one line of the kite is shortened when the kite reaches its maximum height. Then, by performing this so-called ‘side slip’ maneuver the kite changes its position and can be pulled back to its starting position with little air resistance. This way, the performance of a multitude of cycles, respectively, loops is possible.

The single lines are each rolled on one drum on board of the vessel once the kite has landed. Alongside of the drums are generators which are used as alternator converting kinetic energy into electric energy when flying the kite and unwinding the line. While landing or winding the kite, they are used as a motor pulling the kite back to the vessel and winding the line on the drum. Shifting the drums on a guide rail lets the line evenly wind on the drums.

In terms of reliability, the lines are one important component of the KitVes systems. The lines are made by Dyneema® and are much lighter than steel cable. As their failure would cause a complete system breakdown, their MTTF is determined. A methodological approach to combine methods for reliability engineering with a system model, is illustrated using the MTTF and DeCoDe. Hence, the DeCoDe model is presented first.

DeCoDe – A holistic system description approach

The Demand Compliant Design (abbreviated DeCoDe) is a system model to describe mechatronic systems aiming at requirement-oriented product development. Basic is the idea to characterize the system from different point of views, such as in terms of KitVes functions, processes and components. After recording these system elements and structuring them hierarchically, interdependencies between them are worked out and filled in matrices. These interdependencies can be illustrated graphically as well. Therefore DeCoDe can be used for a methodological support of the product development process, as information is gathered which enables the system engineer to analyze the system and to derive appropriate measures. The system model becomes more detailed during the process of product development as pieces of information are added successively. (Rosendahl, 2009)

In extension of this model, the DeCoDe+X approach was presented by *Riekhof* and *Schlund* on last year's QMOD (Riekhof, 2010). DeCoDe+X stands for the systematical combination of DeCoDe as a model for system description with further methods out of the field of quality management and product development. Thereby the information flow takes place bidirectionally. DeCoDe makes standardized input available for the other method, like supplying a FMEA with requirements, functions and components (Ott, 2007). Additionally, DeCoDe is suitable to adopt the output of other methods which induces a synergetic effect. The general procedure of combining DeCoDe with different methods is called Workflow of Methods.

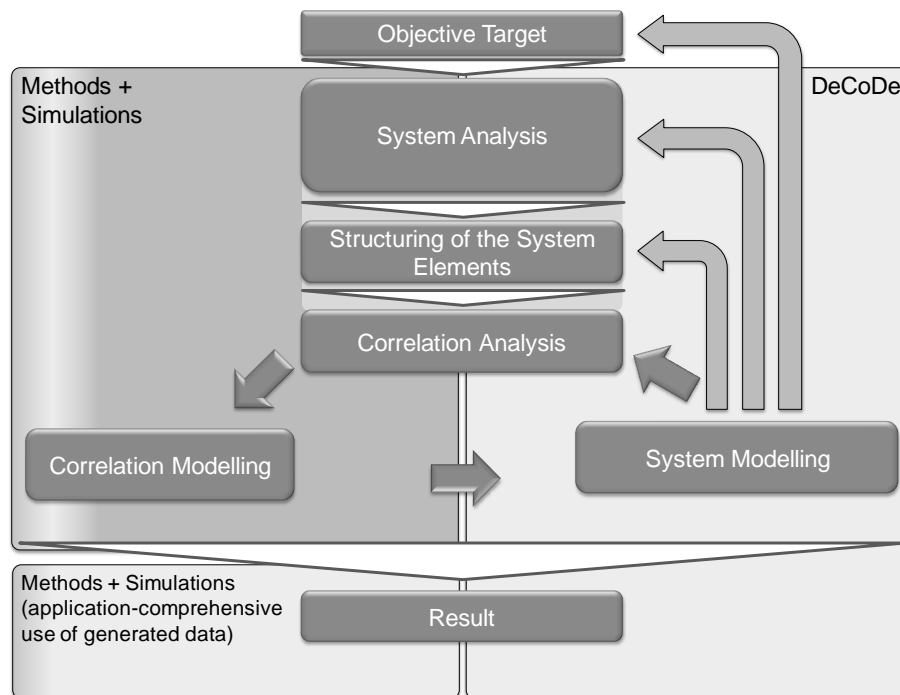


Figure 68: The Workflow of Methods (Riekhof, 2010)

Due to a problem-oriented objective target a system analysis is made using the system elements respectively the correlations and interdependencies of the DeCoDe matrices. Then, gathered information is used for correlation modeling and obtaining required input for the employment of the method. Gained output is transferred back to the system model of DeCoDe. This approach

shall result in an application-comprehensive usability of gained data by means of the revised system modeling in the DeCoDe matrices.

Creating a system model of KitVes elements in DeCoDe

According to the DeCoDe approach, dependencies between DeCoDe elements are set, if two elements influence each other or are dependent on each other. This means that if one of the linked elements is changed, the other one might have to be changed as well or at least influences have to be checked. As the lines of the KitVes system are crucial for the reliability of the whole system, in the following figure all elements are singled out, which directly affect the lines, either by being assembled with the lines, having direct influence on its reliability (blue squares) or by using respectively involving the lines in functions (green circles) or processes (grey hexagon). It is important to distinguish between direct and indirect dependencies. If a dependency is indirect, other components are interconnected. For example: The lines are doubtlessly necessary for fulfilling the process 'energy generation', which suggests a dependency. But this dependency is indirect, as the line participates in this process by transmitting energy to the drum, which transmits energy to the generator. Therefore other components are interconnected and the dependency cannot be direct.

Figure 69 gives an overview to all functions, processes and components directly related to component 'Line 1'.

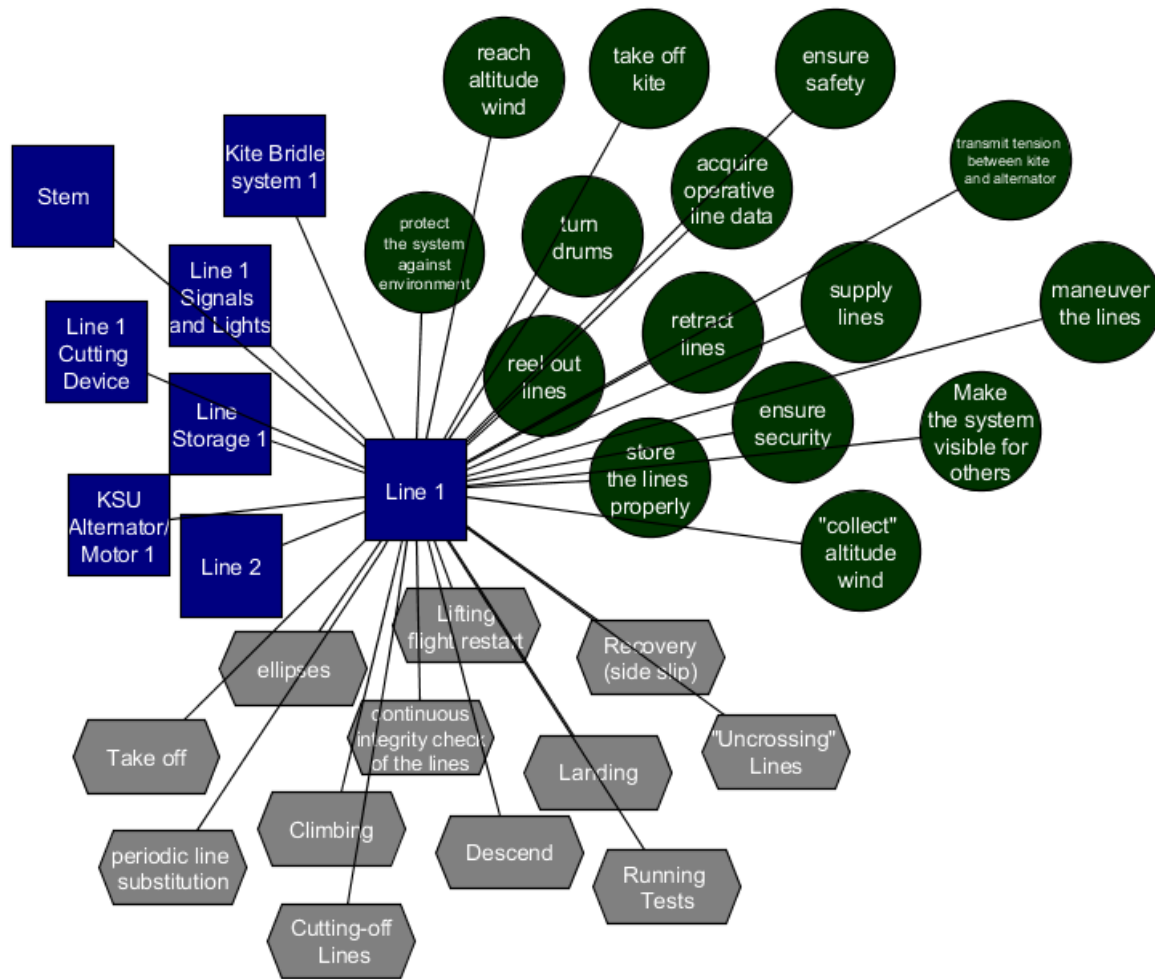


Figure 69: Functions, processes and components linked with the line

This figure is a model of KitVes elements on basis of the DeCoDe approach with focus on the component 'Line'. Using these direct dependencies as an input for the DeCoDe + MTF approach, all potentially negative effects on the lines were identified and an appropriate test bench was designed, simulating the most relevant parameters that could lead to a failure of the lines. Therefore, the first step of the concept depicted in Figure 5 is taken.

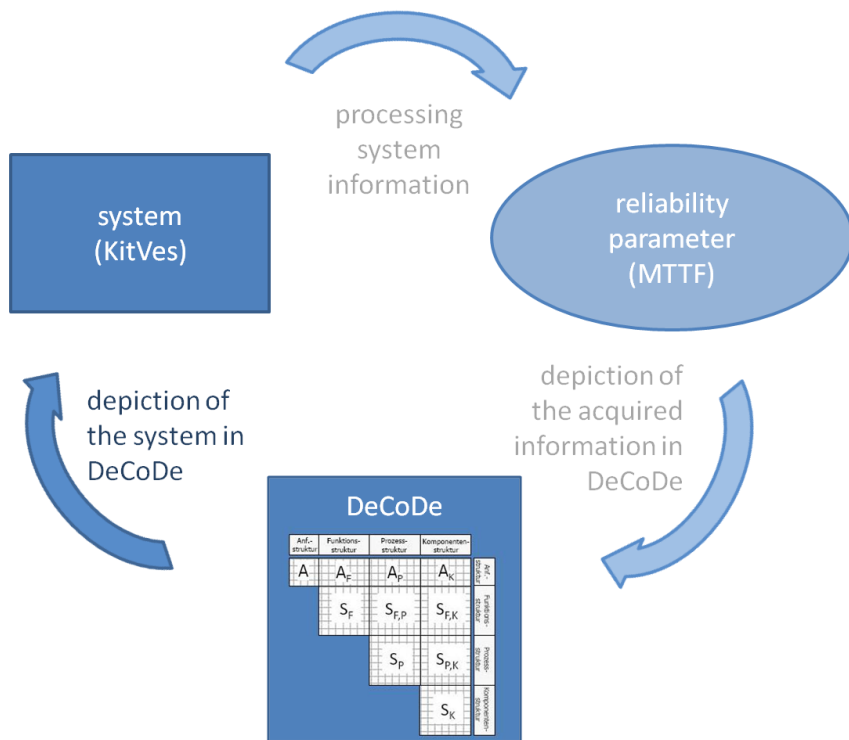


Figure 70: Depiction of the system in DeCoDe

Having depicted the KitVes system in DeCoDe the next step is the processing of required system information. As mentioned above, this means the design of test procedures for the lines. Laying the focus on the MTTF, which requires failures for its determination and on the ascertainment of measures that consider dependencies between system elements, the determination of the MTTF is described in the following.

Determination of the MTTF

Examinations of qualitative as well as quantitative methods led to the choice of a Weibull analysis, as the Weibull distribution is a distribution function suitable to represent various behaviors of system malfunctions. Generally, there are three types of failure performances: early failures, random failures and wear-out failures (cf. Figure 71). As the KitVes system applies lines of synthetic fiber in a way little experience and research exists about, the type of failure performance could not be determined in advance.

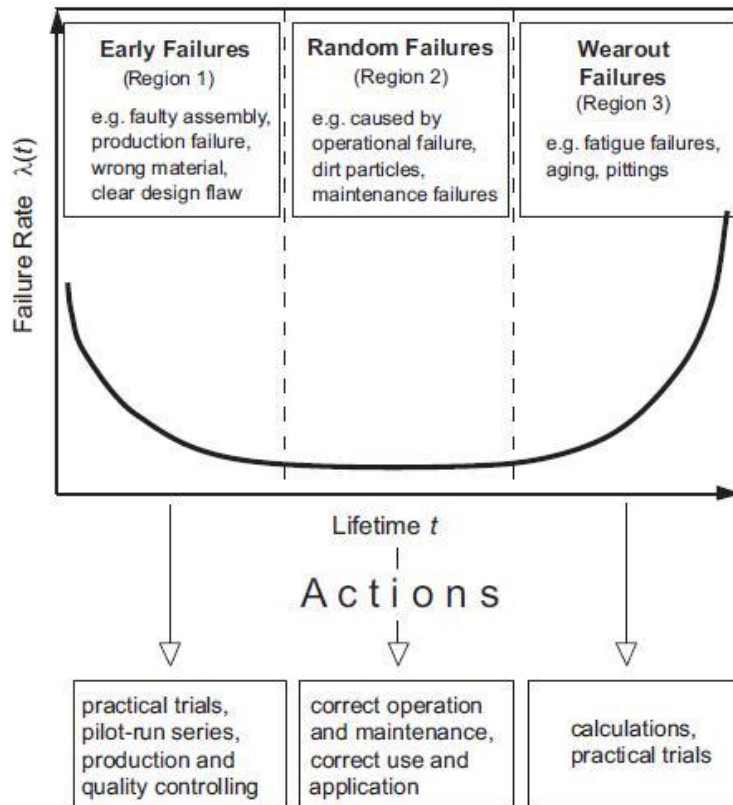


Figure 71: The "bathtub

curve" (cf. Bertsche, 2008 p. 24)

In order to simplify the tabulation of the failure probability in the Weibull probability plot, the accumulation of failures into classes may be useful. Classes contain a stochastic number of failures that occurred during a defined time interval. In terms of the Weibull probability plot, failures of a big sample size are usually subdivided into 5 to 20 classes. Each class has an index (i) and contains a certain number of failures ($\Delta n_{a,i}$) that occurred within this specific class j. The value for the operating life time is determined by the upper limit of each class. For example, if one class contains the operating life time in hours and reaches from 1,000 to 2,000 hours, the intersection point with the x-axis is 2,000. Depending on the band width of all classes, the logarithmical graduation of the scale can be used to display an operating life time that extends over several decimal powers. The intersection point with the y-axis can be calculated using the cumulative frequency (VDA, 1984):

$$(1)$$

In this case, n stands for the sample size while G_j stands for the summed up number of failures occurred until a certain point in time or respectively until class j , i.e. G_j is the sum of all failures $\Delta n_{a,i}$ that occurred until t .

As project data from KitVes is not available for non-disclosure reasons, the MTTF determination will be demonstrated on fictitious data. The following cumulative frequencies and a sample size of $n=60$ are taken as basis:

Table XXXII: Cumulative frequency of failures in class intervals

class interval [cycles]	cumulative frequency H_i [%]
(0, 10.000]	0
(10.000, 20.000]	6,67
(20.000, 30.000]	15,00
(30.000, 40.000]	41,67
(40.000, 50.000]	68,33
(50.000, 60.000]	91,67
(60.000, 70.000]	98,33
(70.000, 80.000]	100,00

The operating time is measured in cycles. One cycle represents the stress on the line of performing the process of winding and unwinding the line on the drum once.

As mentioned before the upper limit of the class interval determines the position of the values on the x-axis. With the cumulative frequencies, which determine the position on the y-axis, the failure data can be filled in the Weibull probability plot represented by blue dots. Then a line of best fit, the so-called Weibull straight, is drawn through these points. Mirroring this line through point "Pole 1" enables the user to read the shape parameter β off the scale on the right hand side. In this case β equals 3.6. Additionally, the characteristic lifespan T^* can be determined graphically using the Weibull probability plot. T^* is the value on the x-axis of the intersection point between the Weibull straight and the horizontal line marking the cumulative frequency of 63.2%.

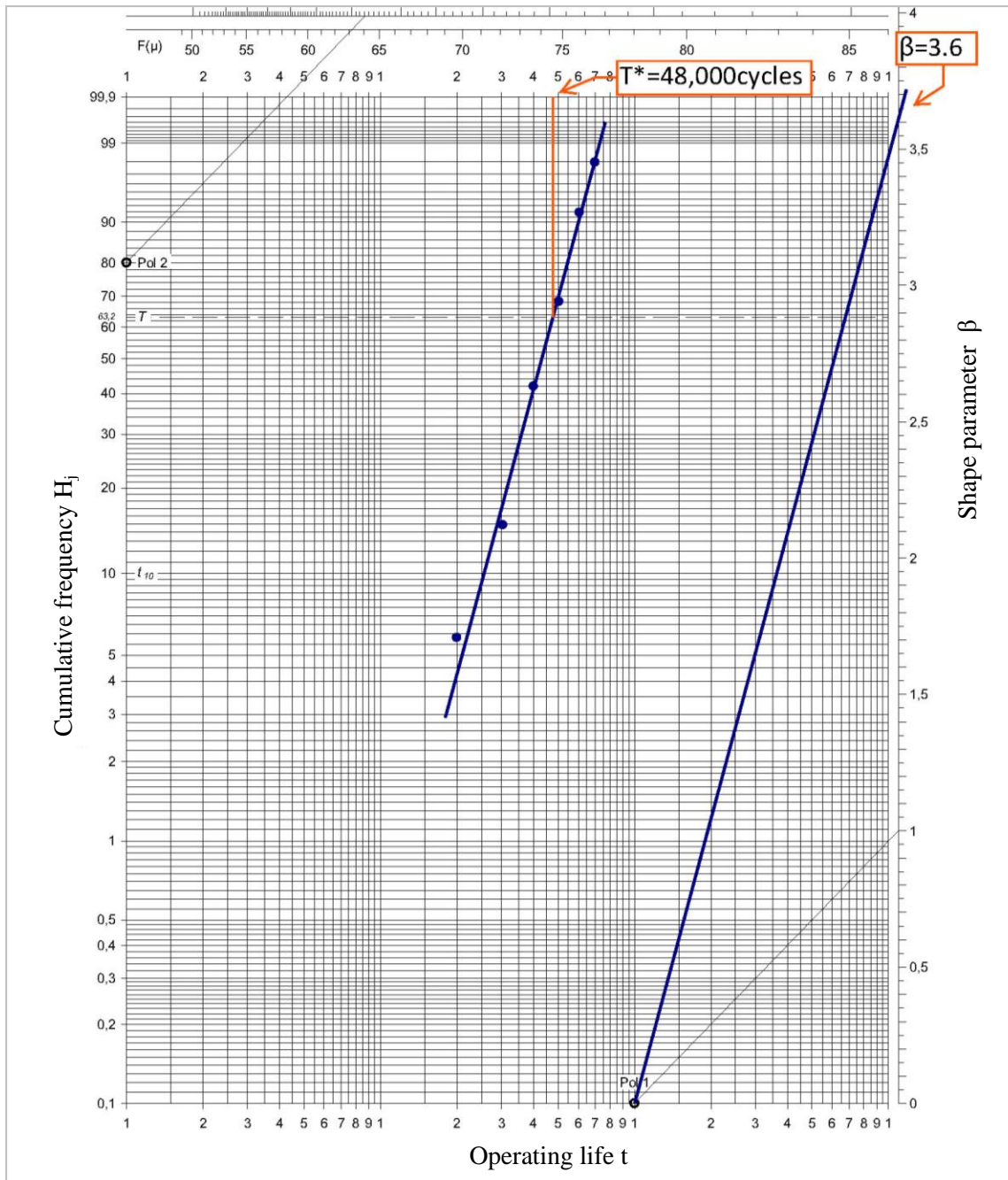


Figure 72: The Weibull probability plot (cf. DGQ, 1995)

On basis of the graphically determined parameters T^* and β , the position parameter α can be calculated.

$$\underline{\hspace{10em}} \quad (2)$$

With given values, α equals following equation.

$$\underline{\hspace{10em}} \quad (3)$$

Now, all necessary parameters are available to determine the MTTF on basis of equation (4).
 (4)

Values for the Gamma function Γ are tabulated. The value for _____ equals 0.90107^{32} .
 (5)

43,251

At this point system information in form of the reliability parameter MTTF has been generated. It now needs to be integrated in the DeCoDe model by attributing the lines.

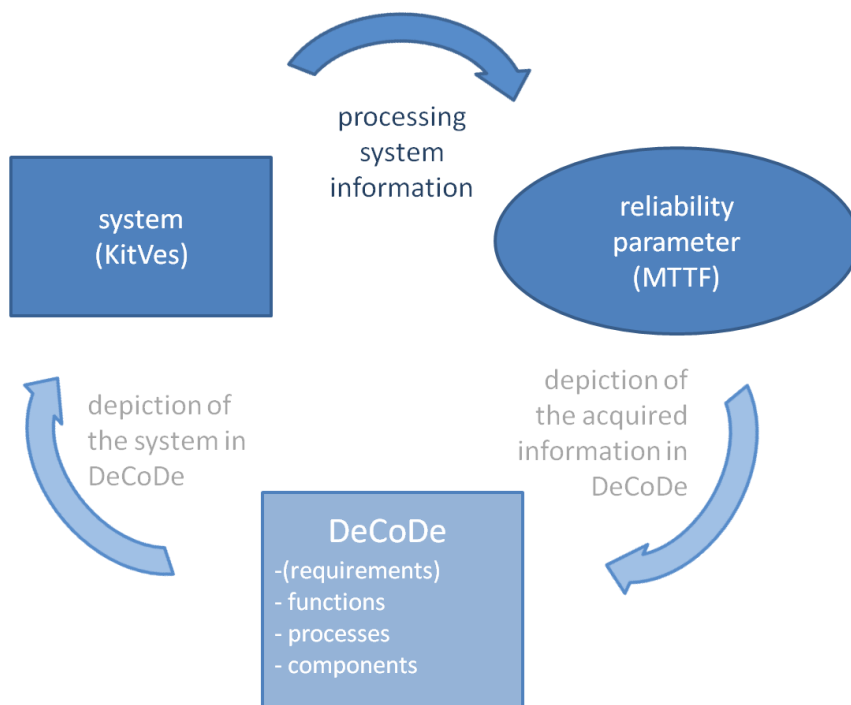


Figure 73: Processing system information

Integration of the MTTF in the DeCoDe Model

For achieving the best benefit from the gathered information, the MTTF is integrated in the DeCoDe model. As the line represents a component in terms of DeCoDe and the MTTF is a parameter, which describes that component, the information needs to be added to the symbol representing the line to display the context as close to reality as possible. Additional information

³² cf. <http://mars.wiwi.hu-berlin.de/mediawiki/statwiki/index.php/Gamma-Funktion>, accessed 2011-05-18

that describes a DeCoDe element, such as the reliability parameter MTTF does for the line, is integrated in the model as an attribute. Other attributes for the lines could be for example length, rope diameter, etc. The list of possible attributes is represented by a light blue ‘stack of paper’ in the background of the element they specify.

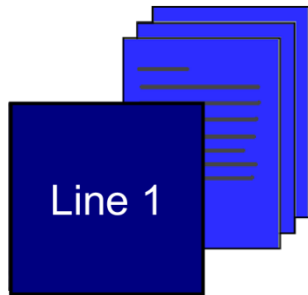


Figure 74: The symbol for attributes

Attributes potentially contain information, which is relevant for elements linked with their reference element. The importance of the determination of the MTTF is to gain reliability data in early phases of the product development process. It allows deriving measures for improving the reliability and safety of the KitVes system in consideration of possible impacts measures could have. This consideration of impacts and dependencies is supported by the DeCoDe-based system modeling. The combination displayed in

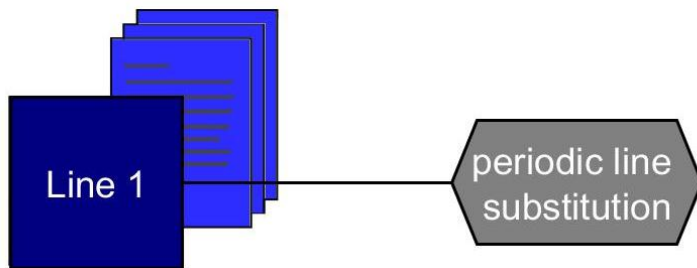


Figure 75 serves as an example.

‘Periodic line substitution’ is a maintenance measure to avoid a premature breaking of the line which would result in the loss of the kite, including all attached sensors. By determining the MTTF using the Weibull analysis, now data is available that allows a specification of the point in time (for a demanded conditional probability of survival) when the periodic line substitution has to take place. So, by attributing the lines with the MTTF and linking the process of periodic line substitution to it, this measure for reliability improvement can be quantified on an empirical data-base. This way, information about failure performance of the line is valuable for finding the ideal time interval for substituting the lines before they break.

If the lines are substituted way before they are worn out, this foils cost-efficiency. If the substitution interval is chosen too large, the loss of the kite is ventured.

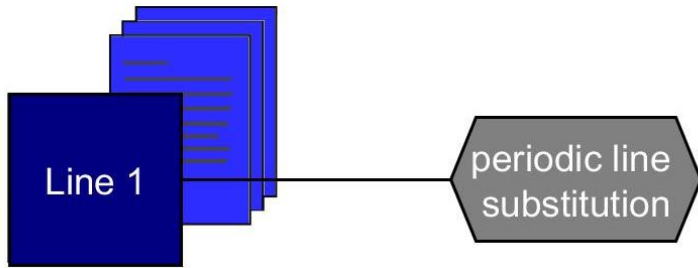


Figure 75: Attribute influencing related element

This is just one of many examples about how an attribute provides relevant information for elements, which are linked with the element the attribute describes.

Attribution is an appropriate method to integrate information into the DeCoDe model. Integrating the MTTF leads to a better understanding of the system behavior and its interdependencies in terms of reliability. Figure 76 sets this step into the concept elucidated before.

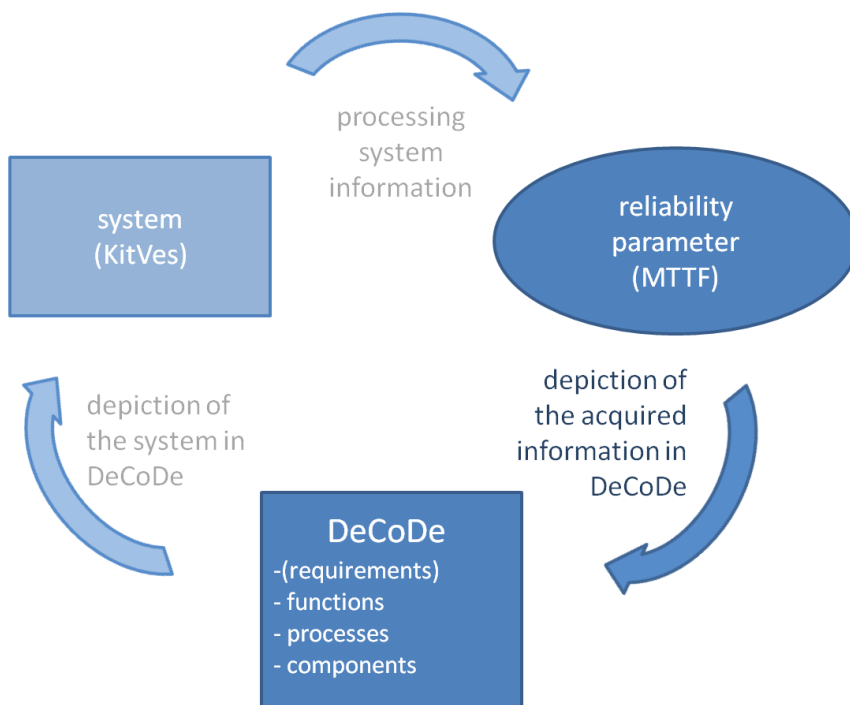


Figure 76: Depiction of the acquired information in DeCoDe

Possible Design Decisions

The knowledge about the impact of reliability parameters on the system is a first step to discuss possible measures to improve the reliability and quality of the system taking into account system inherent interdependencies.

Relevant for the operating life of the line is the ratio of the rope diameter d and the drum diameter D , which is described by the D/d -factor. A thin line on a large drum results in low stress on the line, whereas a large line diameter in combination with a low drum diameter results in increasing internal friction and thus reduces the operating life of the line.

Therefore the line diameter and the drum diameter could be a starting point to improve the reliability of the KitVes system. The DeCoDe model includes information about how changes on certain elements of the system influence other elements.

A third option to improve the reliability of the system is an adjustment of the time interval for periodic line substitution, which was mentioned before.

These three possible measures

- 1) decreasing the line diameter,
- 2) increasing the drum diameter,
- 3) and adjusting the time interval of periodic line substitution

are depicted in Figure 77. The number of the measures are integrated with reference to the element which is the starting point. As the drum is not part of Figure 69, but its parent element 'Line Storage 1', both are integrated in Figure 77. The hierarchical relation between those elements is represented by a dashed line.

All measures aim at the improvement of the requirement 'reliability', which is represented by a yellow rhombus.

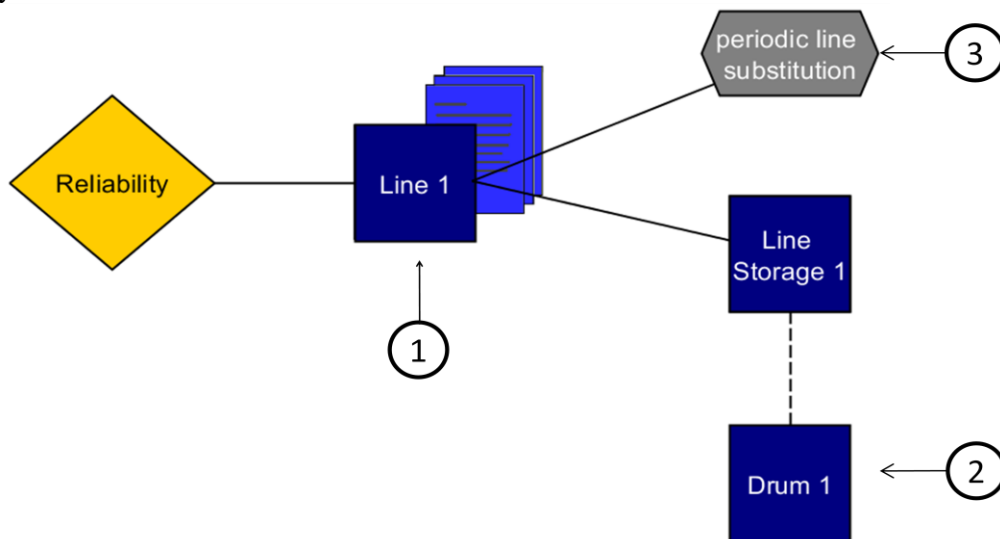


Figure 77: Measures for improving reliability

Consequently, the combination of DeCoDe and Weibull analysis is eligible to deduce new approaches for system improvement.

Special benefit of the presented Workflow of Methods (DeCoDe + MTTF) is the usability in the early phases of product development, when data and experiences with the product being developed are rare. By the inclusion of system describing information in the DeCoDe model, the rare pieces of information are used efficiently. Additionally, an empirical data-base was created and set in a system context, which may function as foundation for decision-making.

Currently, an extension of the method combination aiming at the attribution of the dependencies is in process.

Research limitations

The presented approach bases on a method integration supported by DeCoDe+X. It shows how even poor data due to a lack of experiences for new technologies can be used to discuss possible measures for the ascertainment of quality and reliability. Thus, this approach does not replace detailed reliability analyses but yet allows a first examination of these factors. The implementation requires sufficient test data and the ability to handle large data volumes.

Originality/value

The approach is a first step to integrate information gained by using established methods into a holistic system description model in the early phases of the product development process. Usually, available data for new technologies is rather poor and not integrated in system models, yet. Their integration enables design decision making on basis of the knowledge about the impact of single reliability parameters on the system.

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Integration of a Level-Model for difficult to quantify Characteristics in a Reference Process of Product Development

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Key words: Product Development, Difficult to Quantify Characteristics, Motorcycles, Quality Management, Perceived Quality, Four-Level-Model

Category: Research Paper

Introduction

The design and the resulting overall impression of a product becomes an increasingly importance in consumer awareness. Sometimes the overall impression influences the purchase decision for or against a product unconscious (Schmitt, Pfeifer, Betzold 2007). The increasing number of products and product variants in a market places new challenges to enterprises to differentiate from competitors and to generate competitive advantage. Thus, the satisfaction and enthusiasm of the customer is always difficult, because it's hard to distinguish in special market segments from competitors. But the individuality of the customers gives enterprises the chance to achieve success, already in saturated markets.

In the past decades functional perceptions like reliability and durability were success factors to increase customer satisfaction. Meanwhile, the factors are demanded for granted by customers (Prefi 2007). The same is with potential for innovation of a product. Customers expect a clear difference between successor and predecessor of a product.

The development of scales for difficult to quantify characteristics is the main objective of the MeGeQuS project. In product development it should be possible to identify difficult to quantify characteristics and to develop these characteristics in interests of the customer. This happens by the help of scales for difficult to quantify characteristics. The goal-oriented development is assisted by a *Four-Level-Model* which includes the scales. These scales support decisions of separating good and bad characteristics. Motorcycles are used as examples in this project.

This paper describes the integration of a *Four-Level-Model* into a reference process of product development. The *Four-Level-Model* constitutes the framework of MeGeQuS project. Based on these levels and the processes within the levels, the perceptions of customers about difficult to quantify characteristics will identify and described. The perceptions will break down to characteristics, to develop them in customers' best interests. The *Four-Level-Model* includes *Environment-Level*, *Perception-Level*, *Utility-Level* and *Characteristic-Level*. The model must have the feature of transferability in practice. Therefore it's necessary to integrate it in a reference process of product development.

Initial Situation

MeGeQuS Project

MeGeQuS research project will support to identify important areas of customer perception and make them measurable, because they are the basis for purchase decisions. Therefore customer wishes determines property-related goals and scales in product planning. The overall objective of this project is to develop a method that allows creating, handling, changing and erasing scales for difficult to quantify characteristics. By these scales it should be possible to assess how well the product keep customer requirements already in product development. Some requirements are unexpressed but they are expected by customers. The method should be applied on different levels of consideration of a product. The levels are: *Environment-Level*, *Perception-Level*, *Utility-Level* and *Specification-Level*. The first draft of this model is called *Four-Level-Model* in this paper. In addition, tools for structuring and detailed descriptions of the levels are offered. The categorization and weighting of characteristics is supported at the different levels model and allows the mapping of interactions between characteristics. In view of significance the entire model should be reviewed by the application example of motorcycles.

In a first step a basic framework for the level model should be developed. The developed model should be integrated into a reference process of product development, because transferability into the practice should be given. With this topic, this paper deals superficially.

The boundaries of the *Perceptual Level* and the identification of crucial purchase perceptions are performed by using the Repertory Grid technology in a customer-oriented testing. For more information about using Repertory Grid please read the research paper of Katrin Baumert. The paper "*Identifying and Evaluating Characteristics that are Difficult to Quantify Using the Repertory Grid Technique*" is published on QMOD 2011 (Baumert 2011).

The development of the *Utility-Level* is supported by the development of a process for transformation of difficult to quantify characteristics into concrete specifications. The development of the *Specification-Level* and the scales for requirement specification happens in the next stage. Based on the results of the previous stages, the combination of the different levels to a practical procedure model follows.

Currently, the project deals with the *Environment-Level* and the *Perception-Level*. These are already described in detail. Categories of perception were determined by the Repertory Grid and form the starting point for deliberations for *Utility-Level* and *Specification-Level*. Both levels are already in basically conception and will be more detailed in the project later.

Reference Process

To keep the challenge of transferability into practice, the *Four-Level-Model*, which is developed by MeGeQuS project, must be integrated into a reference process of product development. Therefore it's necessary to identify a suitable reference process. As a part of KoKoPE research project a reference process of product development was developed (Bäsler, Burkhard, Woll 2005; Woll, Bäsler 2006; Bäsler 2010). This reference process is the starting point for all further deliberations in the project. In this paper, the developed *Four-Level-Model* will be integrated in

this reference process. Figure 1 shows the process of product development by KoKoPE.

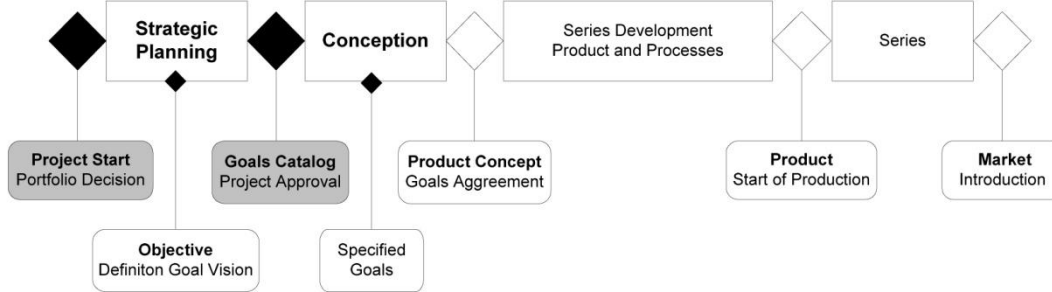


Figure 1: Reference Process of Product Development (Bäsler, Burkhard, Woll 2005; Woll, Bäsler 2006; Bäsler 2010).

At the start of a development project a first vision must be exist. The vision is the starting point of product development. In the progress, the visions and ideas are harmonized under consideration of all enterprise parameters. As part of the goal planning interdisciplinary teams consisting of members from marketing, business strategy, purchasing, engineering, finance, procurement and production develops a goal catalog and a first goal vision (Schaaf 1999). For example it's checked whether the new developed product fits into the product portfolio of the enterprise. Furthermore market and customer trends, focus groups, competitors, sales etc. are considered first-time during strategic planning. A first feasibility analysis as well as a final goal vision takes place in this stage additionally. The final goal vision is the basis for subsequent developments and should be described in detail and fixed.

At the end of strategic planning all customer requirements should be ascertained and fixed in user specification. The user specification is the entirety of all requirements for supplies and services of a contractor within a project (DIN 69901-5 2009). At this milestone the project approval is granted, the strategic framework is adopted and a concept alternative is selected as well.

In the stage of conception all specifications of the final product will be recorded in functional specification. The functional specification is a developed guideline to the realization of the product on the basis of the user specifications (DIN 69901-5 2009). The functional specifications are the starting point for all further steps of product development (Ebert 2010). For consideration of all identified requirements it's important to identify and to describe difficult to quantify characteristics as well. These characteristics have an important impact on the cognitive process of the customer purchase decision. The conception stage is completed by the confirmation of the product concept.

Next stages are production development and production. The illustrated reference process is based on the approach of integrated product development. For the research project not the overall product development process is relevant, so product planning is to be considered primarily. Because of that, production development and production should not be considered in more detail but should be mentioned for completeness. The product development process is completed by the launch of the final product.

This reference process of product development is used as the basis for all further considerations in MeGeQuS project. In the following the *Four-Level-Model* will be integrated in the process of product development. It will be shown at which points the individual levels attach.

Linking Four-Level-Model and Reference Process of Product Development

The Environment-Level

Customer requirements on a product depend on certain expectations. Therefore in the *Environment-Level* deliberations are carrying out to derive complete requirements from the expectations. Some effects on customer requirements are:

- the considered market segment,
- the tracking of the market and the segment,
- the image of the brand and the associated overall impression,
- the strategic positioning of the product

or the strategic position of the enterprise.

For example, the market segment influenced certain customer requirements already before product development. Potential customers of the motorcycle segment *Super-Sportster* place a different requirement on the characteristic *Speed* then customers of the segment *Tourer*.

Customers of a specific segment place special requirements for a product. These requirements should identify to translate them into technical specifications during product development. That is the only way to achieve a customer-oriented characteristic value.

The image of the brand exerts an influence on purchasing decisions of customers also. Today it is necessary to delimit own products and brands from competitors. This necessity derives from the increasing saturation of the markets. Purchase decisions are not made solely by product offering because many products are substitutable. Criteria such as availability, price and quality of a product are not superficial purchasing decisions (Diekhof 2003). Therefore enterprises must strive to differentiate themselves from competitors and generate a clear picture of their product ranges. The enterprise's image and the offered product must match to induce customer confidence. Sometimes consumers choose certain brands to express themselves. The image and the brand's personality play a crucial role (Keller 1993).

Already before product development, the enterprise must check that product idea fit with brand image. Also it must be verified whether consumers can identify themselves with these products. That is the way to develop customer confidence in a product (Meffert, Burmann 1996). Confidence arises when a customer can rely on the quality of the products of an enterprise. Conditions to achieve confidence are: reciprocity, continuity, consistency and individuality (Meffert, Burmann 1996a). This aspect of trust leads to saving costs on the side of the enterprise, because there are no investments for attracting new short-term customers. Therefore, confidence in the brand ensures economic success. On the customer side, the confidence in the brand reduces the risk of wrong purchase decisions (Bünte 2005).

With the image of a certain brand, image dimensions are connected. For example, in the mind of car drivers BMW or AUDI are sporty and dynamic. Enterprises need to know about their image dimensions and must adapt new product development accordingly. These considerations and decisions have to be taken in advance so one can be sure to derive customer requirements correctly and to interpret them properly. All these specifics will be considered on the

Environment-Level.

The deliberations about the *Environment-Level* stand at the very beginning of product development. Examples of questions that an enterprise should ask itself before starting product development:

- Which market segment I want to enter?
- Does the product idea fit to the image of my brand?
- What is with competitors in the segment?

Exemplary a product group was selected for MeGeQuS, to use the developed methodology. Motorcycles were identified as a suitable product, because emotional customer wishes are very strongly here. Figure 2 shows the *Environment-Level* and its possible components. The considerations of other components are also possible. Components always depend on the particular situation of an enterprise.

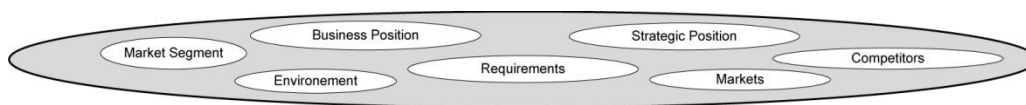


Figure 2: Environment-Level of the Four-Level-Model

The *Environment-Level* takes place before strategic planning and is assigned to the start of the project. It includes some initial ideas and visions, and their feasibility is tested.

Perception-Level

On *Perception-Level* perceptual dimensions of the customer are identified and depicted. The dimension of perception influences the cognitive decision process for or against a product. A product consists of a variety of product characteristics. Finally, the customer perceives only a small subset of these characteristics. Based on these characteristics the customers make their purchase decisions (Schmitt, Quattelbaum 2009). The other characteristics become unconsciously filtered by the brain and play a minor role in the purchase decision (Bortz, Döring 2006; Dawar, Parker 1996; Kroebel-Riel, Weinberg 2003).

In product development process the *Perception-Level* is assigned to strategic planning. In this stage the definition of the goal vision take place. Based on the overall impression customers makes a decision to buy a product or not. The influences on this decision are described by categories of the *Perception-Level*. These categories affect customers in the evaluation of the products.

On December 2010 a first attempt was executed to identify categories of the *Perception-Level* by experts of university and industry. After final discussion the participants of the workshop came to the following preliminary categories, which could have a strong influence on purchase decisions:

- technical performance,
- image of the brand,
- costs and
- sensuous perception.

The influence of technical performance of a motorcycle and the image of the brand on the

purchase decision was undisputed in the workshop. The assignment of certain characteristics to a perceptual dimension has to be more precisely specified in the next time. For example, it must be ascertained to which dimension ergonomics should be assigned. On the one hand it's possible to assign ergonomics to the dimension of technical performance but on the other hand it's also possible to assign it to the dimension of sensuous perception, because a good ergonomics convey the feeling of "pleasing impression" or a felling of "wellness". On that point it is necessary to make a precise definition which makes differentiation clearly in future.

The image of a product exerts a significant influence on the consumer acceptance and is influenced predominantly after sales launch. For example the influence can take place by product placement. Product placement refers to the effective integration of a product as a prop in action sequences of movies for example (Fuchs, Unger 2007). In most cases, products are placed to respond a certain target group or to call attention to the product.

More in detail the aspect of sensuous perception is to be considered. Sensuous perception can also be described as likeability. Again, a distinction is still difficult, because aspects such as *Haptic* or *Sound* still difficult to classify. Likeability also belongs to a so-called wellness factor which is difficult to quantify. On the one hand the wellness factor can be consider as the sum of all perceptions on the other hand ergonomic perception can also consider with wellness factor.

Between the dimensions of the *Perception-Level*, there are interactions that cause mutual interference of the categories. For example, the interactions can be depicted like in Figure 3.

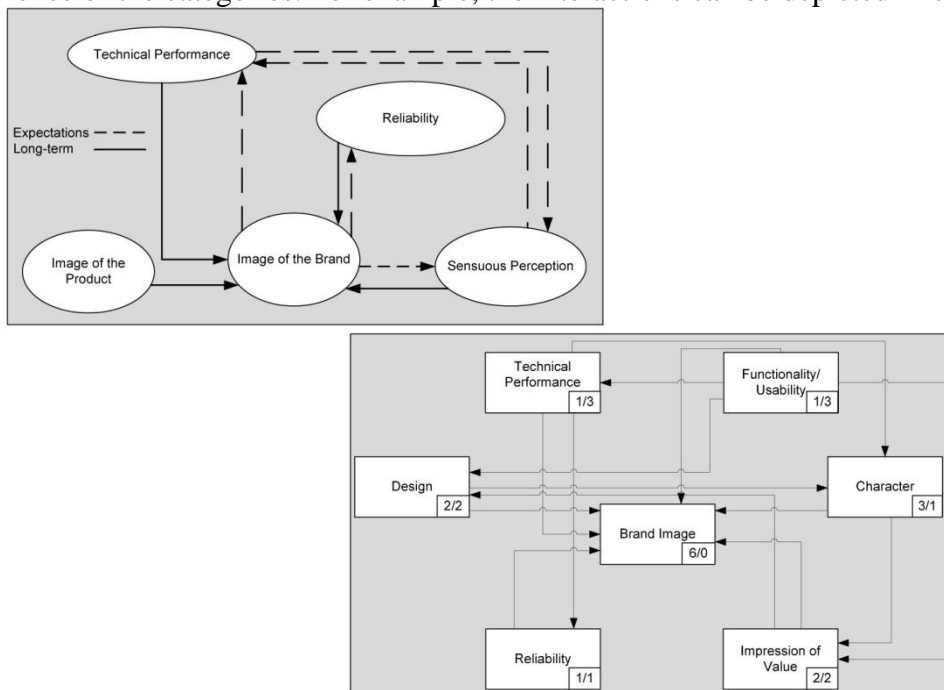


Figure 3: Depiction of possible interactions on the Perception-Level

From December's discussion the identified dimensions of the *Perception-Level* should be validated by a further workshop. At the second workshop test persons were invited and interviewed about their product awareness. The determination of the perception takes place through interviews. An attempt was made to determine perceptual dimensions of customers to the

product Motorcycle during the second workshop. There, the technique of repertory grid was applied. The workshop was carried out on May 28th at BTU Cottbus. Five equivalent *Naked Bikes* were evaluated and compared against each other by 27 test persons. The evaluated *Naked Bikes* were:

Aprilia SL750,
BMW R850,
Triumph Triple Speed 1050,
Kawasaki Z1000,
Suzuki Bandit 1250.



Figure 4: Evaluated Motorcycles (Phoenix-Motorrad 2011; Motorrad-News 2011; BMWMC 2011; Tradoria 2011)

In this way it was possible to derive perceptual dimensions of the volunteers. The exact results were not available at the time of submission this paper.

If the dimensions are identified on the *Perception-Level*, it is necessary to accurately describe the content of each category. This makes it easier to differentiate to other categories and promotes on the other hand, the general understanding of what is meant by the single dimension. Therefore confusions and misunderstandings can be reduced to a minimum.

Certain categories have a higher priority than others for the customer. For example the image of the brand can be higher than the image of the product for the customer. Because of that it is necessary to identify weighting factors for every single category. These can be derived through correlation analysis or a paired comparison for example. Depending on individual cases, other methods for determines weighting factors are:

direct weighting,
absolute weighting,
Method of weighted scoring (Moeller 2007).

Between the single categories interactions should be considered as well. For example a decreasing reliability can have a negative impact on the product image. The other way around, an

appreciation of the product images can exert a positive effect on brand image.

In summary, on the *Perception-Level* the perceptual dimensions of the customers, which have a major impact on product perception and therefore on the purchase decision, become identified. The identified dimensions are checked for interactions with each other and weighting factors for the single dimensions can be introduced. This helps to distinguish important from less important dimensions. An exemplary layout of the *Perception-Level* is shown in Figure 5.

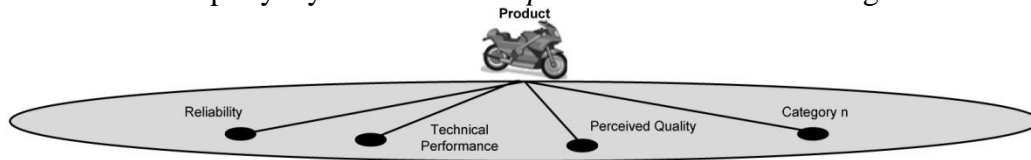


Figure 5: Perception-Level of the Four-Level-Model

Utility- and Specification-Level

In the reference process of product development, the *Utility-Level* takes place in setting the frame of strategic goals and finally the project approval. If decisions are made about the strategic frame in the development process, all categories of *Utility-Level* should be known and should be described in terms of content and be differentiated against each other. Interactions of the categories and weighting factors for each category must be determined as well.

On the *Utility-Level*, the identified categories of the *Perception-Level* are detailed further and broken down like a tree structure. For example, the technical performance can be subdivided on the *Utility-Level* as follows:

- engine,
- chassis,
- suitability for daily use and
- safety etc.

With the completion of the *Utility-Level* the finalized user specification of the product should be present. In this user specification all quality requirements of customers, which are resulted from the higher levels, are combined. This information may include technical performances, information on layout and design requirements, functions, prices, investment requirements, conditions to suppliers and other conditions for example (von Regius 2005).

The collected and processed information of the *Utility-Level* are transferred to the *Specification-Level*. On this level specified goals of product development are finalized and adopted. The requirements which were fixed in user specification become more detailed and break down to product characteristics on *Specification-Level*. Also a detailed description of each product characteristic is necessary to define the difference between it. Interactions are also considered at this level as at all other levels. In addition certain product characteristics can be weighted. All product characteristics are described with concrete values and were stated in the functional specifications. The functional specification describes how the stated requirements are to be implemented in product development. Therefore the functional specification is the starting point for further product development. In reference process of product development the *Specification-Level* belongs to the stage of *Conception*, in particular to the milestone *Specified Goals*

Currently the *Utility-Level* and the *Specification-Level* are still under conceptual design. At the moment, the research project MeGeQuS dealt with the *Perception-Level* and the development of perceptual dimensions. The detailed development of the other levels occurs in project progression as well. Figure 6 shows the draft of the *Utility-Level* and the *Specification-Level* and the tree structure which combine the levels.

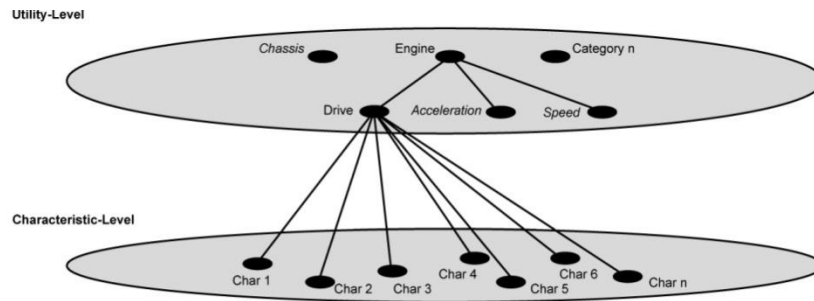


Figure 6: Perception- and Characteristic-Level of the Four-Level-Model

The entire *Four-Level-Model* is shown in Figure 7. As you can see the *Perception-Level*, the *Utility-Level* and the *Characteristic-Level* are in direct relationship to each other. The *Environment-Level* are more superior and reflects the general conditions which must be considered by new product development.

In Figure 7 no interactions of the different elements are considered, also the weighting factors and the scales are missing. This level model should be the basis for all further developments in the project. During the project, the *Four-Level-Model* is supplemented by the missing elements continuously.

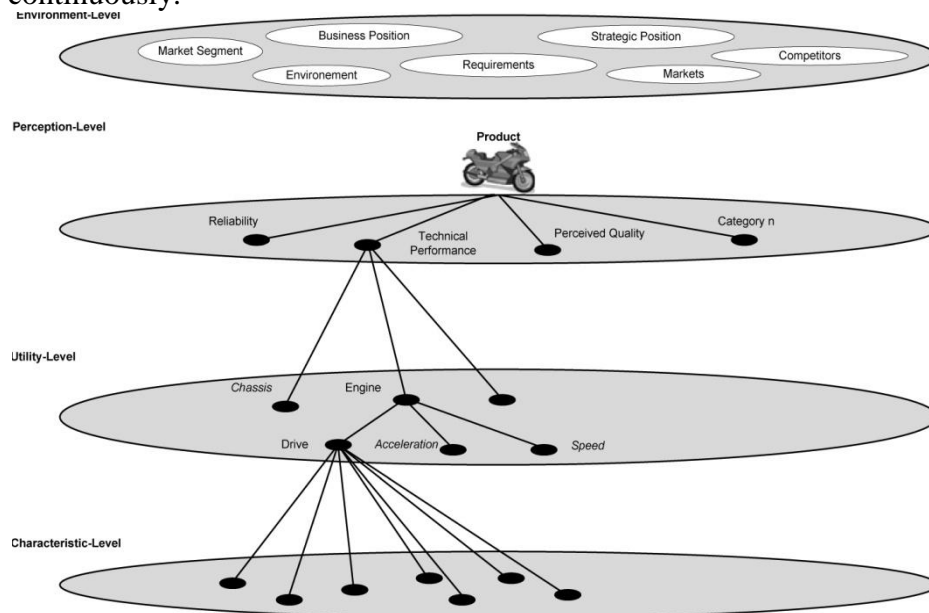


Figure 7: Complete Four-Level-Model of MeGeQuS

Figure 8 shows the linked reference process of product development and the *Four-Level-Model*.

The derived model includes all annotations and deliberations which made in sections 3.1-3.3. As you can see in Figure 8 the model concerns only the first stages of product development. The *Characteristic-Level* closes the *Four-Level-Model* during the stage of conception and the finalized specified goals.

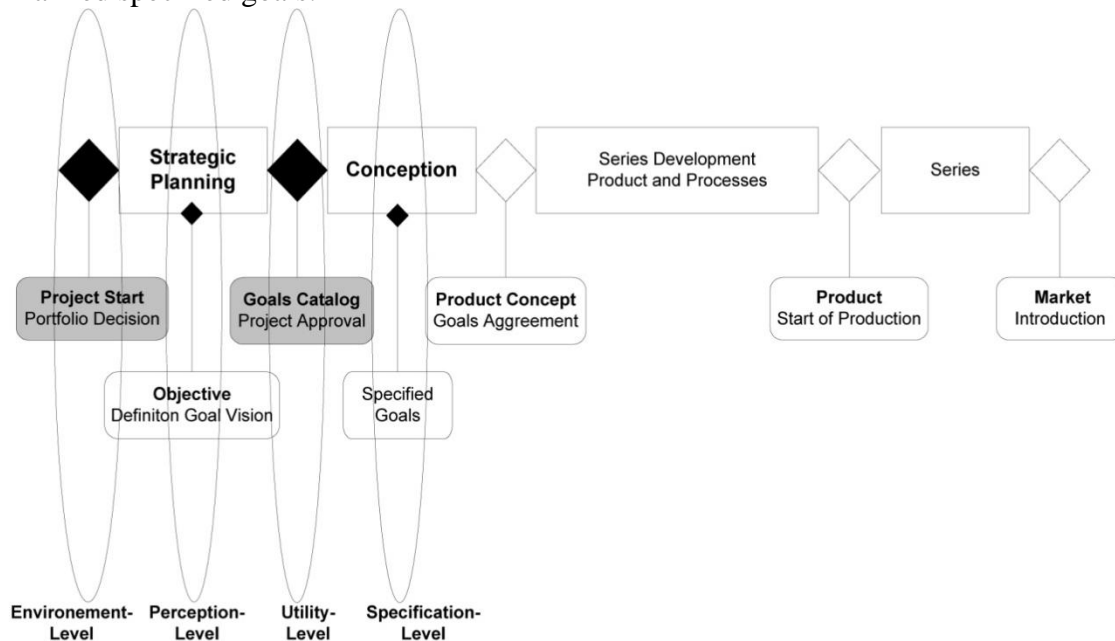


Figure 8: Linked Reference Process and Four-Level-Model

Summary

In a first step of the MeGeQuS project the basis of a *Four-Level-Model* was developed. The final model should it make possible to identify, to describe and to transform difficult to quantify characteristics, so that it is possible to monitor and control these characteristics during product development.

At the first level, called the *Environment-Level*, general conditions of the product development are considered and analyzed. For example the decision will be taken in which market segment the new product should be launched. The situation of competitors is analyzed also.

At *Perception-Level* all perceptual dimensions of the customer are recorded. These dimensions represent all perceptions of the customer. Technical aspects are considered at *Perception-Level*, also. Finally all major categories of customer perception should be optimized, because they are important for purchase decision. To optimize these dimensions, it is necessary to describe them and to go in details further.

The detailing of the dimensions happens at the *Utility-Level*. At their, all customer requirements are identified in detail. At this level the user specification is developed. Difficult to quantify characteristics like *Design* or *Aesthetic* are considered as well as technical parameters. At *Characteristic-Level*, difficult to quantify requirements will translate into technical parameters and will describe in the functional specification.

The determination who the *Four-Level-Model* attached in product development process was the goal of this paper. Based on this model, *Utility-Level* and *Characteristic-Level* will be described in more detail and will elaborate further during project duration. The difficult to quantify characteristics should be measurable by scales. The goal is to assess products during development and to evaluate and to get an impression how good a product is or will be.

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Limits of Quality Management

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Quality Management is our research field and it is under development over the last century starting with inspection in mass production up to today's Total Quality Management in any application such as public services. But what is today our research field? Let us try an analytical top down approach starting with our well-known terms and definitions from the international standards.

Quality management (QM) is defined as “coordinated activities to direct and control an organization with regard to quality” (ISO 9000:2005). In the Note it is defined that QM “includes establishment of the quality policy and quality objectives, quality planning, quality control, quality assurance and quality improvement”

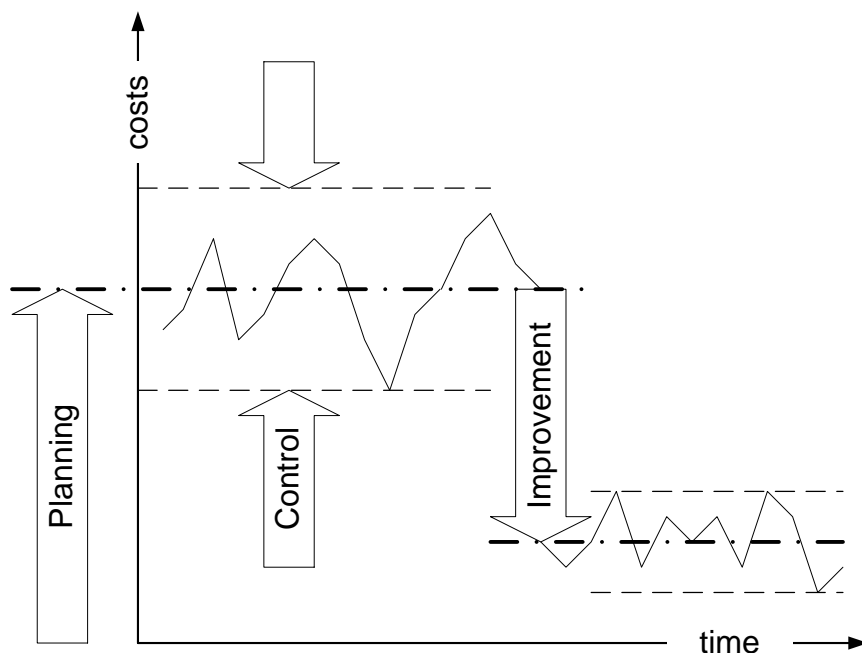


Figure 1: Jurans trilogy (Juran 1999)

From my point of view we can define it more simply regarding Juran's trilogy (Juran 1999), fig 1. Joachim Herrman started it last year on the QMOD (Herrmann 2010). QM includes only planning, control and improvement of quality of different objects. Objects are products, processes and enterprise structures. Setting objectives is a task of quality planning. Defining the quality policy is a task of quality planning in the enterprise. Defining processes is quality planning of processes.

But where is quality assurance defined as “providing confidence that quality requirements will be fulfilled”? Providing confidence is showing the procedures how an enterprise is working and records how it worked within the quality management system. Perhaps we should name this system organizational system. Organization includes operational and organisational structure.

The operational structure is a synonym of the processes to me. The concept of the terms can be presented as a quality cube, fig 2.

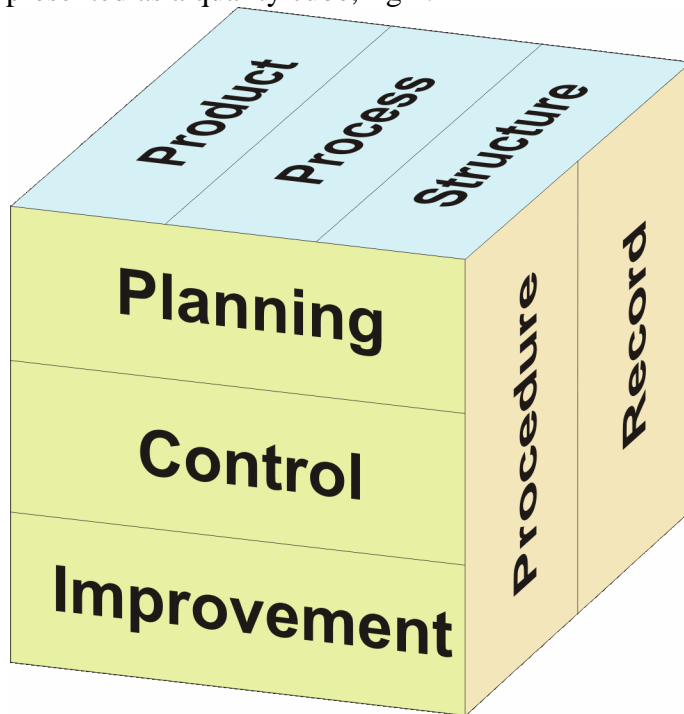


Figure 2: The quality cube

Now we have a rough framework for the main activities of quality management. Let's try to define the tasks of quality planning, control and improvement as the links between the main activities and a set of larger or smaller tools such as FMEA or Pareto analysis. To define the tasks of QM you can perform a so called execution analysis which may lead to the tasks, Maurice Bäsler considered in his doctoral thesis (Bäsler 2010). This work got different awards. Perhaps it may be a starting point for further discussion in our quality society.

Quality planning is “part of quality management focused on setting quality objectives and specifying necessary operational processes and related resources to fulfill the quality objectives” (ISO 9000:2005). It includes the following tasks (Woll 2009):

- Determination of the purpose of an object,
- Determination of the grade,
- Determination of realization possibilities,
- Determination of a quality characteristic and requirement.

Quality control is “part of quality management focused on fulfilling quality requirements” (ISO 9000:2005) and includes

- Determination of the realized character of an object,
- Evaluation of the character,
- Determination of necessary actions.

Quality improvement is “part of quality management focused on increasing the ability to fulfill quality requirements” (ISO 9000:2005). Tasks can be systematized according to its scope within the company. The increase of potentials of an organization is the objective. In product development we have so called “lessons learned sessions” at the closure of the project. Six Sigma-Projects are typical approaches to improve enterprise performance.

But what are these tasks useful for? At first we can describe what tasks or methods are good for.

- FMEA is good for controlling the Quality of a product or process concept.
- QFD is good for planning the quality characteristics and the requirements.
- Pareto is good for the evaluation of objects characteristics.

At second we can identify typical “white” areas such as methods for describing the purpose of an object. May this be the description of the product functions? Then we have identified the link to engineering systematic. Let us start together this new research journey.

Limits and interfaces of QM

In Germany there was a discussion starting in 2002 about the development of the quality science (Woll 2002). What is our way in the future?

- We will expand the area of QM-Approaches to every application area!
- Back to the roots - and cooperation!

We have to be conscious about the limits of our research fields especially when we are doing research work together with colleagues of other disciplines. Then we can identify interfaces or outstanding items which should be covered by other specialists or items that are out of research's scope.

To identify limits of our research field we should have a look to other disciplines or areas of research in different views. We can do this in several views. One simple approach is to look at the enterprise processes:

- A life-cycle-oriented view is focused on the kernel processes of an enterprise, processes which aimed at the customer.
- A resource-oriented view emphasizes the different service processes within the enterprise.
- A hierarchical view that covers the levels of management or leadership.

This “house” helps us and enterprises to identify their processes. We even use this for our own university processes.

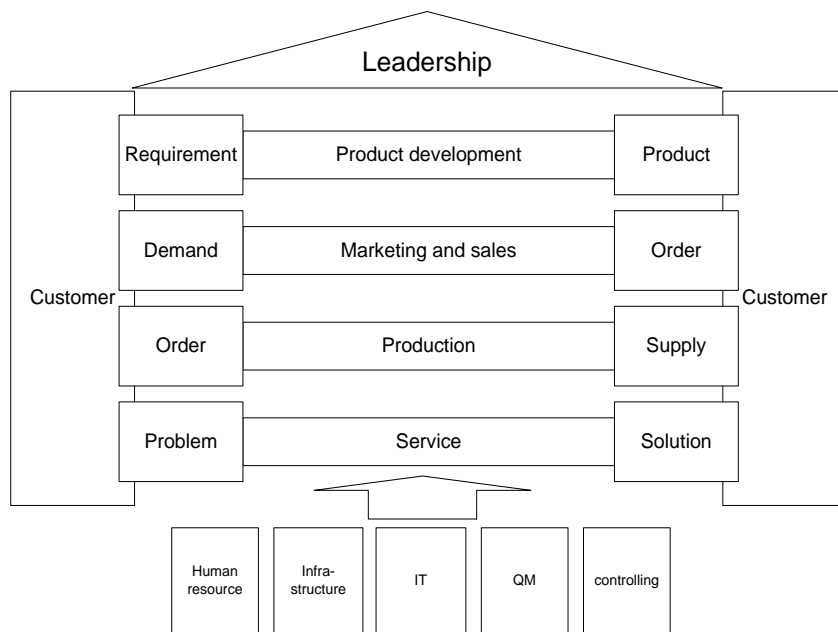


Figure 3: Enterprise processes

A life-cycle-oriented view

The life-cycle-oriented view is focused on the kernel processes of an enterprise:

- Product development,
- Production,
- Marketing and sales,
- Service.

Let us have a look at product development as an example, because we have different projects running in this area. Here we find different research fields, marketing, design and engineering, project management and risk management for example.

- **QM and Marketing**
We are cooperating with Marketing in QFD. They use strong methods such as the well known conjoint analysis. They do in this area different integrating approaches with QFD and the house of quality (Abu Assab 2011). The repertory grid is another method we carried out within a German basic research project. This method can help to identify customer relevant product features (Baumert 2011).
- **QM and Engineering**
The product developing engineers are working today in virtual environments. They handle all information in so called product life cycle management systems PLM. Especially the requirements will be handled here too. So we have to deliver our results from the QFD Process into their systems linked to the product structure. We have to know the environment of requirements engineering (Pohl 2007). On the other hand there are special research fields in the area of cooperation in product development. One example here is bid preparing in consortia (Wiesner 2011). The development of Scales for Q-

Characteristics is one example for a project in the area of Requirement Engineering (Woll 2009). All this examples show potentials of cooperation in research.

- QM and Project Management

It is in the scope of project management to run successful projects. Product development projects are not successful if the quality of the new product is too low. QM must be an integrated part of PM. But PM also controls time and costs (Woll 1999).

In a concrete development project the project manager is responsible not only for the quality of the project results. He is also responsible for meeting time and cost objectives.

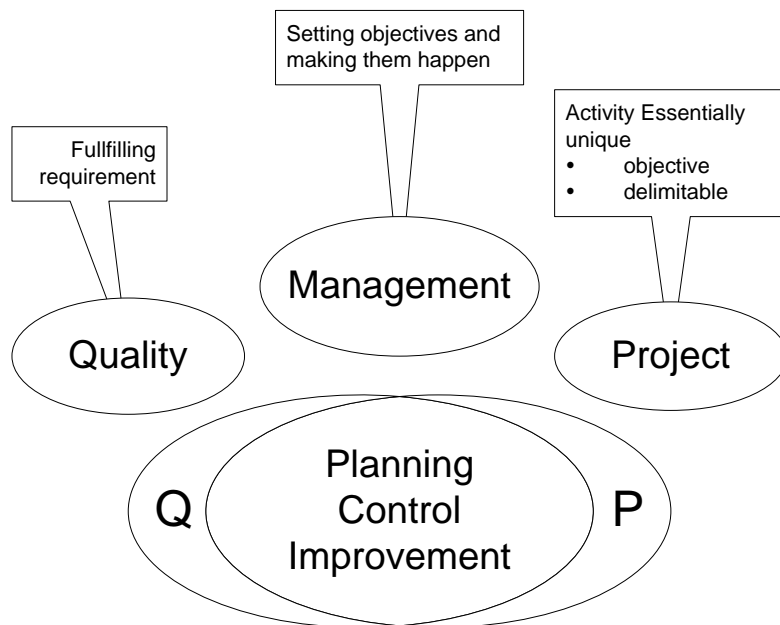


Figure 4: similarities and differences of quality and project management



Figure 5: The magic triangle (Kerzner 2009)

In these circumstances you can find a figure we all know Fig. 5.. I like this one very much, because I was taught it as the magic triangle of QM. Today the magic triangle of PM is a bit modified (Kerzner 2009). But let us come to a conclusion in this area. Quality is an integrated part of PM. QM is more focusing on the technical issues. PM emphasizes project time and project costs.

- QM and risk management

Technical risk management is preventive quality management but let us look at the projects risks (Woll 2007), fig. 6.

In this context, when referring to a project “Risk”, we take the term from a business administration definition, which considers it “a possibility of loss of investment.” Simply put, there is a ‘risk’ that the project will not yield the planned Return on Investment (ROI).

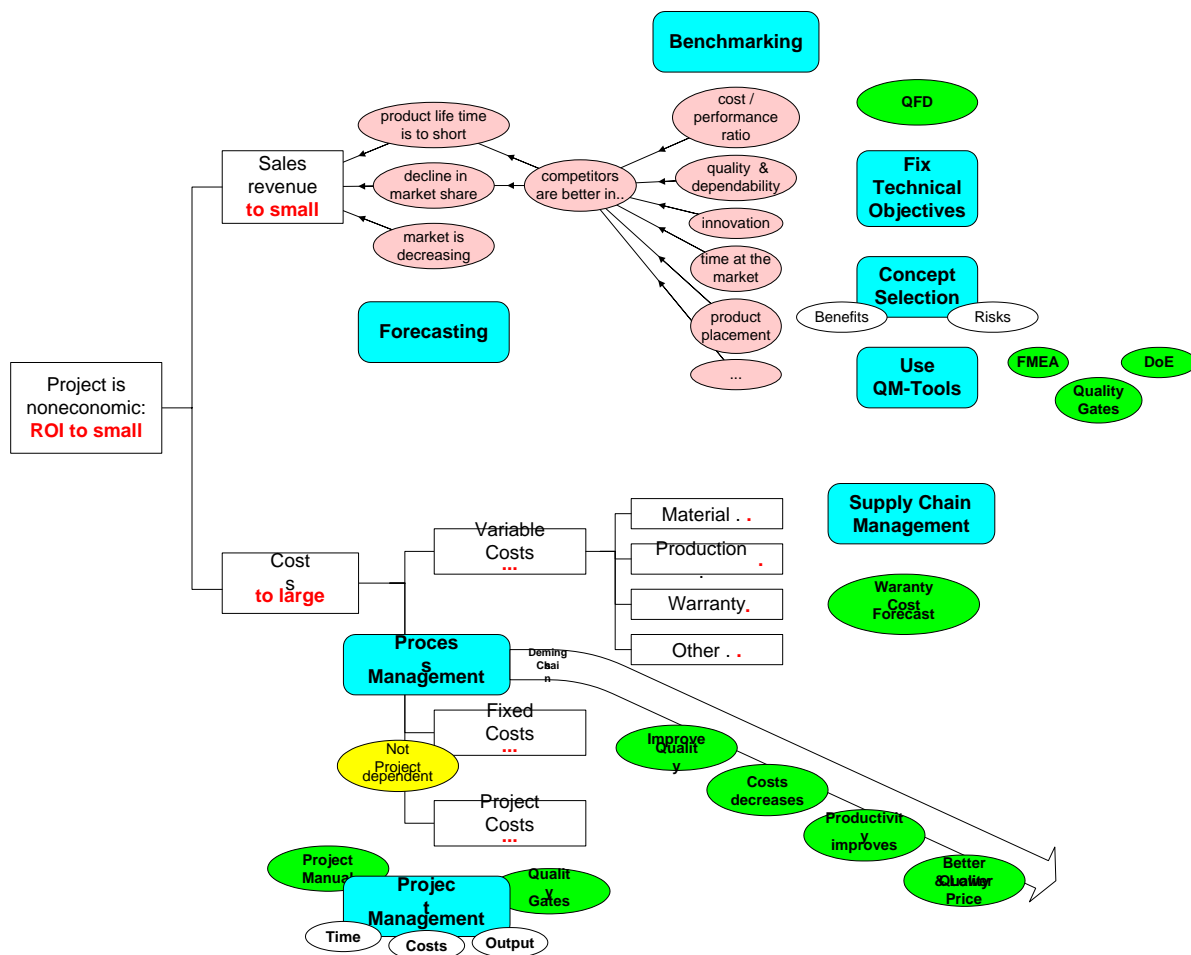


Figure 6: project risks

This process must begin in the early phases of product development as part of the initial profit estimate. The outcome is the initial profile estimate and the resultant ROI prognosis for this particular project. The ROI estimation is based on the sales revenue and costs of the project.

The sales revenue is based on the product prices and total sales over the project time. The costs are divided into individual costs, which can be attributed directly to the product, fixed costs, which have to be paid by the project and actual project costs until the start of production or product launch to the market. Individual costs include material costs or costs of all supplies, production costs for manufacturing and assembly, estimated warranty costs and other costs, such as revision, special expenses for sales, etc.

Any deviation of real sales volumes from the planned volumes represents a risk or a chance to have a direct impact on the project ROI. Possible sources of deviation are results of low quality, wrong interpreted market requirements, especially in comparison to competitors on one hand, one the other to high individual, fixed and project costs due to bad processes. Market understanding and process management are of special interest in QM. Putting all the rules for successful projects in a manual aids the project manager.

Let us summarize the statements:

- Results of risk management is better ROI,
- Technical risks have influence on ROI,
- Technical RM is preventive QM,
- QM in projects leads to better ROI.

But what are the conclusions? QM tasks are integrated in enterprise processes, let us do it better than the competitors.

A hierarchical view

A second view is derived from the hierarchical level of management. On top level we should look at possible similarities and differences between *Total Quality Management*, *Strategic Management*, *Change Management* or other company management concepts.

Is there anything else than Total Quality Management? Is the EFQM-model the only model for self assessment? QM is one concept among others. But what are the others? We should identify them!

A resource-oriented view

A third view can concentrate on the resources. Here the question arises about the importance of *Quality Management* under different services and together with them. Areas are

- QM and IT-infrastructure,
- QM and human resource management,
- QM and controlling,
- QM and logistics and
- QM and others.

From my point of view an interesting paper occurred last year in Germany. It is the first statement edited by the German society for Quality and the international controller network to define similar objectives and approaches in their work (DGQ ICN 2010).

Summary

QM is planning, control and improvement of different objects. We should find consensus about all the single tasks of QM. Under different views we can define a lot of cooperation fields such as Risk management. This paper gave some hints for defining interfaces between research areas and should initiate a discussion in our international society of quality researchers.

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Strategic Improving Actions Based on the Refined Analysis of Service and Quality Attributes

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Introduction

In the past two decades, the pursuit of customer satisfaction has been the focus of business management. In a worldwide survey of 681 senior executives conducted by the *Economist* during October–December 2002, 65% of the respondents reported that customers were to be their main focus over the next three years, compared with 18% who reported that shareholders were to be their main focus (Gupta & Lehmann, 2005). Another study, conducted in 2000 with 148 financial institutions, found that 72% of the companies stated that customer-related performance was an extremely important driver of long-term success, compared with 31% who chose short-term financial performance as the most important driver of long-term success (Gupta & Lehmann, 2005). This awareness of the importance of customers to long-term success means that companies are cognisant that their future is determined by their ability to respond to customer needs and expectations quickly and efficiently (Willis, 1996).

One of the most important issues in business in recent years has been the impact of service quality on the profits and other financial outcomes of an organisation (Rust et al., 1995). Much research effort has therefore been directed to an analysis of the customers' perception of service quality and the development of strategies to meet customer requirements and expectations (Parasuraman et al., 1988; Zeithaml et al., 1996). Moreover, as service organisations have become increasingly customer focused and driven by customer demands, it has become increasingly important to meet customers' expectations and retain their loyalty (Disney, 1999).

The European Customer Satisfaction Index (ECSI), which was developed by the ECSI Technical Committee (1998) on the basis of models developed by Fornell (1992) and Fornell et al. (1996), has attempted to link customer satisfaction to both its determinants and its consequence (which was posited as being customer loyalty). The model identified the determinants of customer satisfaction as being perceived company image, customer expectations, perceived quality, and perceived value (value for money). Other studies have also found a strong link between customer satisfaction and customer loyalty (Fornell, 1992; Anderson & Sullivan, 1993; Jones & Sasser, Jr. 1995; Gorst et al., 1998; Sirohi et al., 1998; Disney, 1999; Stank et al., 1999; Bartikowski and Llosa, 2004). Moreover, perceived quality and perceived value have been identified as important drivers of customer satisfaction (Fornell, 1992; Fornell et al., 1996; Kristensen et al., 1999; Martensen et al., 2000; Cassel & Eklof, 2001). The same authors have identified customer value as being strongly influenced by perceived quality.

Wang et al. (2004) also developed an integrated model of service quality, customer value, satisfaction, and the behavioural intentions of customers. In their model, these authors found that only customer value and customer satisfaction had a statistically significant effect on the behavioural intentions of customers. However, they found that customer-perceived service quality can influence the behavioural intentions of customers indirectly by affecting customer value and customer satisfaction.

The conclusion that customer “value” strongly affects the consumers’ purchasing behaviour is emphasized by many researchers. According to Ostrom & Iacobucci (1995), the notion of ‘value’ appears to be closely associated with the concepts of cost and pricing, relative to quality. Zeithaml (1988, p. 14) defined ‘value’ as “... the consumer’s overall assessment of the utility of a product or service based on perceptions of what is received and what is given”. This definition is consistent with other researchers who have suggested that ‘value’ is essentially a cognitive ‘trade-off’ between benefit and cost (Dodds et al., 1991; Gale, 1994; Ostrom & Iacobucci, 1995; Woodruff, 1997; Slater, 1997; Wang et al., 2004; Lindgreen & Wynstra, 2005). For example, according to Ostrom & Iacobucci (1995), customer satisfaction/dissatisfaction is a relative judgment that takes into consideration *both* the benefits obtained through a purchase *and* the costs required to obtain that purchase.

The above discussion suggests that quality and price (and hence the value) are the critical factors for consumers in making purchasing decisions. It would thus seem that a firm that can provide high-quality services at a lower price than its competitors will have a competitive advantage that should result in increased business and enhanced financial returns. In the past, most firms used the improvement of service quality as a major strategy. However, in an age of increasing competition, merely improving service quality is not enough; rather, creation of customer value has also become essential for long-term success.

The present study addresses the issue of the relationship between customer value and customer satisfaction by developing an integrated model. The proposed model incorporates both the refined Kano’s model (Yang, 2005) and the customers’ satisfaction level. According to the proposed model and the consideration of the “importance-satisfaction model (I-S model)” (Yang, 2003a; 2003b) and the frequency of use of service items, a service company can determine its priorities for improving various quality attributes in its service offering.

The remainder of this paper is organised as follows. In the following section, the conceptual frameworks for the study are presented. This includes the Kano’s model (Kano et al., 1984), the refined Kano’s model (Yang 2005), and the importance-satisfaction model (Yang 2003a; 2003b). The paper then explores the framework of the strategic improving decisions by a combination of the refined Kano’s model and the satisfaction levels. A practical application of the model in a 5-star Taiwanese hotel is then presented, the improvement decisions for the hotel can be determined by the combinative considerations of the proposed model, I-S model and the frequency of use of service items. The paper concludes with managerial implications and a summary of the main findings.

Conceptual frameworks

Kano’s model and the refined Kano’s model

Customer satisfaction has traditionally been perceived as a one-dimensional item—the greater the fulfilment of desired quality attributes, the greater the degree of customer satisfaction. However, some quality attributes fulfil customer expectations to a great extent without necessarily implying a greater level of customer satisfaction (Matzler & Hinterhuber, 1998). Several studies have therefore attempted to link the physical and psychological aspects of quality to see how specific

attributes of a product or service actually relate to customer satisfaction or dissatisfaction (Schvaneveldt et al., 1991). Kano et al. (1984) therefore posited that two aspects of any given attribute should be considered—an objective aspect involving the degree of fulfilment of the quality attribute and a subjective aspect involving the customers' perception of satisfaction.

According to Kano et al. (1984), quality attributes can then be divided into five categories as follows.

- * *Attractive attributes*: Customers will be satisfied if these attributes are present, but their absence does not cause customer dissatisfaction.
- * *One-dimensional attributes*: Customer satisfaction is positively and linearly related to the performance of these attributes—that is, the greater the degree of fulfilment of these attributes, the greater the degree of customer satisfaction (and vice versa).
- * *Must-be attributes*: The absence of these attributes will result in customer dissatisfaction; but whose presence does not significantly contribute to customer satisfaction.
- * *Indifferent attributes*: The presence or absence of these attributes does not cause any substantial satisfaction or dissatisfaction to customers.
- * *Reverse attributes*: The presence of these attributes will cause customer dissatisfaction, and their absence will result in customer satisfaction.

According to Kano's model, it might not be sufficient to satisfy customers by merely meeting their basic performance requirements. In a highly competitive market place, organisations need to create product/service attributes that are targeted specifically towards satisfying customers beyond their expectations (Tan and Pawitra, 2001). Kano's model can be useful in this regard. If quality attributes are categorised, products/services can be designed in accordance with the relevance of each quality attribute, according to its category. For example, it is critical to identify 'must-be' quality attributes and to meet demand for these at or above a minimum threshold level. Providers must also do their best with respect to the 'one-dimensional' attributes. The 'attractive' quality attributes can be identified as competitive weapons to draw the attention of customers, especially new customers.

Although Kano's model has many applications (Miyakawa & Wong, 1989; Schvaneveldt et al., 1991; Matzler & Hinterhuber, 1998; Yang, 2005), the model has a deficiency in that it fails to consider the *degree of importance* of various attributes (Yang, 2005). In response to this problem, Yang (2005) refined Kano's model by taking account of the degree of importance of attributes as perceived by customers. The refined model effectively subdivided each of Kano's first four categories ('attractive', 'one-dimensional', 'must-be', and 'indifferent' quality attributes)—thus making a total of eight categories from the original four. These can be summarised as follows.

- * With respect to the *must-be* quality attributes, if such a quality attribute is also found to have a high level of importance in the estimation of customers, this quality attribute is not only a *necessary* quality requirement but also a '*critical* quality attribute'. In contrast, if a must-be quality attribute is considered less important, it can be defined as a '*necessary* quality attribute', but without being considered *critical*.
- * With respect to *one-dimensional* quality attributes, increasing such attributes will raise customer satisfaction. A one-dimensional quality attribute is therefore a *value-added* quality attribute. It is therefore possible to define some one-dimensional quality

attributes with a high level of importance as ‘*high value-added* quality attributes’, whereas others can be classed as ‘*low value-added* attributes’.

- * For the *attractive* quality attributes, those with high level of importance can be classified as ‘*highly attractive* quality attributes’, whereas those of less importance can be classified as ‘*less attractive* quality attributes’.
- * The *indifferent* quality attributes were referred to as ‘*care-free* quality attributes’. However, if an indifferent quality attribute does possess a higher level of importance, it can be defined as a ‘*potential* quality attribute’ because it does have some potential to attract customers. The *indifferent* quality attributes can therefore be classed as *care-free* or *potential*, depending on their degree of importance.

This refined Kano’s model, as developed by Yang (2005), can be used to develop precise pricing strategies that take account of the nature and importance of various quality attributes.

Importance–satisfaction (I–S) matrix

The importance-satisfaction’ (I–S) model (Yang, 2003a; 2003b) uses a quadrant map to identify potential areas for improvement by comparing the satisfaction level and importance degree of the various attributes (Fontenot et al., 2005). As shown in Figure 1, the model features the satisfaction level of various quality attributes on its vertical axis and the degree of importance of those attributes on its horizontal axis. These values are obtained from surveys of customers. The mean (or median) values on each axis are used to divide the satisfaction and importance measures into a ‘high’ range (above the mean (or median)) and a ‘low’ range (below the mean (median)). Four quadrants are thus formed (see Figure 1).

Take in Figure 1 about here

Figure 1: Importance–satisfaction matrix

The quadrants shown in Figure 1 can be summarised as follows:

- *I. Excellent area:* The items or attributes located in this area are those that have high degrees of importance and high levels of satisfaction. A service provider should maintain or enhance the performance of these attributes.
- *II. To-be-improved area:* These items or attributes have a high degree of importance but a low level of satisfaction. A service provider needs to take action to improve the performance of these items.
- *III. Surplus area:* The items in this area are less important to customers, but are being offered in a more-than-satisfactory fashion. The firm can reduce the offering level for the consideration of cost reduction.
- *IV. Care-free area:* The items located in this area are of little importance to customers and are being presented in a less-than-satisfactory fashion. Service providers do not need to pay any more attention to these items because customers are not concerned about them.

This model can be used to prioritise plans for improvement in certain areas.

Strategic decisions for improvement

In the past, service providers have undertaken improvement activities in their service offerings on the basis of customer satisfaction surveys, giving priority to improving the service items that record a low degree of satisfaction (Yang, 2003a). This decision-making process is inadequate because it can overlook some important attributes that are used by customers in assessing service quality (Deming, 1986; Berry et al., 1990). In contrast, if service providers simultaneously conduct evaluations of satisfaction *and* importance on pre-determined service items, they can then prioritise their improvement strategies appropriately and adopt the most effective strategies to increase both customer satisfaction and customer value.

The determination of the categories of service items under Kano's model requires a customer survey using a questionnaire of the type developed by Kano et al. (1984). In addition, service providers need to conduct surveys of customer satisfaction and importance levels for a set of pre-determined service attributes. Having conducted these surveys, providers can proceed to make decisions on these attributes as described below.

Service items with high satisfaction

As noted above, service items with high satisfaction can be divided into those with a high importance level and those with a low importance level.

High satisfaction and high importance

Utilising the categories of the refined Kano's model (Yang, 2005), appropriate actions for items with a high satisfaction rating and a high level of importance can be summarised as follows.

- *Must-be items (critical attributes)*: Because these service items are critical to customers, high performance must be maintained with respect to these items.
- *One-dimensional items (high value-added attributes)*: Maintenance of high performance with respect to these items will result in high customer satisfaction.
- *Attractive items (highly attractive attributes)*: Because these services are very attractive to customers, providers should maintain high performance with respect to these items as a competitive weapon.
- *Indifferent items (potential attributes)*: If any of these exist, they have the potential to become attractive over time. These items can thus be provided to customers, but providers need to reduce costs as much as possible.

High satisfaction and low importance

Utilising the categories of the refined Kano's model (Yang, 2005), appropriate actions for items with a high satisfaction rating and a low level of importance can be summarised as follows.

- *Must-be items (necessary attributes)*: Although these service items are not especially important to customers, they are still necessary. Service providers can take actions to reduce costs while retaining these items at a performance level that is acceptable to customers.
- *One-dimensional items (low value-added attributes)*: Similar decisions apply to these attributes as applied to the 'must-be attributes' of low-importance (that is, 'necessary attributes') immediately above.

- *Attractive items (less attractive attributes)*: These items have some (but weak) attraction to customers. Providers can adopt outsourcing to reduce costs.
- *Indifferent items (care-free attributes)*: The customers are not concerned about these items, but they are satisfied with the existing performance. Firms can take action to reduce the costs (without significantly affecting customer satisfaction).

Service items with low satisfaction

As noted above, service items with low satisfaction can also be divided into those with a high importance level and those with a low importance level.

Low satisfaction and high importance

Utilising the categories of the refined Kano's model (Yang, 2005), appropriate actions for items with a low satisfaction rating and a high level of importance can be summarised as follows.

- *Must-be items (critical attributes)*: These service items are of very concern to the customers, and providers must therefore undertake actions to improve the quality and performance of these items immediately.
- *One-dimensional items (high value-added attributes)*: Because these service items provide high value to customers, service providers must improve the quality and performance of these attributes.
- *Attractive items (highly attractive attributes)*: To attract consumers, service providers should implement improvement actions to enhance the quality and performance of these service items.
- *Indifferent items (potential attributes)*: Because there are few service items in this category, providers can offer these services using outsourcing, but they need to ask their outsourcing partners to take action to improve the performance.

Low satisfaction and low importance

Utilising the categories of the refined Kano's model (Yang, 2005), appropriate actions for items with a low satisfaction rating and a low level of importance can be summarised as follows.

- *Must-be items (necessary attributes)*: These service items are necessary but not critical to customers. Providers can take improvement actions to enhance the performance to a level that is acceptable to customers.
- *One-dimensional items (low value-added attributes)*: Because these service items can provide some added-value to customers, the providers can take actions or use outsourcing to raise the performance to an acceptable level.
- *Attractive items (less attractive attributes)*: Providers need not provide these services themselves; outsourcing can be utilised. However, it is necessary to improve the performance in these items.
- *Indifferent items (care-free attributes)*: Taking account of cost considerations, providers can cease the provision of these service items; outsourcing can be used to satisfy needs of the few customers who request these services.

These recommendations are shown in Figure 2.

Insert Figure 2 about here

Figure 2: Strategic actions based on categories of refined Kano's model and satisfaction level

Practical application

Study design

To demonstrate the practical application of the model described above, an empirical study was conducted in a five-star hotel located in Taichung, Taiwan. The 20 service items and 4 quality attributes to be included in the questionnaire were decided in consultation with several key staff members. The questionnaires were completed by the hotel's customers. A total of 126 customers completed the questionnaires, but only 115 questionnaires were valid for analysis.

The following measures were undertaken:

- * the degree of importance of the 20 service items and 4 quality attributes;
- * the level of customer satisfaction of the 20 service items and 4 quality attributes;
- * the categories of the service items according to Kano's model of the 20 service items and 4 service attributes; and
- * the usage frequency of the 20 service items.

For the first two measures, Likert-type scales (from '1' to as 'extremely unimportant (or very unsatisfied)' to '5' as 'very important (or very satisfied)') were used. For the third measure, the methodology suggested by Kano et al. (1984) was used. For the fourth measure, we also used a five scales; from '1' as 'never used' to '5' as 'used very often'. We used the 115 valid questionnaires to analyze the categories of refined Kano's model, the importance degree, and the usage frequency level for the 20 service items. All the analytic results the results are shown in Table 1.

Having obtained the results for degree of importance (on a scale of 1–5), these were then classified into two broad categories: (i) 'high' if the degree of importance was greater than the mean (4.03); and (ii) 'low' if the degree of importance was less than the mean. This also allowed classification of the items and attributes according to the refined Kano's model. For the satisfaction level, these were then classified into two broad categories: (i) 'high' if the satisfaction level was greater than the mean (3.67); and (ii) 'low' if the satisfaction level was less than the mean.

Insert Table 1 about here

Table 1: The analytic results for service items

Improvement decisions based on the analytic results and the I-S model

The categories of the 20 service items and 4 quality attributes according to the refined Kano's model are shown in column 5 of Table 1. It is apparent that there were no 'critical' items, but three service items were identified as 'high value-added' items. These were numbers 2 (reservation service), 4 (toothbrush and toothpaste), and 7 (bottled water). three items were

categorised as ‘highly attractive’ items. These were numbers 1 (internet access), 3 (breakfast), and 6 (transportation to and from airport/station). Because these six items (1, 2, 3, 4, 6, 7) have the potential to exert a significant effect on customer satisfaction and value, the hotel should provide these at a high level of performance.

Among these six items, items 1, 3, 4, and 7 were the four most frequently used services (see column 6 of Table 1), and item 2 was the seventh most frequently used. Moreover, customer-satisfaction levels with respect to these five items (items 1, 2, 3, 4, and 7) were also high (see column 4 of Table 1). These five items were all placed in the ‘excellent’ area of the I-S model, see the column 7 of Table 1 and Figure 3. It is thus apparent that the hotel should maintain their good performance with regard these five items as a high priority based on the considerations of the framework of the strategic decisions for improvement (see Figure 2), I-S model, and the usage frequencies of these items. But, the hotel can further raise the performance levels on item 1 (internet access) and item 7 (bottled water), since their satisfaction levels are not very high. The appropriate improvement decisions for these service items are listed in column 8 of Table 1.

The remaining item among the three ‘highly attractive’ services was Item 6, which referred to a free transportation service to and from the airport/station. Although it was classified as a ‘highly attractive’ item on the refined Kano’s model, but it was classified as ‘to be improved’ on the I–S matrix (that is, high importance but low satisfaction). The hotel needs to take improvement action to raise its performance on this service item. This service item had a low frequency of usage (ranked 15th). The likely explanation is that most foreign visitors require such a service, whereas most domestic guests do not. Because this hotel is quite close to the rail station, but somewhat distant from the airport, the hotel could compromise by offering a good transportation service to and from the airport/station. Because this service item had a low usage frequency (ranked as 15th among all items), it is best to adopt an outsourcing strategy to achieve this.

Take in Figure 3 about here

Figure 3: The locations of 20 service items and 4 service attributes in I-S model

Among the highly important service items, only item 5 (water boiler) was classified as a ‘potential’ attribute. This indicates that the customers were not especially concerned about this service item, but that the offer was appreciated by many customers. This item was located in the ‘excellent’ area on the I-S model, the hotel should maintain the good performance level on this item.

For the service items of low importance, there was no ‘low value-added’ item; however, there were three ‘less attractive’ items and ten ‘care-free’ items (see column 5 of Table 1). The ‘less attractive’ items were numbers 8 (free local telephone calls), 10 (newspapers and magazines), and 14 (charged long-distance telephone calls). The ten ‘care-free’ items were numbers 9 (travel information), 11 (laundry service), 12 (swimming pool), 13 (fitness centre), 15 (safe box), 16 (car rental), 17 (city tour), 18 (tea and coffee), 19 (fruit basket in room), and 20 (beverage/cocktails voucher). All these ten items were located in the ‘care-free’ area on the I-S model. It means that these service items were not very concerned by the customers and the provisions of these items were not very satisfied by the customers, besides the item 12, see column 7 of Table 1.

Based on the consideration of I-S model, the hotel seems no need to take any improvement action on these items, but the usage frequencies of these items should be taken account by the hotel. Among these service items, items 10, 18, and 19 had high or moderate frequencies of usage (5th, 8th, and 9th respectively). It is apparent that customers used these offered items (newspapers, tea and coffee, fruit baskets) even though they did consider them especially important. If the hotel wanted to reduce its costs, these offers could be adjusted. However, if it chose to do so, the hotel should be aware that approximately half of its customers rated service item 10 (newspapers) as being somewhat attractive (this item being formally categorised as 'less attractive', rather than 'care-free' as was the case with items 18 and 19). The offer of newspapers thus has value to a significant proportion of customers. Maintain the provision of free tea, since the local customers have the habit to drink tea. But the provision of free fruit basket in room can be cancelled.

It is of interest that the other two items that were categorised as 'less attractive' (items 8 and 14) both referred to telephone calls, and their usage frequencies were moderate (10th and 11th respectively). These two items might have been considered more important in the past, but the prevalence of mobile telephones has meant that these two items are now becoming less attractive. However, some customers still need to use such telephone services, and the hotel should therefore continue to provide these two services, although them were located in the 'care-free' area on the I-S model.

Service item 9 (travel information) was classed as 'care-free' according to both refined Kano's model and I-S model and had a low frequency of use, but its degree of importance was quite high (ranked 9th among the service items). This indicates that some customers value this service, and the hotel needs to continue to offer this service item. In contrast, the offers of service items 15 (safe box) and 20 (beverages/cocktails coupons), which were also classed as 'care-free' on both refined Kano's model and I-S model, can be ceased to save costs.

The final two items for consideration-item 12 (swimming pool) and item 13 (fitness centre)-were both categorised as 'care-free' items and both had low frequencies of use. It is apparent that customers were not concerned about the offers of these facilities. The business of such facilities could therefore be managed independently and reduce the room rates, and guests could be asked to pay an extra charge for using them. For a new hotel, a better decision would be not to construct a swimming pool or fitness centre in the first instance; the cost savings could then be used to offer a lower room rate, which is likely to attract more customers than the offer of a swimming pool or fitness centre.

With regard to four quality attributes listed in the last four rows of Table 1, it should be noted that they were all of high importance, and their importance degrees were very high. It means that the customers very concern these quality attributes. The first three attributes were all placed in the 'high value-added' category, which have significant contribution on the customers' value, and all were classified as 'excellent' in the I-S model. The hotel should aim to maintain or enhance its performance with respect to these attributes. Item 4 (room rate) was a 'highly attractive' item, but it was classified as 'to-be-improved' in the I-S model because its satisfaction level was low. This indicates that customers believed that the room rate was too high. If the hotel were to adopt the strategic improvement actions described above, its reduced costs on certain items would allow the room rate to be decreased (thus raising the satisfaction level of this attribute), hotels would be able to decrease costs, decrease the room rate, acquire more customers, and increase total profits.

Conclusion

In today's highly competitive markets, consumers are increasingly searching for products and services that offer good value in the form of lower prices while maintaining high quality. In these circumstances, providers need to change their traditional approaches to improving service quality. The present study has developed a useful methodology for analysing service items on a strategic basis. The integrated model proposed here is based on the 'refined Kano's model' and combined with the frequency of use of service. By utilising this analytic methodology and the I-S model, service providers can make strategic improvement decisions with regard to the service offers. As a result, the providers can increase the customers' satisfaction, reduce the operating costs, and hence raise the customers' value. This ultimately leads to significant competition advantages for the providers.

The customers very concern the service attributes, for example, security of hotel's facilities, service manner of staffs, cleanliness and comfort of rooms, and room rate, more than the offers of service items. It is thus that the hotels need to improve the performances on these service attributes. Room rate is considered as 'to-be-improved' in the I-S model, the hotels can decrease the room rate by reducing or eliminating the provisions of the service items which are classified as 'care-free' in the refined Kano's model and considered as 'surplus' or 'care-free' in the I-S model, especially the swimming pool and the fitness centre.

Although the present study has focused on a hotel in providing an empirical example of the utilisation of the proposed model, the methodology can also be applied in other service industries—such as healthcare providers, travel agents, insurance companies, and so on. In addition, the methodology can also be implemented in manufacturing industries.

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Measuring the antecedents of loyalty and impact of ISO 9001 in online banking in Spain

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Introduction

It is so easy to switch online providers (Reichheld & Scheffer, 2000). Moreover loyal customers buy more, are willing to spend more, are easier to reach, and act as enthusiastic advocates for our firms (Harris and Goode 2004). It is therefore extremely important that service providers on the Internet know how to improve loyalty levels and repeat purchasing decisions among their customers (Buttle & Burton, 2002; Parasuraman et al., 2005).

Given the widespread acceptance that online customer's perceived service quality is an antecedent of customer satisfaction, which in turn is a key determinant of customer loyalty. Yet, although the relationship between satisfaction and loyalty seems almost intuitive, the relationship has been found to vary significantly under different conditions (Anderson & Srinivasan, 2003). Additionally recent research indicates that e-service perceived quality cannot be reflected in a unidimensional or simple customer evaluation (Fuentes-Blasco et al., 2010). In this sense, too little is known from the nature of the drivers of e-loyalty.

The consequence chain models, that link service quality to loyalty with perceived value and satisfaction as mediators were strongly argued (Harris and Harrington, 2000; Parasuraman et al., 2005; Boshoff, 2007; Marimon et al., 2010; Meng, 2010). Nevertheless, the results from earlier studies in online contexts are not consistent. For example the well established quality-satisfaction-loyalty chain was not supported in one of their online services studied (Harris and Goode 2004). Thus thorough understanding of factors that may influence customer e-loyalty is of paramount importance, as it may help e-retailers gain competitive advantage by implementing precise strategies to increase e-loyalty

In addition, given concerns for e-retailer to establish and maintain long term relationships with their customers in such a competitive environment, some were keen to adopt ISO 9001 with the scope directly related to customers (offices, claim, etc). The literature review mostly support the notion that the implementation of this standardized quality assurance system is beneficial for

organizations. However, those who are not in favour argued that the benefits of ISO 9000 family has brought leads to much more confused and uneven results from the point of view of organizations. For example, while some companies highlight organizational improvement, others emphasized only the marketing benefit (Casadesus et al 2001). Furthermore, prior researches on the impact of ISO 9001 have entrenched their investigation from the organizations viewpoint. This study has chosen to conduct research drawing heavily on the customer's point of view.

Against this background, this research extends current understanding of e-loyalty and its antecedents through a close examination of the followings: (i) propose and apply a scale to measure e-service quality in electronic bank (e-banking) sector; (ii) to investigate crucial factors that may influence customer loyalty explicitly service quality and customer satisfaction and to assess the mediating effects of customer satisfaction on service quality and customer loyalty and (iii) to examine if the implementation of ISO 9001 with the scope directly related to customers, spawn any discrepancies on e-service perceived quality, customer satisfaction and customer loyalty from customer's outlook.

Literature review

Customer loyalty

Customer loyalty is considered essential to business survival, especially in the context of e-commerce (Reichheld & Scheffer, 2000). It was asserted that 5 percent improvement of customer retention can cause a profitability increase that ranges between 25 percent and 85 percent. Loyal customers are less likely to change provider because of price, while they also tend to recommend the business to others (Reichheld and Scheffer, 2000).

In a fundamental contribution to the loyalty literature, there are many different approaches aiming at the definition and conceptualisation of loyalty. One approach regards loyalty in behavioural sense "a customer who continues to buy" (Buttle & Burton., 2002). Whereas other approach is that there is an affective component to customer loyalty where feelings are important. Thus loyalty is also examined under the attitudinal sagacity, which can be derived from psychological involvement, favouritism and a sense of goodwill towards a particular product or service (Kim et al., 2006). Taken as a whole, loyalty may be explained from different approaches, but the general convergence is that both characteristics, behavioural and attitudinal must be taken into account.

Some authors have emphasized the need to examine how to improve loyalty levels and the Internet consumer acquisition decision (Parasuraman et al., 2005; Boshoff , 2007; Fuentes-Blasco et al., 2010; Marimon et al., 2010; Meng, 2010). Obviously, understanding these antecedents can help e-retailers gaining competitive advantage by carrying out specific strategies to increase e-loyalty, which in turn will enhance business performance.

Customer satisfaction

More than just attracting customers, there is need to retain them and keep them coming back to the site and this can only happen if they are satisfied. Harris and Harrington (2000) pointed out

that customer satisfaction can be attained by companies, which have understood their customers' needs and make every effort to provide services in an effective and efficient manner.

In general, higher levels of customer satisfaction can lead to a reduction of the perceived benefits of alternative suppliers and hence higher repurchase intentions (Anderson and Sullivan, 1993). Moreover customer satisfaction leads to greater trust which in turn enhanced customer loyalty, willingness to pay more and cross-buying. Cristobal et al. (2007) initiate that perceived e-service quality affect positively customer satisfaction and loyalty. Indeed satisfaction with electronic environments drives traffic to web sites and encourages repeated use of the site (Qimei Chen et al., 2008). Ultimately the quality of e-service leads to trust and satisfaction (Sahadev & Purani, 2008).

Various studies appear to show consensus emerging that customer satisfaction is a key determinant of customer loyalty (Bloemer et al., 1999; Fornell 1992; Anderson and Sullivan 1993). Bloemer et al., 1999 states that the precise nature of the interaction between customer satisfaction and loyalty is notoriously elusive but satisfaction would appear to have a positive effect on service loyalty. Fornell (1992) found that high satisfaction results in customers with increased loyalty and less prone to be approached from competition. Anderson and Sullivan (1993) established that satisfied customers have greater propensity to be retained and resist to alternative options.

Measuring Service Quality

During the past few decades, service quality played a vital role as a key factor in differentiating service offerings. Service quality has been a centre of attention from practitioners and scholars; because of its strong impact on customer trust, customer loyalty, customer satisfaction, business performance. Guo et al., 2008 confirmed that service quality helps to maximize profits of service providers and to reduce uncertainty for the buyer of services.

It should be noted that e-service quality has the potential to increase attractiveness, hit rates, customer retention and positive word of mouth (Santos, 2003). Different instruments were developed to capture and elucidate service quality by various researchers to numerous service industries. Most of measuring instruments were largely based on SERVQUAL (Parasuraman et al., 1988). The primary value of SERVQUAL lies in its powerful benchmarking, diagnostic, and prescriptive tools (Kettinger and Lee, 1997).

Nonetheless with the development of e-commerce and e-service, SERVQUAL has been subjected to critical theoretical and experimental assessments, as it is not fairly appropriate to evaluate e-service quality. E-service quality is defined as a measure of how well the level of the delivered services matches customer's expectation (Parasuraman et al., 2005), or the overall customer assessment and judgment of e-service delivery in the virtual marketplace (Santos, 2003).

In these circumstances an instrument such as E-S-QUAL was developed (Parasuraman et al., 2005). The instrument demonstrated good psychometric properties as a mean of evaluating e-service quality and has started to receive considerable attention in the academic literature. Boshoff (2007) extended the original instrument to six dimensions instead of four, and

demonstrated important relationships between the dimensions of e-service quality and the construct of perceived value and loyalty. Marimon et al. (2010) expanded the Boshoff model in a setting of an online supermarket in Spain, adding the new construct, analysing the relationship between loyalty and purchasing. Recently, Meng (2010) also conducted measurement equivalence tests, applying the two scales (E-S-Qual and E-RecS-Qual) to the African American and Chinese cultural settings, and found that the e-service quality measurement can be generalized to different cultures. Fuentes-Blasco et al., (2010) adapted the items from E-S-Qual and E-RecS-Qual scales to measure e-service quality and confirmed consequence chain: electronic service quality -perceived value - e-loyalty

In considering that the instrument is fairly recent, of course debate about its usefulness is expected both in the academic field and also among practitioners of e-business. However authors such as (Parasuraman et al., 2005; Boshoff, 2007; Akinci et al. 2010; Fuentes-Blasco et al., 2010; Marimon et al., 2010) confirmed that E-S-QUAL in general is a useful instrument to evaluate e-service quality in a variety of situations.

Impact of ISO9001

In a global market quality remains a competitive reality. Undoubtedly for numbers of organizations in general and banks in particular the issue of improvement in the quality of products and services remains imperative. ISO 9001 which belongs to the family of ISO 9000 standard is a generic management system that can be applied to any organization. It is a widespread model for quality management systems with a goal to guarantee quality control and assurance. Often branded as competitive advantage, with the endeavour to identify and anticipate customer requirements. As well as enhance internal and external performance of the organization, while keeping to its optimum satisfaction and loyalty of customers and other parties involved.

ISO 9001 has gained popularity as a number of certifications that have been issued soared to more than 1,064,755 in 178 countries world wide (ISO survey 2009). The popularity of ISO 9000 implementations, unfortunately, also translates into a dilemma. With mixed success in implementation, praise and criticism on ISO 9000 certification are easy to find from trade magazines, news media and the business community. These standards do not seem to provide many external benefits and competitive advantage any more, as most competitors in the industries that require ISO registration are already registered. Those companies are now looking for tangible internal benefits from the ISO 9001 standards (Casadesus & Karapetrovic, 2003).

However, related scholar research on the benefits of ISO 9001 has been extensively conducted from many perspectives with different outcomes. E.g. Vloegeberghs and Bellen (1996) emphasized that the most important benefits are internal: improve awareness of the importance of quality, of the problems of the company and improvement in product quality. While Quazi and Padido (1998) affirmed the most important benefits are external: increased customer satisfaction, satisfaction of customers' requirements and improvement in product quality and market competitiveness. Tsuang Kuo et al., 2009 substantiate that ISO 9001 certification significantly improves the effectiveness of quality management practices and that service experienced better improvements than manufacturing in five out of six areas investigated.

The benefits of ISO 9000 certification in general are very difficult to measure, for example, rises in productivity or increase market share (Jones et al., 1997) despite these difficulties in quantifying and measuring benefits, “internal” and “external” aspects companies can be distinguished (Tsiotras and Gotzamani, 1996). This distinction is used in this study, by calling e-service users to help interpret the results of implementing ISO 9001 standards in e-service setting.

Conceptual Framework and Research Hypotheses

Figure 1 research model

Based on literature review previously described in the upper section, the following hypotheses may be posited:

H1: online service quality will positively affect online loyalty

H2: online service quality will positively affect online satisfaction

H3: online satisfaction will positively affect online loyalty

H4: online satisfaction will mediate the effects of online service quality on the online loyalty.

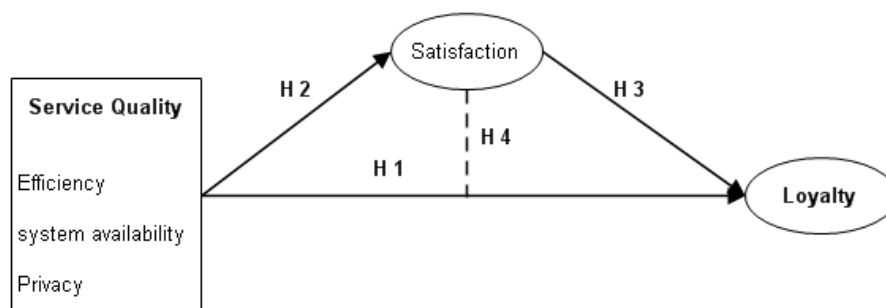
H5: ISO 9001 certification leads to a higher perception of service quality, more satisfied customers and a higher loyalty intention

Research methodology

Questionnaire design

To congregate data for these purposes, a structure questionnaire was designed by a blend of existing constructs. E-service quality was adapted from the original E-S-QUAL (Parasuraman et al., 2005). In accordance with Akinci et al., 2010, some items in the original scales were discarded to facilitate application of the scales in online banking services. From the 22 items originally developed; FUL2, FUL4 and FUL5 items were removed from the ‘Fulfilment’ dimension as they evaluate “physical goods in stock or available for delivery” all deemed not relevant for online banking by the authors. The four e-service quality dimensions were: efficiency (8 items), system availability (4 items), fulfilment (4 items), and privacy (3 items). They were reworded to fit in the context of online banking as suggested by (Parasuraman et al., 1988, 2005).

The items measuring loyalty were also drawn from Parasuraman et al., (2005) and e-satisfaction



was evaluated using a four items scale formerly used by (Ribbink et al., 2004). The items measuring e-satisfaction and e-loyalty were adopted with minor alterations. Each item was assessed by a five-point Likert-type scales where possible answers ranged from 1=strongly disagree to 5= strongly agree

Sampling and data collection

To collect the data, Spanish online banking users were randomly invited by mail and directed to a specific website containing the structured questionnaire, which they then self administered. The main key factor for screening respondents was that they must be consumers of e-banking. The survey was made available in three languages (Catalan, Spanish and English) and respondents were given a possibility to complete the survey in the language they understood the best.

Most banks in Spain as general information often publish on their websites the International standards they implemented in their institution. Since the main interest of the study was to identify banks that implement ISO 9001 with the scope directly related to customers (offices, claims, etc.). A formal letter was sent to bank managers with a very short questionnaire included.

Data collection was completed in May 2010, after rejecting some incomplete or invalid questionnaires, 16 banks were retained and 428 valid questionnaires remained from Spanish customers of e-banking.

Data analysis and results

Sample profile

No gender bias was detected and two thirds of the respondents were aged less than 34 years. The educational level of the sample was high, with more than two thirds of the sample having a university or a master degree. An overwhelming majority (65.9%) of the respondents earned less than € 24,000 annual incomes, two thirds used e-banking less than one week ago. Also the sample is skewed toward banks with no ISO 9001(57.5%). 16% of our samples were “others”, referring to banks we were unable to outline the scope of the standard implemented.

Since most of banks in Spain are traditionally cramped to a specific region or province. The respondents' profiles were comparable to the total population of the banks. Thus the sample was not biased towards any of the banks.

E-service quality scales assessment

We first conducted Exploratory Factor Analysis (EFA) on the items on the amended E-S-QUAL, with normalized varimax as the rotation method (Hair et al., 1998) using the Kaiser criteria of eigenvalues greater than 1 to determine the initial number of factors to retain. The Kaiser-Meyer-Olkin (KMO) measure was 0.935. Bartlett's sphericity test was 5,125.3 (df = 171) with a significance of 0.000. The EFA of the constructs was indicated since it satisfied the statistical fitness criteria Kaiser-Meyer-Olkin (KMO) and Bartlett's test. Only three dimensions, which accounted for 64.11% of the variability of the sample, were identified.

The first factor (labelled 'efficiency') gathered seven of the eight efficiency items. Only item EFF5 ('the website loads its pages quickly') migrated from this factor to the second factor. The second factor was labelled 'system availability'. The seven items loaded on this 'new' factor of system availability were: the original four items of 'system availability'; Full1 and Ful2 items of 'fulfilment'; and (iii) the item EFF5 from 'efficiency'. The third factor neatly included all three items of 'privacy'. In addition two of the original 'fulfilment' items were discarded because they loaded equally on 'efficiency' and 'privacy'. Hence, the original 'fulfilment' dimension was removed. This finding is consistent with previous studies (Fuentes-Blasco et al., 2010; Marimon et al., 2010; Boshoff, 2007). The overall result is also consistent with the empirical evidence in the literature which shows that e-service quality cannot be reflected in a uni-dimensional or simple customer evaluation, as it has multiple perspectives or dimensions (Meuter et al., 2000; Zeithaml et al., 2002; Boshoff, 2007; Fuentes-Blasco et al., 2010; Marimon et al., 2010). The EFA analysis thus revealed three dimensions to evaluate e-quality in e-banking: 'efficiency', 'system availability', and 'privacy'

Reliability and validity assessment of the adapted E-S-QUAL

We conducted confirmatory factor analysis (CFA) to further assess the factor structure of the modified E-S-QUAL. Cronbach's alpha for the constructs ranged from .887 (system availability) to .906 (efficiency) exceeding the generally accepted minimum level of 0.7 (Nunnally & Bernstein, 1994) and demonstrating high internal consistency and thus reliability of each dimension.

Furthermore first-order confirmatory factorial analyses utilising robust maximum-likelihood estimation were performed using EQS software: involving the retained items in the amended E-S-QUAL scale to assess e-quality. Comparative fit index (CFI) was 0.933 and the Bentler-Bonett non-normed fit index (BBNFI) was 0.921 (all >.9) and root mean-square error of approximation (RMSEA) was 0.065 (<0.07). The Satorra-Bentler scaled chi-square χ^2 was 323.63 on 116 degrees of freedom the measurement model fit showed that the ratio $\chi^2/df=2,789$ (<5), and all standardized factor loadings were statistically significant at $p < 0.000$. These results indicate that global fit was acceptable (Byrne, 1994; Hu & Bentler, 1999). The loads were all high (at a significance level of 0.05). The amended model was therefore shown to be an acceptable fit for the data.

The validity of individual items on their corresponding factors was confirmed by load values greater than 0.707 (Carmines & Zeller, 1979), with the exception of item 'EFF 5' "My bank X site loads its pages faster", which was slightly lower. Since it was so close to the threshold it was decided to be retained, in accordance with the relaxed criterion suggested by Barclay et al. (1995). Content validity of multidimensional scales can be assumed on the basis of the close similarity between the modified scales and the original E-S-QUAL models of Parasuraman et al., 2005. Factor loadings of the confirmatory model were found to be statistically significant (level of 0.05) and greater than 0.5 (Sanzo et al., 2003).

All these evidences (EFA and CFA) together supported the convergent validity of the scale component dimensions.

Factors that may influences e-loyalty

The second objective of this study was to examine and explain the cause and effect relationships between online service quality, online satisfaction and online loyalty in an online banking setting. The conceptualization framework of the research model is portrayed in figure 1.

Evaluation of measurement model

Both scales for the constructs satisfaction and loyalty were unidimensional. In each case EFA of the scales extracted only one factor. From the CFA, cronbach's alpha of both satisfaction .916 and loyalty .816 exceeded the recommended value of 0.7 (Nunnally & Bernstein, 1994) and demonstrating high internal consistency.

In addition, validity of individual items within the constructs of satisfaction (.842 to .926) and loyalty (.765 to .890) were also confirmed. The Cronbach's alpha values jointly with factor loadings of the amended E-S-QUAL dimensions and satisfaction and loyalty, exceeded the conventional cutoff values, and thus provided evidence of an acceptable internal consistency for each construct.

Moreover, the average variance extracted (AVE) for all scales were greater than the recommended value of 0.5 Fornell and Larcker's (1981) authenticating the convergent validity. In addition, modified E-S-QUAL dimensions have consistently strong positive correlations with satisfaction (.657 to .723) and loyalty (.493 to .601). The square root of the AVE was greater than the correlations presented by each construct with other constructs Fornell and Larcker's (1981). All this evidences supported the discriminant validity of the items as measures of their respective underlying constructs.

Hypotheses testing

We performed multi regression analysis (see table I) with five control variables included in the analysis namely: gender, age, education, annual income and the last usage. Model H1 (Figure 1) shows direct effect of service quality on loyalty without satisfaction. Observably a large portion of the variation of loyalty is accounted for service quality as 43.4% of total variance was explained; indicating that service quality is significantly related to loyalty. All three dimensions of service quality are proved to have positive statistically significant direct effects on loyalty. The factor representing Efficiency have the strongest effects on loyalty (standard beta = .387, $P < 0.001$), followed by the factor Privacy (standard beta = .226, $P < 0.001$) and System availability (standard beta = .128, $P < 0.05$).

Model H2 (Figure 1) shows the direct effects of service quality on satisfaction alone. All the three dimensions of service quality were positively significantly related to satisfaction, with 67.3% of total variance explained. Likewise efficiency makes the highly contribute to the dependent variable (standard beta = .393, $P < 0.001$), subsequently privacy (standard beta = .337, $P < 0.001$) and system availability (standard beta = .233, $P < 0.001$).

The possible mediation effects of satisfaction on the relationship between independent variables of service quality and the dependent variable of loyalty was analyzed in model H4 (Figure 1). We followed Baron and Kenny (1986) procedures, by regressing both service quality and customer satisfaction on loyalty. The results show that adjusted R-square in model H4 compare to model H1 have increased by 10.1%, consequently satisfaction have strong and direct effects on loyalty

(standard beta = .557, $P < 0.001$) confirming model H3 (Figure 1). Furthermore standard beta of the dimensions of service quality in model H1 are significantly higher than those in model H4. Only efficiency have a significant effect on loyalty (standard beta = .168, $P < 0.01$) and the remaining dimensions of Service quality, System availability and Privacy are no longer significant. Thus the effect of service quality on loyalty is weaker due to the mediation effect of satisfaction. Although efficient effects on loyalty in model H4 remained statistically significant, the strength was reduced by less than half compared to model H1. Meaning the relationship efficiency-loyalty was partially mediated by satisfaction. Succinctly, hypotheses H1, H2, H3 and H4 were supported; however no significant relationship was confirmed between the control variables and loyalty.

Table I: regression analysis of service quality and satisfaction on loyalty

	H1: →Loyalty beta	Quality Standard	H2: →satisfaction Standard beta	Quality	H4: Satisfaction mediating (Quality →Loyalty) Standard beta
<i>Control variables</i>					
Gender	.016		-.010		.022
Age	-.093		-.047		-.067
Education	-.038		-.038		-.017
Annual income (€)	.085		.009		.079
Last use of e-banking	-.092		-.029		-.076
<i>Independent variables</i>					
Efficiency	.387***		.393***		.168**
System availability		.128*	.233***		-.002
Privacy	.226***		.337***		.039
Satisfaction	-		-		.557***
Adjusted R ²	.434***		.673***		.535***

NOTE: Significant at * $P < 0.05$; ** $P < 0.01$; *** $P < 0.001$

Mann-Whitney U test

The question of interest was: to know whether the implementation of ISO 9001 in e-services with the scope directly related to customer spawn any discrepancies on service quality, customer satisfaction and customer loyalty from the customer's outlook.

The Mann-Whitney U test was used to determine the differences between the two groups of e-service user, the significance level was set at $p < 0.05$. The mean scores and the results of the Mann-Whitney U test for the dependent variable related to the implementation of ISO 9001 or not. Surprisingly, no statistically significant differences between the two groups were observed in terms of customer service quality, customer satisfaction and loyalty intention. Thus hypothesis H5 was rejected.

Conclusions and practical implications

The analysis of the research data showed that the amended version of the E-S-QUAL scale (Parasuraman et al., 2005) best represents the measurement of e-service quality within an e-banking context in Spain. The modified version of the scale moved two items of the original 'fulfilment' and one item from 'efficiency' dimension into the 'system availability' dimension. The 'fulfilment' dimension was discarded as the leftover items failed EFA test. Hence the amended scale demonstrated good psychometric properties and has three dimensions ('efficiency', 'system availability' and 'privacy'), rather than the original four. This modification is in accordance with Boshoff (2007), who also removed the 'fulfilment' dimension in his model. The modification is also supported to some extent by Fuentes-Blasco et al. (2010), who found that this dimension had a lower coefficient path to e-quality in their model.

The second objective was to investigate the effect of service quality and customer satisfaction on customer loyalty. We anticipated and tested an integrated online loyalty model, which includes e-service perceived quality and customer satisfaction. Our results show that e-service perceived quality is a major predictor of both online customer satisfaction and loyalty. All three service quality dimensions impact significantly and positively upon both concepts. Also the pattern of effects is consistent across dependant variables and suggests that 'efficiency' have the strongest effects on loyalty, followed by 'Privacy' and 'System Availability'

The second objective of the study also shows that satisfaction has a vastly significant positive effect on loyalty, in addition to significantly mediates the effects of service quality in online loyalty. 'Privacy' and 'System Availability' dimension were absolutely mediated; besides, 'efficiency' and loyalty relationship was partially mediated by satisfaction, hence exposing the exceptionally strong positive influence on loyalty. The results obtained largely agree with relevant research found in extant of literature (Harris and Harrington 2000; Parasuraman et al., 2005; Fuentes-Blasco et al. 2010; Marimon et al. 2010)

Finally this study scrutinized if the certification of ISO 9001 in e-services with the scope directly related to customer (office, claim, etc.) offspring any discrepancies on e-service perceived quality, customer satisfaction and customer loyalty from the customer's viewpoint. Surprisingly a comparison between certified and non-certified organizations shows no differences in term of customer service quality, customer satisfaction and loyalty intention. The non detection of any significant differences is probably due to :(i) online banking bid to customers a complete control over their accounts, thus the absence of human interactions and physical premises may shadow the perception of the benefit of ISO 9001. (ii) In addition banks are well organized and structured and often offer a very high standard of e-services compared to low involvement e-retailing services. Hence performance may not have necessarily improved after certification. Consistent with Casadesus and Karapetrovic (2003) who emphasized that, the standards do not seem to provide much external benefits and competitive advantage any more, as most competitors in the industries that require ISO 9000 registration are already registered. Especially in industry sectors that do not specifically require this registration, for example retail or banking operations, external benefits are by default of secondary importance.

In term of practice, given the competitive atmosphere of e-service providers this study offers a number of practical implications. In the light of preceding evidences, e-service perceived quality and customer satisfaction are factors of paramount importance in forecasting online loyalty. Managers must set clear guidance wishing to enhance customer loyalty, by formulating customers' intimate strategy based on comprehensive loyalty antecedents. E-service perceived quality positively influences customer satisfaction and online loyalty. This suggests the relevance of delivering high e-service quality to maintain and increase customer satisfaction and loyalty intentions. Moreover the study reveals that 'efficiency' is the most critical predictor of both satisfaction and loyalty intentions. Thus managers are called to place greater emphasis on online service attributes associated to the ease and speed of accessing and using the site.

In addition, previous research has argued that privacy (protection and safeguarding of customers' private information) was the last critical dimension in predicting online loyalty (Parasuraman et al, 2005). The regression analysis in this study shows that the factor representing this dimension is the second contributor in predicting customer loyalty. This suggests that managers should ensure that their site is free from a torrent of spam. As well as making sure that personal information of their customers in general or their credit card numbers in particular may not be fraud. Online satisfaction significantly mediates the effect of service quality on loyalty, over and above was an important factor in predicting loyalty. Managers must adopt customer satisfaction enhancement strategy that closely deals with e-service perceived quality as its antecedent. In addition feedback and complaint resolution are to be monitor efficiently.

Although the findings provide consequential implications for e-services, this study also had some limitations. This research revealed that customers did not perceive any differences between e-services (ISO 9001 certified and non-certified) and resulted in some conclusions. The study did not explore causalities, thus an additional research is required to confirm reasons for the lack of perceived differences. Furthermore the study was based on a particular sector, replication in other settings is recommended.

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Empowerment of the Line Managers in HRM—HRM Effectiveness Link: Creating a Service Culture in Malaysian Large Service Firms

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Topic: Human Resource Management for building quality and service culture

Introduction

The importance of human resource (HR) and their management remains ever more critical to organizations. Modern organizations are under relentless pressures to change. It has long been argued that organizations have to focus on the value of investments in HR as a major source of competitive advantage (Beer, Spector, Lawrence, Mills, and Walton, 1984, Guest, 1990; Schuler and Jackson, 2005) in the face of structural changes in the organizations. HR is seen as the foremost intangible asset which comprises a firm's core competence and crucial to solving organizational problems and increasing performance (Rowley and Saaidah, 2007). This raises the question of how HR should be managed in the context of the knowledge-economy to generate superior value including the key question of the organizational architecture of HR management (HRM) function.

The traditional role of the HR function is the provision of administrative support. Historically, HRM was viewed as a collection of personnel activities including payroll, benefits, compensation, records, and training. However, since mid 1980s, many theorists and practitioners have called for HRM to become more business-oriented, market-minded, and change-minded. The HR function is beginning to redefine its role (Wright, Dyer, and Takla, 1999) from one of administrative support to one of being a strategic partner. Despite these calls for a significant strategic role for HR, HRM is a relatively new area of interest in Malaysia and less is known about its people management (Rowley and Saaidah, 2007). In fact, Hazman Shah (1998) found that Malaysian HR managers tend to have little influence in the strategic management process. This is also evident in Rowley and Saaidah's (2007) finding that Malaysian people management is still characterized as more like 'personnel', than 'HRM'.

The biggest challenge for Malaysian companies is in developing its HR to match the rest of region (Rozhan and Teh, 2003). The transformation from personnel management to HRM is necessary for Malaysian companies. The transition from personnel management to HRM reflects the emerging organization-wide commitment to human capital development (Sheehan, 2005). A primary reason for this transition is that HR departments are being called upon to play a much more strategic role in organizations (Lawler and Mohrman, 2000; Ulrich, 1997a). No longer can HR professionals simply focus on the administrative aspect of HR activities. Rather, they are increasingly expected to simultaneously become much more flexible, responsive, efficient, and, ultimately, make a strategic contribution to their company. In response, many HR managers are devolving some of the HR activities to the line managers (Hazman Shah, 1999, 2002; Holt-Larsen and Brewster, 2003; Kulik and Bainbridge, 2006; Teo and Rodwell, 2003) as a move to

become more strategic in their orientation. The line involvement in HR is expected to immediately lend a business perspective to the HR activities.

Despite the growing interest in line managers' involvement in HRM, empirical research on empowerment of the line managers in HR activities has been limited and, hence more empirical research is called for (Perry and Kulik, 2008). More research can, not only show the level of empowerment of the line in HR matters, but also identify obstacles and suggest ways to overcome it.

Background of the Study

Over the past decades, scholars in the HRM field have conducted a range of conceptual and prescriptive work regarding line managers' involvement in HR activities. Also, it emerged as the predominate paradigm for research. However, it was only in the late 1990s and in the past few years, empirical research of line involvement in HR activities became popular and attracted numerous studies (e.g., Hazman Shah, 1999; Budhwar, 2000; Johnson and Mouly, 2002; Teo and Rodwell, 2003; Mayrhofer, Muller-Camen, Ledolter, Strunk, and Erten, 2004; Andersen, Cooper, and Zhu, 2007; Perry and Kulik, 2008). There is, however, little published empirical research exploring the relationship between empowerment of the line and HRM effectiveness. In fact, Perry and Kulik (2008) highlighted that "there has been little empirical research that directly explores the link between devolution and people management effectiveness" (p. 263).

The transfer of HR responsibility from the HR managers to the line managers could have positive outcome for both HR and line managers. Teo and Rodwell (2003) reported that line managers were satisfied with the performance of their HR departments. Similarly, the study by Whittaker and Marchington (2003) found that the line managers claimed to be satisfied with the HR responsibilities that have been devolved to them and keen to take on activities that relate explicitly to the development of their team. From the HR manager's perspective, Kulik and Bainbridge (2006) found that HR managers are more optimistic than line managers about the benefits of line manager involvement for the organization (in terms of higher employee satisfaction and organizational performance). Furthermore, HR managers in Kulik and Bainbridge's study are more likely than line managers to suggest that HR will involve the line in more people management activities in the future.

Therefore, this paper provides an empirical investigation of the impact of empowerment of the line on HRM effectiveness in Malaysia and looks at the implications of the findings for both managers and practitioners. However, before proceeding to the analysis, the principal studies examining the effects of empowerment of the line as independent or dependent variable on various topics were first reviewed. This paper finishes with conclusions and implications.

The Problem Statement

Empowerment is important and necessary but still shows limited progress in practice. Empowerment, like many other popular management prescriptions, is tendered as universally applicable robust practice. Many questions about its efficacy including whether it will make HRM effective remains unanswered. Empowerment literature in general is psychological in nature aimed at the individuals in organizations. Researchers have associated empowerment with

positive outcomes such as employee effectiveness (Cohen and Ledford, 1994), commitment to quality (Howard and Foster, 1999), job satisfaction (Spreitzer, Kizilos, and Nason, 1997; Thomas and Tymon, 1994), and innovativeness (Hyatt and Ruddy, 1997; Spreitzer, Janasz, and Quinn, 1999) in the workplace. Nonetheless, empirical research about empowerment is not extensive and has a rather uneven focus, and in most cases is very limited to individual or group level of analysis. Empowerment such as the object of this study is even more limited. This is especially true in the area of empowerment of HRM responsibilities to the line managers.

Further, although some benefits and problems of empowerment are realized, the level of empowerment of the line managers in HR activities has not been systematically examined. Although the devolution of HR responsibilities from HR managers to line managers is both a growing and global trend, it is a relatively modest trend (Holt-Larsen and Brewster, 2003). To the best of the researcher's knowledge, empirical evidence on this topic is very limited and not very well established in Malaysia. In addition, a universalistic claim that empowerment is a prescription for all organizations all the time.

As mentioned previous section, the transformation from personnel management to HRM is necessary for Malaysian organizations. As Chew (2005) highlighted, although the role of the HR department and its importance is gradually expanding in most Malaysian firms, the general notion is that the HR department still plays largely an administrative role. Consistent with this argument, result from a more recent study involving 32 manufacturing companies in Malaysia by Long and Wan Khairuzzaman (2008) indicated that HR professionals are lacking in their capacity to play an important role as a strategic partner and agent for change. Recently, management scholars have suggested that the activities of HR managers are being reallocated and redesigned in conjunction with HR's new role as a strategic partner (Lawler and Mohrman, 2000; Ulrich, 1997b). If HR is going to become a strategic partner in today's organizations, some of the HR responsibilities will need to be shifted to line managers.

The Purpose of this Study

The purpose of this study is to examine the relationship between empowerment of the line and HRM effectiveness within large firms in Malaysia.

Research Questions

The following specific questions were addressed in this study:

1. Is there a positive relationship between empowerment of the line and the effectiveness of the HR roles?
2. Is there a positive relationship between empowerment of the line and the effectiveness of the HR contributions?

Past Empirical Studies on Empowerment of the Line and HRM Effectiveness

The following section contains relevant past works that provides the necessary background for this study.

Empowerment of the Line

In this paper, empowerment of the line is focused as independent predictor of HRM effectiveness. In research terms, empowerment of the line may be considered as independent or dependent variables. There exists some empirical support for this position.

Hazman Shah (1999) analyzed data from 200 Malaysian firms using a multiple linear regression approach to test a contingency model of line influence in HR decisions. He hypothesized positive relationships between intensity of competition, interfunctional cooperation, intensity of HR, and perceived importance of HR to organizational strategy and line influence in HR decisions, while the capacity of HR service was hypothesized as negatively related to line influence in HR decisions. Results supported only the positive relationship between interfunctional cooperation and perceived HR importance and line influence in HR decisions, and negative relationship between capacity of HRM service and line influence in HR decisions.

Budhwar (2000) investigated the determinants and variables which determine the degree of line involvement in HRM practices in the UK. Based on a large-scale study of a questionnaire survey and in-depth interviews, he utilized discriminant analysis using a stepwise method to partition UK organizations into high or low devolved. The study found that variables which uniquely influence the level of line involvement in HRM practices are the presence of unions, monitoring training through performance tests, systematically analyzing employees' training needs, and cost reduction HR strategy.

Johnson and Mouly (2002) examined the effects of size of the organizations on involvement of line managers in HR functions. A total of 531 New Zealand organizations from public and private sectors participated in the study. They found the involvement of line managers in HR functions is attributed to the preponderance of small organizations in New Zealand (i.e., which employ between 50 and 100 people).

Teo and Rodwell (2003) examined the relationships between strategic involvement, the level of devolution of operational HR activities, HR influence, strategic integration, and performance of public sector HR departments in Australia. A total of 145 HR managers and line managers from 34 agencies participated in the study and retained for the firm-level analysis. The analyses were carried out using the *Partial Least Square* latent path model, which showed that the devolution of the operational HR activities to line managers had an impact on the extent to which line managers' perceptions of the effectiveness of the HRM function.

Mayrhofer *et al.* (2004) collected and analyzed data from 20,688 companies in the private sector for-profit organizations with more than 200 employees from 18 European countries using a logistic regression analysis. Quasi-longitudinal data was used in their study. Devolvement was hypothesized as having positive relationship with organizational performance. However, they found no significant effects regarding the link between devolvement of HR responsibility to line management and organizational performance.

Andersen *et al.* (2007) examined the effect of SHRM practices on perceived firm financial performance. A total of 66 Australian firms participated in the study. The data was gathered through mailed questionnaires and based on a stratified random sample. Their survey research

finding indicated that devolvement of HRM was practiced to a moderate extent in the firms sampled. Using a correlation analysis, interestingly, they found a negative correlation between line management devolvement and perceived organizational performance. However, after controlling for firm size, the relationship between line management devolvement and perceived organizational performance was not statistically significant.

A study conducted by Perry and Kulik (2008) in the US on devolution and human resource managers' perceptions of people management effectiveness revealed a positive effect of devolution on perceived people management effectiveness. This effect was qualified by an interaction between devolution and line support. Unsurprisingly perhaps, they found this interaction revealed that providing line managers with training and support for their human resource responsibilities had a greater positive impact on perceived effectiveness in organizations that had not devolved (non devolvers) compared to those that had (devolvers).

Kulik and Perry (2008) analyzed data from 174 HR decision makers for industry sectors in the North America using a mediated regression analysis approach to investigate the effect of devolution on HR's strategic role and construed image. Results revealed that a devolution strategy had a positive effect on HR managers' perceptions of their unit's reputation among line managers. This effect was partially mediated by changes in the HR function. Specifically, devolution increased HR's involvement in the operation of business units and in the organization's strategic planning.

HRM Effectiveness

There has been a great deal of research on HRM effectiveness. There are a few studies have been conducted with multiple informants instead of only the HR managers (Han, Chou, Chao, and Wright, 2006; Teo and Crawford, 2005; Wright, McMahan, Snell, and Gerhart, 2001). Also, questionnaires survey approach was a widely used method in data collection process (e.g., Richard and Johnson, 2001; Wan, Kok, and Ong, 2002; Richard and Johnson, 2004; Perry and Kulik, 2008; Han et al., 2006). To date, there was one study examined the relationship between devolution and perceived people management effectiveness (Perry and Kulik, 2008), but it was conducted in US among 174 HR managers, a country that has been classified to be high on individualism and low on power distance (Hofstede, 1980). Furthermore, Perry and Kulik (2008) examined individual HR managers as their unit of analysis in their study rather than organization. The somewhat low number of relevant studies can be both explained and justified by the relative "newness" of the subject area (the related article was published by Perry and Kulik, 2008), and the fact that devolution of HRM responsibilities to the line managers constitutes one aspect of the empowerment concept. Thus, this study sought to expand such research in a different cultural setting, one that is characterized by lower individualism, higher uncertainty avoidance, and higher power distance.

Wright et al.'s Measure for HRM Effectiveness

In the context of this study, Wright *et al.*'s (2001) measure of HRM effectiveness which focuses on HR's effectiveness in performing various roles and HR's effectiveness of its contributions. The effectiveness of HR roles are captured the essence of the roles proposed by Ulrich (1997a). These roles also resemble the kinds of activities that comprise Huselid, Jackson, and Schuler, (1997) "strategic" HRM effectiveness. Specifically, Wright *et al.*'s (2001) measure it in terms of:

1. The “Strategic Partner” role focuses on HR’s participation in and influence over the formulation strategy.
2. The “Tailoring Practices” role highlighted the role of HR in strategy implementation. It deals with tailoring HR practices to support the business strategy once it is formulated.
3. “Providing HR Services” encompasses HR’s role in providing the basic services.
4. “Providing Change Consulting” refers to HR’s role in helping line executives to effectively manage cultural and organizational change.
5. “Developing Organization Skills and Capabilities” deals with HR’s role in identifying and/or developing critical organizational core competencies or capabilities.

The second aspect of HRM effectiveness measure is on its contributions, and this served as more of an overall evaluation of the function. The HR contributions component is evaluated on how the HR function was being run and how it was contributing to the firm on different dimensions (e.g., how HR contributed to the firm’s competitive position, bottom line, core competence, and human capital). These two aspects of HRM effectiveness has been used and validated in the past studies (Han *et al.*, 2006; Mitsuhashi, Park, Wright, and Chua, 2000; Wright, McMahan, Snell, and Gerhart, 1998, 2001).

The Present Study

This limited base of empirical studies indicates that there is a significant relationship between empowerment of the line managers in HR activities and HRM effectiveness. In this paper, the term empowerment of the line will refer to the involvement and gives responsibility to line managers in the execution and administration of HR activities rather than HR managers. Indeed, the study by Teo and Rodwell (2003) and Perry and Kulik (2008), albeit based upon empowerment of the line, demonstrate good support for the relationship between empowerment of the line and HRM effectiveness.

Thus, examining this relationship could be an important step toward understanding the linkages between empowerment of the line and HRM effectiveness. The following specific hypotheses were tested:

H1a: Empowerment of the line has a positive impact on the effectiveness of the HR roles.

H1b: Empowerment of the line has a positive impact on the effectiveness of the HR contributions.

Research Design

A mail survey approach was used in the study. Each firm was sent a survey packet which addressed to the HR manager that contained one copy of a survey questionnaire to the HR manager and two copies to the line manager. Each questionnaire was accompanied by a cover letter explaining the purpose of the study and a prepaid self-addressed envelope for the questionnaire to be returned directly to the researcher. HR manager was asked to complete the HR managers’ survey. Then, he/she was asked to distribute line manager’s questionnaire to the line manager. All questionnaires were coded to match to the individual organization so that the researcher could track responses and ensure that returned line manager and HR manager

questionnaires could be match to respective organizations. Following Teo and Rodwell (2003), in order to minimize the effect of common method variance, single respondent organizations were eliminated by only including those organizations for which the present study could obtain, at least, a matched pair from one HR manager and one line manager.

A total of 724 large firms were identified from the Federation of Malaysian Manufacturers' Directory as the population for this study. The criteria for inclusion as the population were large firms. Large firms normally have a formal organizational structure and differentiated with a high likelihood of HR departments for handling human resources (Tzafrir, 2005). Smaller companies very often do not even have something like a formal personnel department (Mayrhofer *et al.*, 2004). Small and medium enterprises in the services sectors are enterprises with full-time employees not exceeding 50 (SMIDEC, 2003). Thus, in the present study, the population is the large service firms that have 50 or more full-time employees. A total of 724 survey packets were sent to all firms in the population.

Returned questionnaires were from 142 firms. This represented a response rate of 20 per cent. This response rate is favorable to the response rate of other similar recent HRM studies that sampled of companies in Malaysia (e.g., Hazman Shah, 2002; Rozhan and Poon, 2000) and is considered reasonably adequate, given the low rate of response associated with mail surveys. A total of 34 questionnaires were not usable due to insufficiency and incomplete data either from HR manager or line manager. This resulted in only 108 complete set of questionnaires for final analysis.

Instruments

Demographic Questionnaire

HR managers were asked to indicate the type of organization, number of employees, and year of establishment.

Empowerment of the Line

The extent of empowerment of the line managers in HR activities was ascertained by examining the extent of transfer in the 17 HR areas covering recruitment and selection, training and development, performance appraisal, manpower planning, pay and rewards, motivation of staff, productivity issues, staff communication, union relations, design of jobs, flexibility of staff, quality initiatives, employee involvement, organizational development and change, staff welfare, disciplinary issue, and personnel relations. This categorization was adapted from an instrument by Hazman Shah (1999). The original instrument required respondents to identify the level of line influence to affect HR outcomes. The responses were captured on the scale of 1 to 7, with 1 indicating not empowered at all to 7 indicating empowered to a great extent.

HRM Effectiveness

HRM effectiveness was assessed by two dimensions (the effectiveness of the HR roles and the effectiveness of the HR contributions) from the scales developed by Wright *et al.* (2001). The present study measured the effectiveness of the HR function through how well the department is

performing in terms of the HR roles (5 items) and HR contributions (10 items). HR roles gauged the effectiveness of the HR function in terms of the roles “providing HR services”, “providing change consulting services”, “being a business partner”, “developing organization skills and capabilities”, and “tailoring practices to fit business needs”. The effectiveness of the HR roles were assessed on a seven-point scale with 1 (not meeting needs) to 7 (all needs met) scale. The effectiveness of the HR contributions were assessed by asking the respondents to rate their agreement with ten statements regarding HR’s contribution using 1=not at all to 7=to a great extent.

Results

Firm’s Profile

About 8.3 per cent (9) of the firms have between 50 to 100 employees, 31.5 per cent (34) between 101 and 250 employees, 19.4 per cent (21) firms had 251 to 500 employees, and the per cent of the firms with 501-1000 employees is 15.7 per cent (17). Twenty-five percent (27) firms had more than 1000 employees. Meanwhile, 4.6 per cent (5) of the firms sampled have been in business for less than 5 years. Additionally, about 33.3 per cent (36) of the sampled firms have been in business for more than 20 years. Therefore, there is a good mixture of old and new companies in the sample.

Factor Analysis of Empowerment of the Line

Empowerment of the line with 17 items was subjected to a principal components analysis. Varimax rotation was the choice of rotation selected. The overall MSA is .889 indicating sufficient intercorrelations and the Bartlett’s Test of Sphericity is significant. The total percentage of variance of extracted by these factors is 63.743 per cent. Only 10 items included in the final analysis after considering cross-loading and low communalities values. These items were then labeled as “empowerment of the line”.

Table 1
Factor analysis of empowerment of the line

Items	Factor
	F1
Performance Appraisal	<u>.744</u>
Manpower Planning	<u>.732</u>
Motivation of Staff	<u>.866</u>
Productivity Issues	<u>.809</u>
Staff Communication	<u>.850</u>
Design of Jobs	<u>.716</u>
Flexibility of Staff	<u>.727</u>
Quality Initiatives	<u>.871</u>
Employee Involvement	<u>.876</u>
Organizational Development & Change	<u>.769</u>
Eigenvalue	6.374
Percentage of Variance	63.743

Total Variance Explained	63.743
KMO Measure of Sampling Adequacy	.889
Approximate Chi-Square	809.363****

Note. $N = 108$. Items included for the respective factors are underlined for identification; **** $P < .001$.

Factor Analysis of HRM Effectiveness

HRM effectiveness was measured with two dimensions; the effectiveness of the HR roles and the effectiveness of the HR contributions. To further validate the underlying structure among the items, the 15-item measurement was subjected to a principal components analysis with Varimax rotation. Two factors were extracted from the Varimax rotation method (see Table 2), representing two dimensions of HRM effectiveness measure. The overall measure of Sampling Adequacy is .902 and the Barlett test of sphericity showed significance for the overall correlations within the correlation matrix. Two meaningful factors explained 68.386 per cent of the total variance. Eight items were loaded onto Factor 1. The original name the effectiveness of the HR contributions was retained. Meanwhile, four items were loaded onto Factor 2. It was labeled as the effectiveness of the HR roles.

Table 2
Factor analysis of HRM effectiveness

Items	Factors	
	F1	F2
FACTOR 1: The Effectiveness of the HR Contributions		
This department provides me with useful and timely information regarding HR issues.	<u>.709</u>	
This department has helped to enhance the firm's competitive position.	<u>.666</u>	.434
This department provides value-added contributions to the firm's bottom line.	<u>.734</u>	.410
This department contributes to building and/or maintaining the firm's core competence.	<u>.664</u>	.469
This department contributes to building the firm's employees/managers as a source of competitive advantage.	<u>.714</u>	.464
The policies, practices, and procedures coming from the HR department help front-line managers and employees in their jobs.	<u>.874</u>	
	<u>.877</u>	
The HR department has developed a well coordinated set of policies, practices, and procedures.	<u>.820</u>	
The HR policies, practices, and procedures help support the firm's business plan.		
FACTOR 2: The Effectiveness of the HR Roles		
Being a business partner.		<u>.779</u>
Developing organization skills and capabilities.		<u>.719</u>
Developing organization skills and capabilities.		<u>.788</u>
Tailoring practices to fit business needs.	.355	<u>.792</u>

Eigenvalue	6.754	1.452
Percentage of Variance	56.287	12.099
Total Variance Explained	56.287	68.386
KMO Measure of Sampling Adequacy	.902	
Approximate Chi-Square	928.807***	

Note. $N = 108$. Items included for the respective factors are underlined for identification; *** $P < .001$.

^a Factor loadings less than .30 have not been printed and items have been sorted by loadings on each factor.

Measure Reliabilities, Descriptive Statistics, and Intercorrelations

Table 3 presents the reliability, means, standard deviations, and correlations among the variables. Data analysis revealed acceptable reliabilities for the scales used in this study. The bivariate analysis shows that empowerment of the line is positively correlated to both the effectiveness of the HR roles and the effectiveness of the HR contributions. With respect to the two measures of HRM effectiveness, the effectiveness of the HR roles is very highly correlated with the effectiveness of the HR contributions.

Table 3
Reliabilities, descriptive statistics and correlations of measures

	Cronbach's Alpha	Mean	Std. Deviation	1	2
1. Empowerment of the Line	.935	5.091	0.910	1.000	
2. HRME—Roles	.825	4.834	0.882	.359**	
3. HRME—Contributions	.930	5.042	0.798	.473**	.604**

Multiple Regression Results

A multiple regression analysis was conducted using the HRM effectiveness as the criterion variable.

Table 4
Regression results between empowerment of the line and HRM effectiveness

Variable	HRM Effectiveness—HR Roles	HRM Effectiveness—HR Contributions
	Std Beta	Std Beta
Model Variable		
Empowerment of the Line	.373***	.480***
R^2	.209	.248
Adjusted R^2	.194	.234
R^2 Change	.139	.230
F Change	18.434	32.147

Note: ** $p < .05$, *** $p < .01$

Table 4 provides a summary of the regression analysis for empowerment of the line variable predicting HRM effectiveness. It can be seen that the R^2 is 20.9 per cent, whilst the value of the Adjusted R^2 is .194. The R^2 change is 13.9 per cent and was found to be significant ($p < .01$). This findings show that an additional 13.9 per cent of the variations in the effectiveness of the HR roles is explained by empowerment of the line. The proposed model is also adequate since the F-statistic is significant ($p = .00$). The Durbin-Watson index is at 2.111, which is within the acceptable range 1.5 to 2.5 (Coakes and Steed, 2003). It shows no auto-correlation problems detected in the model. It is also observed that, empowerment of the line variable ($\beta = .373$, $p < .01$) has positive relationship with the effectiveness of the HR roles. As such H1a is supported.

For the second dimension of the HRM effectiveness, R^2 is 24.8 per cent. In addition, the R^2 change (0.230) is significant. This implies that the additional 23.0 per cent of the variation in the effectiveness of the HR contributions is explained by the empowerment of the line. The Durbin-Watson index (1.937) shows that auto-correlation was not the problem. Furthermore, empowerment of the line is positively related to the effectiveness of the HR contributions ($\beta = .480$, $p < .01$). Thus, H1b is supported.

Conclusions and Implications

Strategic HRM that focused on the devolvement of HR practices to line managers is theorized to add value to organizational performance (Bowen and Ostroff, 2004; Ulrich, 1998). Although little previous literature investigated the relationship between empowerment of the line and HRM effectiveness, this study focused upon this relationship. The study's hypotheses are exclusively designed to see the effect of empowerment of the line on HRM effectiveness (the effectiveness of the HR roles and the effectiveness of the HR contributions).

This study found that empowerment of the line to be significantly and positively related to the effectiveness of the HR roles ($\beta = .373$, $p < .01$). Thus, this study has received support for 1(a) research hypothesis. The result implies that organizations interested in enhancing the effectiveness of the HR roles may emphasize the need for empowerment of the line. Earlier conceptualization of the effectiveness of the HR roles by Wright *et al.* (2001) covers the effectiveness of the HR function in terms of roles in providing HR services, providing change consulting services, being a business partner, developing organization skills and capabilities, and finally by tailoring practices to fit business needs. The devolution of HRM activities to line managers (Anderson *et al.*, 2007; Kulik and Bainbridge, 2006; Sheehan, 2005; Teo and Rodwell, 2003) is a useful means for achieving successful implementation of HRM policies and practices particularly the role played by the HR function. This is consistent with Teo and Rodwell (2003) who found that the devolution of the operational HR activities to the line managers has an impact on the line managers' perceptions of the effectiveness of the HR roles.

In addition to the significant relationship between empowerment of the line and the effectiveness of the HR roles described above, the present study also provided evidence on the significant and positive relationship between empowerment of the line and the effectiveness of the HR contributions. The effectiveness of the HR contribution is served as more of an overall

evaluation of the HR function (Wright *et al.*, 2001). Thus, the present study suggest that effective implementation of empowerment of the line practice should result in greater effectiveness of the HR contribution.

Limitations

There are a number of limitations that present opportunities for future research. First of all, this study was carried out in large service firms. One should thus be very cautious in generalizing the results. Further studies on this topic in other contexts are clearly desirable. Second, this study has not investigated how role of the HR department, HR competencies, and culture affect empowerment of the line and hence HRM effectiveness and organizational performance. Therefore, future studies should consider expanding the research model to take these aspects into account.

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The evaluation and ranking of hotel service quality factors by SERVQUAL and Fuzzy MCDM

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Key words: Hotel Service quality, SERVQUAL, AHP, Fuzzy MCDM, TOPSIS

Introduction

Tourism is said to be the fastest growing industry in the world over the past 50 years with no signs of slowing down in the 21st Century (Ramsaran-Fowdar, 2006). Thus, Hotel industry as a valuable firm, play a premium and vital role in image and economy of a country. Hotels can exhibit cultures, habits and ethics of that country.

Proving high quality service is increasingly recognized as a critical factor in the success of firms in the travel and tourism industry (Fick & Ritchie, 1991). Service quality has different effects to a business firm. As a matter of fact, Service quality impacts customer loyalty, satisfaction, and business performance (Hays & Hill, 2006). There are various tools for evaluating service quality, and choosing an appropriate model for a certain industry is necessary for an accurate evaluation. Quality models will discuss in second part.

Service quality can be regarded as a composite of various attributes. It not only consists of tangible attributes, but also intangible/subjective attributes such as safety, comfort, which are difficult to measure accurately. Different individual usually has wide range of perceptions toward quality service, depending on their preference structures and roles in process (service providers/receivers). To measure service quality, conventional measurement tools are devised on cardinal or ordinal scales. Most of the criticism about scale based on measurement is that scores do not necessarily represent user preference. This is because respondents have to internally convert preference to scores and the conversion may introduce distortion of the preference being captured (Tsaur & Chang & Yen, 2002).

Since service industry contains intangibility, perish ability, inseparability and heterogeneity, it makes peoples more difficult to measure service quality. Nowadays, the fuzzy set theory has been applied to the field of management science, like decision making (Hutchinson, 1998;

Viswanathan, 1999; Xia et al., 2000), however, it is scarcely used in the field of service quality (Tsaour et al., 2002).

Multi criteria Decision-making (MCDM) has proven to be an effective methodology for solving a large variety of multi criteria evaluation and ranking problems (Yen & Chang, 2009, p454).

Decision-making problems are the process of finding the best option from all of the feasible alternatives. In almost all such problems the multiplicity of criteria for judging the alternatives is pervasive. That is, for many such problems, the decision maker wants to solve a multiple criteria Decision-making (MCDM) problem (Chen, 2000, p1).

Since the judgments are usually vague rather than crisp, a judgment should be expressed by using Fuzzy sets which has the capability of represent in vague data. Some multi attribute evaluation methods such as AHP, ELECTRE, PROMETHEE, ORESTE, and TOPSIS can handle and solve this problem by integrating Fuzzy set theory. Among these methods, AHP uses a hierarchy of attributes and alternatives while the others do not. (Kahraman, et al, 2007)

The rest of this study is structured as follows: The first part describes important aspects for the assessment of service quality of hotel Industry and presents the evaluation framework and methodology which is used in this study. Next part discusses the procedure and results of empirical study which is evaluating and ranking of service quality in hotel industry in Yazd, Iran. The final results of the empirical study are presented and discussed in the final section. Implications and conclusions are also argued.

Literature review

Evaluation framework of evaluating hotel's service quality

This study applies several methods for evaluating service quality in hotels as shown in Fig. 1. First, we identified the evaluating hotel aspects and attributes with respects to ServQual method and its dimensions, after constructing the evaluation criteria hierarchy; we calculated the criteria weights by applying Analytic Hierarchy Process (AHP) method. The measurement of service quality corresponding to each criterion was conducted under the setting of fuzzy set theory. Finally, we conducted Technique for Order Preference by Similarity to Ideal Solution (TOPSIS) to achieve the final ranking results. The detailed descriptions of each step was elaborated in each of the following sub-section

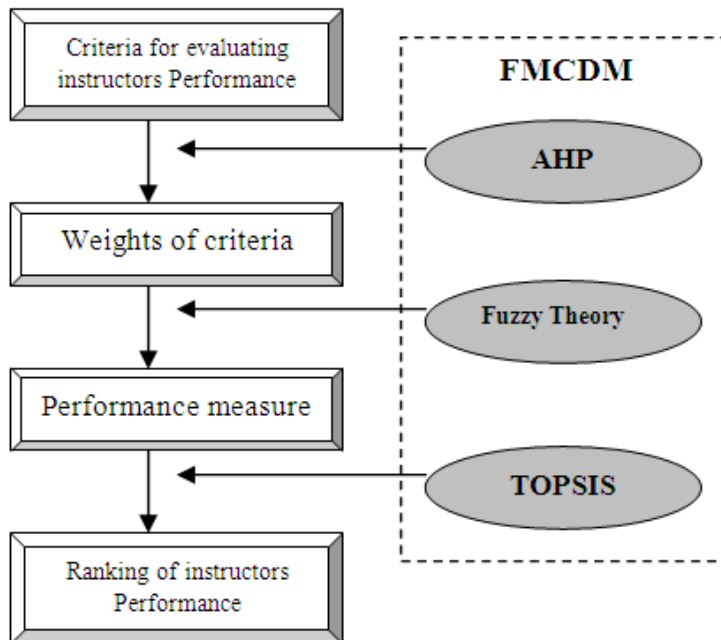


Figure 1: Evaluation framework of evaluating hotel service quality

Evaluation aspects and criteria

The typical multiple criteria evaluation problem focuses on a set of feasible alternatives and considers more than one criterion to determine a priority ranking for alternative implementation (Tsaur et al., 2002). Keeney and Raiffa (1976) suggest that five principles to be considered when criteria are being formulated: completeness, operational, decomposable, non-redundancy, and minimum size.

Different theoretical perspectives on service quality were developed during the 1980s. Gronroos distinguished two types of service quality: technical and functional quality. Technical quality refers to the delivery of the core service or outcome of the service (i.e. what is offered and received), while functional quality refers to the service delivery process, or the way in which the customer receives the service (i.e. how the service is offered and received) (Gronroos, C ,1982).

Lehtinen and Lehtinen discussed three distinct service quality dimensions: physical quality, interactive quality and corporate quality. Physical quality includes the physical aspects associated with the service such as the reception area and equipment. Interactive quality involves the interaction between the customer and the service personnel, while corporate quality includes the firm's image or reputation. From these earlier writings, it can be seen that the notion of service quality arises from a comparison of what the customers feel a seller should offer (i.e. customers' expectations) with the sellers' actual service performance (Parsuraman, A , 2000). This idea was supported by an exploratory research conducted by Parsuraman, A., Zeithaml, V.A. and Berry, L. L. (1985) with 12 focus groups of consumers in four service industries (retail banking, telecommunications, securities brokerage, product repair and maintenance). On the basis of this study, Parsuraman et al. defined service quality as an overall evaluation, similar to, but not the

same as, an attitude and refers to the degree and direction of discrepancy between customers' perceptions and expectations.

They also developed the SERVQUAL scale, an instrument which included five main service quality dimensions: tangibles (appearance of physical elements), reliability (ability to perform the promised service dependably and accurately), responsiveness (promptness and helpfulness), assurance (courtesy, credibility, competence) and empathy (easy access, good communications and customer understanding). Within each dimension, there were several items measured on a seven-point scale ranging from 'strongly agree' to 'strongly disagree' for a total of 22 items.

Though SERVQUAL has been generally robust as a measure of service quality, the instrument has been criticized on conceptual and methodological grounds. One of the main problems mentioned in the literature is the applicability of the five SERVQUAL dimensions to different service settings (Ramsaran-Fowdar, 2006). Some researchers argue that the instability of the dimensionality of SERVQUAL is probably due to the type of service sector under investigation (Babakus, E. and Mangold, W. G. 1989). Parsuraman et al concede though that the universality of the five dimensional structure of service quality remains in doubt and should be further researched (Parsuraman, A., Berry, L. L., Zeithaml, V. A. 1993).

Only a few studies have directly applied the service quality paradigms within the context of the hospitality industry (Bojanic, D. C. and Rosen, L. D. 1993, Saleh, F. and Ryan, C. 1991, Getty, G. M. and Thompson, K. N. 1994). For instance, Saleh, F. and Ryan, C. (1992) applied the SERVQUAL model to lodging services to test the five service quality gaps proposed by the gap model and the dimensionality of the SERVQUAL model as applied to hotel services. They used 33 attributes of hotel services identified in earlier lodging studies rather than the 22 items included in the original SERVQUAL model.

Therefore, research indicated that perceived service quality is contingent upon the type of service offering. This implies that one generic measure of service quality is inappropriate for all services. Previous studies have shown that SERVQUAL does not cover all dimensions of hotel services that are important to guests (Ramsaran-Fowdar, 2006).

Since qualitative research about the quality of lodging services and hotels has been somewhat scarce, further researches were done to identify sub-dimensions based on ServQual for this firm. One of these researches is "Developing a service quality questionnaire for the hotel industry in Mauritius, 2006" by Ramsaran-Fowdar, which is the prime source for our research. As shown in Table 1, Quality attributes in the hotel industry based on ServQual are revised and used as evaluation aspects and criteria.

Table 1: The evaluation criteria for hotel industry

Objectives	Attributes
------------	------------

Tangibility

C1: Convenient hotel location

D1	<p>C2: Neat and professional appearance of staff</p> <p>C3: Spaciousness, cleanliness and comfort of rooms</p> <p>C4: Attractive lobby, appealing interior/exterior hotel décor</p> <p>C5: Availability of High Quality restaurants</p> <p>C6: Image of the hotel</p>
Reliability	
D2	<p>C1: Performing the services at the time promised</p> <p>C2: Well-trained and knowledgeable staff</p> <p>C3: Experienced Staff with good communication skills</p> <p>C4: Staff performing services right the first time</p> <p>C5: Accuracy in billing, food orders</p>
Responsiveness	
D3	<p>C1: Willingness of staff to provide help promptly</p> <p>C2: Availability of staff to provide service</p> <p>C3: Quick check-in and check-out</p>
Assurance	
D4	<p>C1: Friendliness of staff</p> <p>C2: Courteous employees</p> <p>C3: Ability of staff to instill confidence in customers</p>
Empathy	
D5	<p>C1: Giving special attention to the customer</p> <p>C2: Availability of room service</p> <p>C3: Understanding the customers' requirements</p> <p>C4: Listening carefully to complaints and solving ability</p> <p>C5: Recognizing the hotel customer and loyalty program</p>

Analytic hierarchy process (AHP)

The AHP was first proposed by Thomas L. Saaty in 1980 (Saaty, 1980). For years it has been used in tourism planning, (Ryan, 1991; Moutinho & Curry, 1994) and in several areas of social management sciences.

The AHP is a popular technique often used to model subjective Decision-making processes based on multiple attributes. AHP technique is widely used in both individual and group Decision-making environments (Bolloju, 2001, p499).

The AHP weighting is determined by the evaluators who conduct pair-wise comparisons, by which the comparative importance of two criteria is shown. Furthermore, the relative importance derived from these pair-wise comparisons allows a certain degree of inconsistency within a domain. Saaty used the principal eigenvector of the pair-wise comparison matrix derived from the scaling ratio to determine the comparative weight among the criteria (Chiu, 2006, p1247).

In AHP, multiple pair-wise comparisons are based on a standardized comparison scale of nine levels which shown in Table 2 (Chen ,et al., 2009-b, p8458; yen &chang, 2009, p465).

Table 2: Nine-point intensity of importance scale and its description

Definition	intensity of importance
Equally important	1
Moderately more important	3
Strongly more important	5
Very Strongly more important	7
Extremely more important	9
Intermediate values	2,4,6,8

Let $C = \{C_j / j = 1, 2 \dots n\}$ be the set of criteria. The result of the pair wise comparison on n criteria can be summarized in an (n- n) evaluation matrix A in which every element a_{ij} ($i, j = 1, 2, \dots, n$) is the quotient of weights of the criteria, as shown:

$$A = \begin{bmatrix} a_{11} & a_{12} & \dots & a_{1n} \\ a_{21} & a_{22} & \dots & a_{2n} \\ \vdots & \vdots & \ddots & \vdots \\ a_{n1} & a_{n2} & \dots & a_{nn} \end{bmatrix}, a_{ii} = 1, a_{ji} = 1 / a_{ij}, a_{ij} \neq 0$$

At the last step, the mathematical process commences to normalize and find the relative weights for each matrix. The relative weights are given by the right eigenvector (w) corresponding to the largest Eigen value (λ), as: (Dag deviren & et al, 2009, p8143)

$$Aw = \lambda_{\max} w$$

If the pair wise comparisons are completely consistent, the matrix A has rank 1 and $\lambda = n$. In this case, weights can be obtained by normalizing any of the rows or columns of A (Wang and Yang, 2007)

Fuzzy set theory

To deal with vagueness of human thought, Zadeh (1965) first introduced the fuzzy set theory, which was oriented to the rationality of uncertainty due to imprecision or vagueness. A major contribution of fuzzy set theory is its capability of representing vague data (Kahraman et al., 2003, p385).

There are two main characteristics of fuzzy systems that give them better performance for specific applications:

1. Fuzzy systems are suitable for uncertain or approximate reasoning, especially for the system with a mathematical model that is difficult to derive; and
2. Fuzzy logic allows decision-making with estimated values under incomplete or uncertain information (Kahraman et al, 2007).

Let X denotes a universal set. Then a fuzzy subset of X is defined by its membership function: $\mu_{\bar{A}} : x \rightarrow [0,1]$ - which is assigned to each element $x \in X$ a real number $\mu_{\bar{A}}(x)$ in the interval $[0, 1]$, where the value, of $\mu_{\bar{A}}(x)$ at x represents the grade of membership of x in \bar{A} . Thus, the nearer the value of $\mu_{\bar{A}}(x)$ is unity, the higher the grade of membership of x in \bar{A} (Sakawa, 2002, p196).

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Triangular fuzzy numbers and Linguistic variables

TFN is a special type of fuzzy number with three parameters, each representing the linguistic variable associated with a degree of membership of 0 or 1. Since it is shown to be very convenient and easily implemented in arithmetic operations, the TFN is also commonly used in practice (Liou & Chen, 2006, p931)

A triangular fuzzy number \tilde{m} is defined by a triplet (a, b, c) . The membership function μ_m of \tilde{m} is given by (Chamodrakas & et al, 2009, p7410):

$$\mu_{\tilde{m}} = \begin{cases} \frac{x-a}{b-a} & (a \leq x \leq b) \\ \frac{c-x}{c-b} & (b \leq x \leq c) \end{cases}$$

The algebraic operation for the triangular fuzzy number can be displayed as follows: (Chiu, 2006, p1248; Abdolvand et al., 2008, p374)

- Addition of a fuzzy number \oplus

$$(L_1, M_1, U_1) \oplus (L_2, M_2, U_2) = (L_1 + L_2, M_1 + M_2, U_1 + U_2) \quad (1)$$

- Multiplication of a fuzzy number : \otimes

$$(L_1, M_1, U_1) \otimes (L_2, M_2, U_2) = (L_1 L_2, M_1 M_2, U_1 U_2) \quad (2)$$

- Any real number k:

$$K(L, M, U) = (KL, KM, KU) \quad (3)$$

- Subtraction of a fuzzy number \ominus

$$(L_1, M_1, U_1) \ominus (L_2, M_2, U_2) = (L_1 - L_2, M_1 - M_2, U_1 - U_2) \quad (4)$$

- Division of a fuzzy number

$$(L_1, M_1, U_1) / (L_2, M_2, U_2) = (L_1 / L_2, M_1 / M_2, U_1 / U_2) \quad (5)$$

- Average of fuzzy number :

$$A_{ave} = (A_1 + A_2 + \dots + A_n) / n \quad (6)$$

$$A_{ave} = [(L_1 + \dots + L_n) + (M_1 + \dots + M_n) + (U_1 + \dots + U_n)] / n$$

The concept of a fuzzy number plays a fundamental role in formulating quantitative fuzzy variables. These are variables whose states are fuzzy numbers. When, in addition, the fuzzy numbers represent linguistic concepts, such as very small, small, medium, and so on, as interpreted in a particular context, the resulting constructs are usually called linguistic variables (Klir & Yuan, 1995, p102).

Fuzzy sets have vague boundaries and are therefore well suited for discussing such concepts as linguistic terms (such as “very” or “somewhat”) or natural phenomena (temperatures) (Friedlob & Schleifer, 1999, p133).

Variables, whose values are given in linguistic terms, i.e. words, sentences, etc, are called linguistic variables (Chen, 2001; Lin & Chang, 2008).

Each linguistic variable the states of which are expressed by linguistic terms interpreted as specific fuzzy numbers is defined in terms of a base variable, the values of which are real numbers within a specific range. A base variable is a variable in the classical sense, exemplified by any physical variable (e.g., temperature, pressure, speed, voltage, humidity, etc.) as well as any other numerical variable, (e.g., age, interest rate, performance, salary, probability, reliability, etc.). In a linguistic variable, linguistic terms representing approximate values of a base variable, germane to a particular application, are captured by appropriate fuzzy numbers (Klir & Yuan, 1995, p102)

Defuzzification

The result of fuzzy synthetic decision of each alternative is a fuzzy number. Therefore, it is necessary that the nonfuzzy ranking method for fuzzy numbers be employed during service quality comparison for each alternative. In other words, Defuzzification is a technique to convert the fuzzy number into crisp real numbers; the procedure of defuzzification is to locate the Best Nonfuzzy Performance (BNP) value (Tsuar et al., 2002, p110).

There are several available methods to serve this purpose. Mean-of-Maximum, Center-of-Area, and a-cut Method are the most common approaches. This study utilizes the Center-of-Area method due to its simplicity and does not require analyst's personal judgment (Abdolvand et al., 2008, p375).

The defuzzified value of fuzzy number can be obtained from Equation (7).

$$TFN = (L, M, U) \tag{7}$$

$$BNF = [(U - L) + (M - L)] / 3 + L$$

Topsis

The TOPSIS (Technique For Order Performance by Similarity to Ideal Solution) was first developed by Hwang & Yoon (1981). According to this technique, the best alternative would be the one that is nearest to the positive-ideal solution and farthest from the negative ideal solution (Ertugrul & Karakasoglu, 2007). The positive-ideal solution is a solution that maximizes the benefit criteria and minimizes the cost criteria, whereas the negative ideal solution maximizes the cost criteria and minimizes the benefit criteria (Wang & Elhag, 2006). In short, the positive-ideal solution is composed of all best values attainable from the criteria, whereas the negative ideal solution consists of all worst values attainable from the criteria (Wang, 2007). There have been lots of studies in the literature using TOPSIS for the solution of MCDM problems. (Chen, 2000; Chu & Lin, 2002; Wang et al., 2009; Boran et al., 2009).

Take the objective space of the two criteria as example which is indicated in Fig. 2, A^+ and A^- are, respectively, the ideal solution and negative ideal solution, and alternation A1 is shorter in distance in regard to the ideal solution (A^+) and negative ideal solution (A^-) than alternatives A2: As a matter of fact, the ups and downs of these two alternatives are beyond comparison, only

TOPSIS has defined such “relative closeness” so as to consider and correlate, as a whole, the distance to the ideal solution and the negative ideal solution (Tsuar et al, 2002, p111).

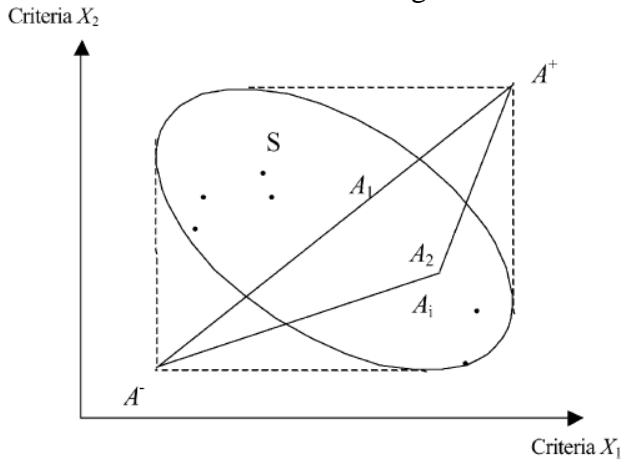


Figure 3: The objective space of the two criteria, the distance between idea solution and negative ideal solution for each alternative.

The calculation processes of the method are as following: (Tsuar et al, 2002, p111)

- Step 1: Establish the normalized performance matrix:

The purpose of normalizing the performance matrix is to unify the unit of matrix entries. Assume the original performance matrix is

$$x = (x_{ij}) \quad \forall_{i,j} \quad (8)$$

where x_{ij} is the performance of alternative i to criterion j .

- Step2: Create the weighted normalized performance matrix

TOPSIS defines the weighted normalized performance matrix as:

$$\begin{aligned} V &= (V_{ij}) \quad \forall_{i,j} \\ V_{ij} &= w_j \times r_{ij} \quad \forall_{i,j} \end{aligned} \quad (9)$$

where w_j is the weight of criterion j .

- Step3: Determine the ideal solution and negative ideal solution

The ideal solution is computed based on the following equations:

$$A^+ = (\max V_{ij} / j \in J), (\min V_{ij} / j \in J'), i = 1, 2, \dots, m \quad (10a)$$

$$A = (\min V_{ij} / j), (\min V_{ij} / j \in J'), i = 1, 2, \dots, m \quad (10b)$$

Where

$j = \{j = 1, 2, \dots, n/ j \text{ belongs to benefit criteria}\}; j = \{j = 1, 2, \dots, n/ j \text{ belongs to cost criteria}\};$

- Step4: Calculate the distance between idea solution and negative ideal solution for each alternative:

$$S_i^+ = \sqrt{\sum_{j=1}^n (V_{ij} - V_j^+)^2} \quad i = 1, 2, \dots, m \quad (11)$$

$$S_i^- = \sqrt{\sum_{j=1}^n (V_{ij} - V_j^-)^2} \quad i = 1, 2, \dots, m \quad (12)$$

- Step5: Calculate the relative closeness to the ideal solution of each alternative

$$C_i^+ = \frac{S_i^-}{S_i^+ + S_i^-} \quad i = 1, 2, \dots, m \quad (13)$$

where $0 \leq c_i^* \leq 1$ that is, an alternative i is closer to A_i^* as C_i^* approaches to 1.

- Step6: Rank the preference order

A set of alternatives can be preference ranked according to the descending order of C_i^* .

Empirical study of hotel service quality

In an effort of conducting the survey, 50 questionnaires were distributed between hotel managers and tourist guides in Yazd, Iran. Out of the 50 surveys, 30 were returned for a return rate of 60%. We used AHP method based on criteria in table 1 for evaluating hotel service quality. The results are shown in Fig. 4.

As shown in Fig. 4, responsiveness and reliability are the most important dimensions among ServQual five dimensions. The impact of these two dimensions is considered to be the most valuable among other in hotel industry.

As shown in Fig. 4, reliability got 0.262 out of 1 and responsiveness got 0.258 out of 1. The rest of dimensions in order of high priority are: Assurance, empathy and tangibility. The sub dimension priorities are also calculated and shown in figure 4 (L stands for for Local score of sub

dimension in a particular dimension and G is for Global score of a sub dimension among all sub dimensions).

Willingness of staff to provide help promptly and Staff performing services right the first time are the most important sub dimensions among all 22 different sub dimensions.

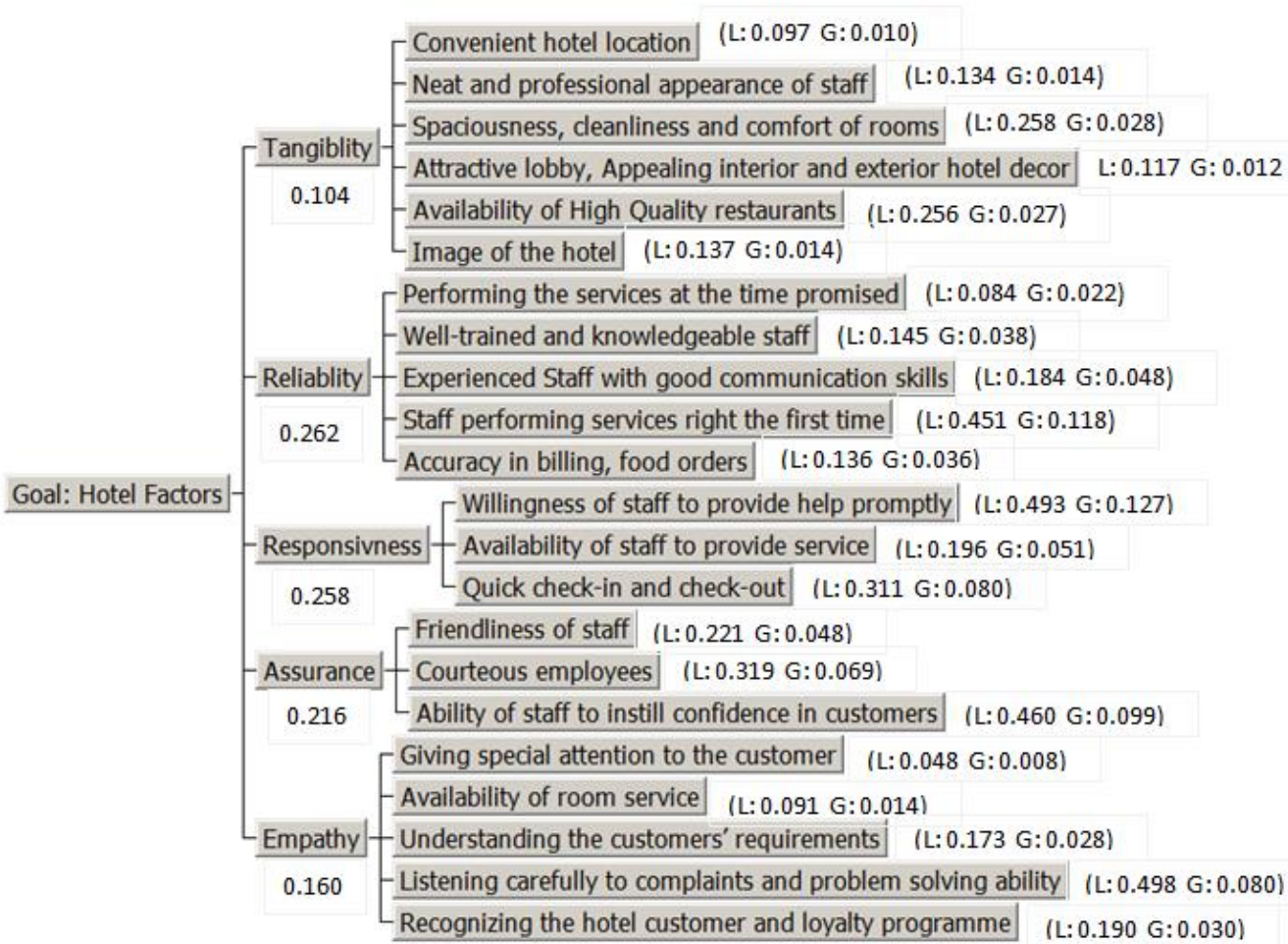


Figure4. Weights of the hotel service criteria.

Another questionnaire was developed by fuzzy approach including five linguistic terms which were strongly disagree, disagree, fair, agree, strongly agree. In order to determine the fuzzy range for each term, responders were asked to specify the range from 1 to 100 corresponding to each linguistic term.

We used the opportunity to have the results of two different kinds of hotels. One of the chosen hotels was a modern hotel (A) and the other was a traditional one (B). Both of them were chained 4 star hotels and located in Yazd, Iran and have a very near share of the local market. 60 questionnaires were distributed between customers of these hotels. Out of the 60 surveys, 50 were returned for a return rate of 83%. The fuzzy results of these two hotels are shown in table 3.

Service quality evaluation criteria	Hotel A	Hotel B
C1	(53.05,68.83,80.27)	(60.00,65.80,70.71)
C2	(52.36,70.26,73.94)	(53.57,63.71,74.28)
C3	(67.89,80.58,93.95)	(68.46,80.00,91.54)
C4	(67.63,81.71,93.68)	(48.66,59.30,70.00)
C5	(17.63,34.45,46.32)	(54.00,65.16,76.33)
C6	(54.69,64.84,80.00)	(52.71,63.14,73.14)
C7	(39.47,44.79,59.47)	(63.00,71.63,82.00)
C8	(44.72,57.64,70.53)	(64.00,74.50,85.00)
C9	(46.58,57.55,73.68)	(64.00,71.50,83.00)
C10	(55.79,70.00,83.95)	(66.25,75.78,85.31)
C11	(35.52,47.29,56.31)	(64.06,71.25,83.40)
C12	(43.68,57.10,70.00)	(62.18,71.56,80.93)
C13	(52.63,65.05,77.36)	(52.05,60.73,69.41)
C14	(68.68,80.45,92.10)	(54.11,62.94,70.59)
C15	(36.05,50.92,63.68)	(55.81,60.15,70.29)
C16	(53.62,65.58,77.89)	(57.05,63.03,73.00)
C17	(35.53,46.84,58.15)	(49.41,58.82,68.23)
C18	(44.74,58.18,64.21)	(55.88,65.29,74.70)
C19	(55.78,65.81,78.68)	(40.00,56.76,65.88)
C20	(38.95,52.24,61.84)	(54.41,63.68,72.74)
C21	(33.94,48.42,56.58)	(49.70,58.09,67.65)
C22	(26.58,33.42,47.10)	(53.25,62.20,71.18)

Each 22 criteria were asked from responders and Averages of fuzzy numbers were calculated using center aria method (as Eq. (6)).

Table 3: Fuzzy service quality measures of hotels

There are several available methods to defuzzify the numbers calculated in table 3. As argued before, the defuzzified value of fuzzy number can be obtained from Eq. (7).

The results of defuzzified values are shown in Table 4. The best result of each criteria among two hotels are showing with *. These values are now crisp and ready for using with TOPSIS. As shown in table 4, Hotel A is better in physical aspect and criteria whereas Hotel B is better in assurance and reliability aspect. In continue, we use TOPSIS to calculate the distance of hotels with ideal solution. We use the weight of each criterion calculated in AHP and shown in table 2, and crisp numbers which calculated in table 4 to measure the overall score of each hotel. Results are shown in table 5.

Service quality evaluation criteria	Hotel A	Hotel B
C1	67.38*	65.50
C2	65.52*	63.85
C3	80.81*	80.00
C4	81.01*	59.32
C5	32.80	65.16*
C6	66.51*	62.99
C7	47.91	72.21*
C8	57.63	74.50*
C9	59.27	72.84*
C10	69.91	75.78*
C11	46.37	72.90*
C12	56.93	71.55*
C13	65.01*	60.73
C14	80.41*	62.54
C15	50.22	62.10*
C16	65.37*	64.36
C17	46.84	58.82*
C18	55.71	65.29*
C19	66.76*	54.21
C20	51.01	63.68*
C21	46.31	58.48*
C22	35.70	62.21*

Table 4: overall service quality evaluation for hotels

Rank	Hotel	Similarity to Ideal Solution
1	B	0.72342
2	A	0.27658

Table 5: Final ranking of hotels

In overall overview, we use AHP method in obtaining criteria weight, and apply TFN to assess the linguistic ratings given by the evaluators. By using TOPSIS, we aggregate the weight of evaluate criteria and the matrix of performance to evaluate the two hotels performance, the results of evaluation can be seen in table 8. In this way, we calculated the similarity to Ideal solution by TOPSIS.

Conclusions and implications

Upon results of these methods, there would be an opportunity to evaluate, measure and rank all aspects of service quality in hotel industry. The most concerned aspects for customers and areas that hotel industry managers have to invest in order to increase customer satisfaction are suggested as below.

Customers are more conscious of staff performance than physical layout of hotels. Investing on developed staffs is strongly proposed. Due to our results, ability of staffs to instill confidence in customers is also a vital key to success. As customers are the one who define the boundaries of quality of service, instilling confidence increase loyalty and trust of them and has its own revenues for hotels. Quick check-in check-out is still a crucial issue in hotel industry which is important for customers.

We use the fuzzy approach on vague objects such as the satisfaction of services in hotel industry. This helps us to have a better comparison based on linguistic terms which are more common.

In this study, the membership function to measure the linguistic variables was used. Therefore, the fuzzy logic, thinking and results of the fuzzy approach are better than the traditional statistic approach.

This study possesses a few limitations. Firstly, our survey respondents were selected among limited hotel managers and hotel industry specialist. This may raise questions regarding representativeness of preference of hotels, especially in the other countries based on their progresses in this industry which is not comparable with Iran. It is strongly advised to consider the size and dimensions of this research before mapping it as a general description in hotel industry.

For further researches, we recommend to use fuzzy AHP and fuzzy TOPSIS for more punctual answers instead of using fuzzy numbers for linguistic terms.

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Managerial coaching: A practice-theory based study of control and support

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INTRODUCTION

Understanding how managers can support and instruct frontline employees in their marketing efforts at customer level has been a key research endeavour in service management. A critical issue is how managerial practices such as workplace coaching create value for those involved. When instructors and frontline employees enter into a workplace coaching activity they also enter into a specific set up of roles—e.g. acting as a coach and acting as a client. The outcome of this interaction need to be valuable for both the frontline employee (the client) and the instructor (the coach) having in mind the objectives of the service organization as well as the expectations of customers. Basically, it is an issue of value formation in this coach-client interaction.

Conceptually, research distinguishes between two major types of value formation. The first is *non-interactive value formation* which holds that value is produced by one actor and received by another—value is conceptualized as *exchanged* (Alderson, 1957; Bagozzi, 1975; Hunt, 1976). The second is *interactive value formation* which stipulates that value is *co-created* during the *interaction* between different agents (see recent conceptualizations of value co-creation in Prahalad and Ramaswamy, 2004; Ramírez, 1999; Vargo and Lusch, 2004; Echeverri and Skålen, 2011)³. We argue in line with this that workplace coaching should be viewed as an interactive, mutually produced phenomena. Both the coach and the client contribute to each others actions.

In this paper, the aim is to outline a framework that explains how interactive value formation in workplace coaching takes place in practice. It is argued that such a framework is lacking in service management and marketing. Key reasons for this can be found in two research limitations in previous research. The first concerns the lack of knowledge of how interactive value formation actually takes place in practice. A major part of previous research is conceptual and abstract. Empirical research has not studied micro practices of interactive value formation, including contexts such as workplace coaching. This makes previous research poor in terms of theoretically explaining and practically guiding managerial efforts of coaching. The second limitation concerns the abundance of positive, as well as the relative lack of negative, accounts of

interactive value formation in the literature (Bonsu and Darmody, 2008; Cova and Dalli, 2009, Zwick *et al.*, 2008). We argue that this resonates poorly with frontline employees' experiences of being subjected to coaching activities in the workplace. Interactive value formation is not only linked to positive outcomes and connotations. Accordingly, both the upside and the downside of coaching interactions need to be explained and accounted for using an interactive value formation framework.

In order to overcome these two limitations, a detailed empirical study of interactions between instructors (coachers) and frontline employees of a Swedish public transport organization are drawn on. Theoretically, the study is based on *practice theory*, which helps us to illuminate and analyze the micro practice of interactive value formation in workplace coaching. In particular, we draw on practice theory as elaborated on in previous marketing and management research, which has begun to address the above-noted limitations (Schau *et al.*, 2009; Skålén, 2009; 2010; Warde, 2005; Echeverri and Skålén, 2011).

The empirical study and our theoretical orientation enable the outlining of a framework that explains interactive value formation in practice. More specifically, the paper employs the dynamic nature of coaching interaction and identifies six interaction value practices in coaching—checking, questioning, defusing, mirroring, legitimizing, and picturing. Further, it assumes that these interaction value practices can be both value co-creating and value co-destructing. It also argues that these six practices are made up of specific elements of practices. Drawing on Schau *et al.* (2009), these elements are discussed in terms of procedures, understandings, and engagements that make it possible to theorize how interactive value formation in coaching takes place and how value is inter-subjectively assessed by agents. More specifically, the paper suggests that value is formed in interaction and derives from coachers and clients drawing on congruent (in the case of value co-creation) and incongruent (in the case of value co-destruction) elements of practices. It argues, furthermore, that the relationship between interaction value practices, elements of practices, and dimensions of interaction value practices is associated with four types of *praxis*—characteristic patterns of interaction between coach and client: reinforced coaching; reduced coaching; recovered de-coaching; and reinforced de-coaching.

THEORETICAL BACKGROUND

In this section, mainstream research into interactive value formation is reviewed, discuss the limitations of this research, and outline a framework based on practice theory that is drawn on to address these limitations.

Interactive value formation research

Above, two major types of value formation are distinguished: interactive and non-interactive. These two types correspond with the two major views of conceptualizing value in management and marketing theory. The first of these is the exchange view of value. This view is associated with non-interactive value formation and has dominated conceptualizations of value in marketing and management research (Bagozzi, 1975; Hunt, 1976; Alderson, 1957). According to this view, value; is embedded in the products, services or actions that focal agent deliver. In a workplace coaching context this is unidirectional education or instruction from coach to client.

The exchange view of value has been challenged by another view which we will refer to as the interaction view.⁴ This view is associated with interactive value formation and stipulates that value is co-created during the interaction between agents (Prahalad and Ramaswamy, 2004; Ramírez, 1999; Vargo and Lusch, 2004; Echeverri and Skålén, 2011). In contrast to conceptualizing value as embedded, this view holds that agents interactively co-create value in collaboration. This implies that value is co-created, realized, and assessed in a social process and context. Value is subjectively assessed from one of the two agents' points of view. The conceptualization of value underlying interactive value formation and the corresponding interaction view of value resonate with Holbrook's (2006) definition of value. Holbrook takes the stance that value resides in actions and interactions and that it is collectively produced but subjectively experienced. More precisely, Holbrook (2006: 212) refers to value as an 'interactive relativistic preference experience'. This definition implies that value; is a function of the interaction between subjects, or a subject, and an object; is contextual and personal; is a function of attitudes, affections, satisfaction, or behaviourally-based judgments; and resides in an experience. This perspective thus holds that value is a function of an individual's articulated set of preferences.

This paper contributes to research on interaction value in workplace coaching and specifically how it is formed. The paper is informed by service management research wherein the idea that value in service settings is co-created during interaction between agents has been key ever since the formation of the research stream. In service management, the understanding of co-creation as initially specified in service marketing has recently been elaborated on in work on the service-centred view conducted by Lusch and Vargo (2006; Lusch *et al.*, 2007; Vargo and Lusch, 2004; 2008, see also Etgar, 2008; Jaworski and Kohli, 2006; Kalaighnam and Varadarajan, 2006). Work on the boundary between marketing and strategic management has also contributed to this elaboration (Prahalad and Ramaswamy, 2004; Normann and Ramírez, 1993; Ramírez, 1999). The service-centred view is articulated using the distinction between 'operand resources', that is 'resources on which an operation or act is performed', e.g. 'land, animal life, plant life, minerals and other natural resources', and 'operant resources', which are most prominently the 'skills and knowledge' that are 'employed to act on operand resources (and other operant resources)' (Vargo and Lusch, 2004:2). It argues that operant resources are key to value co-creation and critiques the exchange view of value for emphasizing operand resources as central to the value formation process. According to the service-centred view, the knowledge and skills located within the organization—e.g. the competence of the employees, shared cultures, information systems, and market information—and in the environment—e.g. customer skills, national cultures, and institutional frameworks—drive value formation. The implication is that value formation is seen as interactively co-created by operant resources acting on operand resources or by operant resources in collaboration, and that value is conceptualized as realized in action: it is only when the knowledge and skills, or the operant resources, are active or activated that value co-creation takes place.

This view of interaction value is also in line with recent conceptualizations in service encounter research that emphasizes that service encounters (internal as well as external service encounters) are co-creation entities whereby the actors mutually contribute to the realization of the service. Oliver (2006) explores conceptually (but not empirically) the dynamics underlying this symbiosis in terms of mutual satisfaction and bidirectionality, the latter referring to the assessment and fulfilment of the other party's needs. According to this view, both actors are obliged to exceed

the other's expectations of them, i.e. the verbal and nonverbal communication of clear mutual expectations regarding appropriate requests. Value, in this sense, is interactional, a reciprocal action, even if the power balance between the parties is more or less asymmetric.

This conceptual framework is argued to be valid also for internal service relations such as interactions between instructor-frontline employees. The way these interactions are formed is an issue *per se*. Utterly, service efforts in this relation have potential effects for interactive value at end-customer level.

Limitations of the interaction view of value formation

The aim of this paper is to outline a framework that explains how interactive value formation takes place in workplace coaching. In relation to this aim, two limitations in previous research are identified. The first limitation concerns the fact that the interactive value formation frameworks put forward are not based on systematic empirical research. Rather, they are conceptual (e.g. Vargo and Lusch, 2004) or draw on anecdotal data (e.g. Prahalad and Ramaswamy, 2004). Sound empirical studies do exist, e.g. Chandon *et al.* (1997) that there is a dyadic perspective on the dimensions of service encounters and Echeverri and Skålén's (2011) empirical work on value co-destruction. See also Skålén (2010) who critically analyse how service marketing and management practices affect service firms and their members, arguing that it is not self-evident that employees make the idea of customer-orientation through coaching a part of their self-understanding. It cannot be taken for granted that individuals choose to attribute such a discourse central to their work (Dean, 1999) even if it is nurtured by discourse and coaching activities, due to the fact that subjectivity arises as an interaction between discourse and human agency (Skålén, 2010). The bulk of previous research does not capture the managerial practices underpinning interaction value in different service relations, internally or at the boundary of the organization. In this paper we address the need for frameworks that explain how interactive value formation takes place in the practice of workplace coaching. Initiating such an articulation requires that the point of departure be taken in a systematic (qualitative) empirical study of such coaching practice.

The second research limitation that we identify in the research into interaction value in service relations concerns the fact that what can be referred to as the downside of value formation is not accounted for. The literature on interaction value is linked to fairly positive connotations—the key notion of co-creation as such is a clear example of this. Prahalad and Ramaswamy (2004) occasionally warn that interactions with providers may sometimes be perceived negatively by customers. When referring to one particular case, for instance, they infer that 'not everyone enjoys such an interactive co-creation process...Nor are all co-creation experiences positive' (Prahalad and Ramaswamy, 2004: 21). A recent exception is Echeverri and Skålén (2011) who elaborate on the concept value co-destruction, though their study focus on the provider-customer interaction, which is not the focus in this paper. In sum, the main impression we get from the literature is that engaging in interactive value formation processes is conceived as unproblematic for the parties involved. Employees are told what to do and assumed to do it accordingly. Along with critical studies of value co-creation (Bonsu and Darmody, 2008; Cova and Dallı, 2009, Zwick *et al.*, 2008), we argue that this is an unrealistic conception. However, unlike these critical studies, the present paper aims to outline a framework that explains how interactive value formation takes place in a workplace coaching setting.

Thus, a framework that explains how interactive value formation takes place in coaching practice needs to be informed by accounts of both the up-side and the down-side of the practice of interactive value formation and outline the dynamics of the interplay. In line with Plé and Chumpitaz Cáceres (2010) and Echeverri and Skálén (2011), we see reasons to suggest a distinction between the co-creation of value and the co-destruction of value during interactive value formation. While co-creation refers to the process whereby agents collaboratively create value, co-destruction refers to the collaborative destruction, or diminishment, of value by providers and customers. Thus, the co-destruction of value, like the co-creation of value, is likely to be an integral part of the interaction between instructor and frontline employee. The paper specifies the notion of co-destruction of value and uses it as a basis for outlining the framework depicting how interactive value formation takes place in coaching practice. However, unlike previous research into value co-destruction (Plé and Chumpitaz Cáceres, 2010), this paper draws on a systematic empirical study and builds on marketing and management research informed by practice theory, which we turn to next.

Practice Theory

Practices

When studying interaction between instructors and frontline employees, from the perspective of practice theory, the point of departure is the observable interactional practice itself (Holt, 1995; Schau *et al.*, 2009; Warde 2005). There is a particular focus on *practices*: the key concept of practice theory (Duguid, 2005; Reckwitz, 2002). Practice theory holds that action is only possible and understandable in relation to common and shared practices and that social order is constituted by practices (Bourdieu, 1977; Foucault, 1977; Giddens, 1984). Practice theories thus conceive of organizations as constituted by the shared practices which actors draw on to act and interpret other actors' actions (Orlikowski, 2007; Schatski, 2006).

Jarzabkowski and Spee (2009: 70), in an overview of practice-theory informed strategy research define strategy practices as shared 'social, symbolic and material tools through which strategy work is done'. According to Chia (2004: 32), practices are 'background coping skills' which actors unconsciously draw on in order to manoeuvre in everyday life. Warde (2005) argues that practices comprise a temporally unfolding and spatially dispersed nexus of behaviours that include practical activities, performances, and representations or talk. Practices are, thus, combinations of mental frames, artefacts, technology, discourse, values, and symbols (Orlikowski, 2007; Schatski, 2006). A particular combination of these different building blocks constitutes practices which, for example, can be 'routinized ways in which bodies are moved, objects are handled, subjects are treated, things are described and the world is understood' (Reckwitz, 2002: 250). Following practice theory, we thus conceive of practices as background coping skills that simultaneously limit and enable interactions, here between instructor and frontline employee.

A key research endeavour in this study will be to identify which practices these actors draw on in order to co-create and co-destruct value when interacting with each other. We will refer to these practices as interaction value practices. In this regard, the present paper will elaborate on Schau *et al.* (2009) who, in their practice-theory informed study of value creation in web-based communities, identified 12 practices based on data concerning interactions between consumers on web forums. In another practice-theory informed study the focus was on provider-customer

interactions and five practices was identified (Echeverri and Skålén, 2011). This rich palette of practices identified in different contexts is, however contextually limited. Thus, the contexts under study in these studies are particular and do not include internal interactions between instructors and frontline employees.

Drawing on previous practice theory research (Duguid, 2005; Schatzki, 1996; Warde, 2005), Schau *et al.* (2009) argue that practices have a common anatomy consisting of the following parts: '(1) *procedures*—explicit rules, principles, precepts, and instructions, called “discursive knowledge”; (2) *understandings*—knowledge of what to say and do, skills and projects, or know-how; and (3) *engagements*—ends and purposes that are emotionally charged insofar as people are committed to them'. We will refer to these parts as *elements of practices*, which will help us to articulate an understanding of how interaction value is inter-subjectively assessed by actors.

Praxis and practitioners

According to practice theory, practices structure *praxis*, i.e. the stream of activity in which different types of action are accomplished. A change in the practices, or a reconfiguration of the elements of practices governing and structuring a situation, implies a change of praxis (Jarzabkowski and Spee, 2009; Reckwitz, 2002; Whittington, 2006). Recently, marketing and service management research has developed rich descriptions of managerial practices and the link between these and actions (Schau *et al.*, 2009; Skålén, 2009; 2010). However, conceptualizations of which types of praxis that are associated with interactive value formation and the practices that foster this type of value formation are lacking. Consequently, the paper aims to contribute knowledge in this area.

In addition, practices and configurations of elements of practices form *practitioners*; the human actors involved in a certain practice. From a practice-theory perspective, human actors are conceived of as unique combinations of practices. Identity/subjectivity is not, thus, conceptualized as a function of the stable constellations of attributes, beliefs, values, motives, and experience residing in the individual, but as subject positions embedded in the 'background knowledge'—the practices—governing and structuring a particular practice in which the individual is involved. As Skålén (2009; 2010) has suggested, a change in the managerial practices structuring a practice thus implies that the subjectivity of the practitioners will change in corresponding ways. However, how interaction value practices and elements of practices form practitioners has not been studied systematically.

METHOD

Since interactive value formation is an empirically under-explored area of research, we decided to adopt an exploratory single-case study design (Eisenhardt, 1989; Yin, 1984; Miles and Huberman, 1994) in order to address the research limitations reported above. Our study of the Swedish public transport organization Göteborgs Spårvägar (Gothenburg Tramways) (GS) focuses on interactions between instructors (workplace coaches) and bus/tram drivers in the GS system.

Data collection

Our main data collection technique was conducting interviews. In total, we interviewed 55 people. Of the informants, 38 were men and 17 were women, reflecting the uneven gender

distribution within the organization. Each interview lasted between 45 minutes and two and a half hours. All the interviews were conducted face-to-face at the organization's premises, e.g. in an office, conference room, or similar.

An initial round of interviews was conducted in May and June 2008. During this phase, we interviewed a group of 5 customer representatives, a group of 4 drivers, a group of 5 strategic managers, and 2 groups (consisting of 3 and 4 people) of frontline managers. These initial group interviews were rather unstructured and were aimed at getting an overview of the organization and identifying the locus of the value formation processes. We returned to the organization in February and again in September 2009 for the second and third rounds of the individual interviews—26 with drivers and 8 with staff working approximately half-time as instructors and part-time as regular drivers⁵. The themes that emerged during the second round were probed during the third round, by asking informants to re-narrate specific instructor-driver (workplace coaching) interactions. The present article draws mostly on the 34 interviews conducted during the second and third rounds.

This selection of informants reflects our choice of bringing a dual perspective into the investigation of interactive value formation. The argument for approaching interaction value practices from both sides is that it gives us rich data from individuals with experience of these practices. Our assumption is that these informants have the capacity to reflect the interactive and dynamic aspects of coaching in their narratives. Especially since we asked the informants questions encouraging them to share narratives regarding interactions between them we argue that interviewing was an appropriate technique for mapping the interaction value practices drawn on by the actors in this particular context (Czarniawska, 1998). A criterion for selection was experiences of workplace coaching. Within that group, we tried to find a range of individuals that mirrored different working experience and working sites. The reason for interviewing instructors and middle managers, besides drivers, was that these contribute to the practice of coaching within the organization by means of different managerial activities, e.g. coaching and monitoring of service interactions in the field. Using this procedure, we can confirm contextual conditions in the organization and we were able to identify the understanding of existing practices.

In addition to interviews we also made some complementary observations of interactions between instructors and drivers during coaching sessions. These observations were made during a few days of intensive field work (at the time of the second and third rounds of interviews) on board different buses and trams, all over the local transport system that GS operates. The observations supported and further elucidated the impressions gained during the interviews.

Data analysis

We transcribed and coded the interviews as quickly as possible after conducting them, Nvivo 7 being used as the data analysis software. The data analysis was inspired by Layder (2005), shifting between data and theoretical concepts. Accordingly, when empirical themes and codes capable of informing gaps in previous research were detected, subsequent data collection focused on developing—or probing—these themes and also structured itself around them. More to the point, a theoretical sensitivity to interactive value formation in coaching guided the ongoing joint collection and analysis of data conducted during the different phases. The iterative reflections upon the empirical material finally contributed to the conceptualizations made in the paper. Specifically, the concept of practice in practice-theory and the constant comparison of interview-narratives made the analysis sensitive to interactive mechanisms central to coaching in public

transport. Moreover, drawing on previous research (Schau *et al.*, 2009), the conceptualizations of the anatomy of practices—as procedures, understandings and engagements—were used as selective coding categories and each constituent was identified in all narratives. Empirical codes, which are *in vivo* codes or simple descriptive phrases, were generated in relation to these three constructs and the two main dimensions of practices—co-creation and co-destruction. Building on these empirical codes, six coaching practices were identified—checking, asking, mirroring, picturing, legitimizing/committing, moulding, problematizing and defusing/downplaying—which could repeatedly be observed in the empirical material. Similarly, the sensitizing concept of praxis was used to empirically identify streams of activities, specifically in relation to interactive value formation. Early on, indications that these streams were dynamic and varied were received, in relation to the process and the outcome of the activity stream as a whole. The concept helped to define central patterns of interactions and to see the links to both co-creation and co-destruction. Based on these patterns, subject positions were defined, also a key concept in our practice-theoretical framework.

By iterating between the data and the conceptualization of practice-theory, it was possible to contribute to previous research by outlining an empirically-based and practice-theory-informed framework of interaction value in workplace coaching. All subsequent data analysis and collection was carried out with this in mind.

FINDINGS

This section reports on the six interaction value practices—checking, questioning, defusing, mirroring, legitimizing, and picturing—that we have identified in our data. Illustrated by quotations, this section describes each of these in relation to the procedures, understandings, and engagements constituting the elements of each practice. In relation to each quotation, we show how configurations of these elements cause either value co-creation—i.e. when the elements are congruent—or value co-destruction—i.e. when the elements are incongruent. The practices are interactive—e.g. both actors construct the practices mutually. The implication is that a coaching practice is not fulfilled until both actors have contributed to it and confirmed the other actors action.

Checking

Both actors identify and relate actual performance to organizational criteria and idealizations. The essence of this practice is manifested when the coach control performance in relation to organizational criteria, idealised conduct, developed workplace praxis and when client confirm and comment on this, which in turn have impact on the coach' next contribution in interaction. When coach and client share organizational discourse on accepted performance criteria (procedures), contextually relevant skills (understandings) and purposes people are committed to are accepted as relevant (engagements) are in congruence, coaching value are co-created. When these parameters are incongruent coaching value is co-destroyed.

Questioning

The coach ask questions to the client who likewise respond with asking counterquestion back to the coach. This is in sharp contrast to ordergiving, instructions or standardized scripted behaviour. The point here is that the coach entice the clients' own conception and evaluation of what he or she is actually doing, rather than directly be subjective to performance without being asked to do so. By this the coach entices information such as explanations, contextual restrictions

and references to specific behaviour. It is about having right attitude towards each other. In comparison with mere instructions the coaches use a more gentle language. Both criticism and positive comments are embedded in the practice of questioning. When coach and client share organizational and societal discourse on accepted norms for ways of asking questions (procedures), situation sensitive skills (understandings) and purposes people are committed to (engagements) are accepted to talk about and are in congruence, coaching value are co-created. If not coaching value is co-destroyed.

Defusing

Another central aspect in coaching is defusing of occurring misdemeanour, critical incidents and the very coaching activity as such. Defusing define the coaching session as legitimate. After all, there is a tension in being analysed and mirrored by another person. Both actors refer to extenuating circumstances in the defusing practice. When coach and client share the perceptions of the tensions in being subject to performance evaluation (procedures), contextually can adapt to the other actor communicatively (understandings) and share the emotionally charged purposes people are committed to (engagements), we argue that the elements of practices are congruent. If so, coaching value is co-created but when they are incongruent, coaching value is co-destroyed.

Mirroring

During coaching interactions the coach mirror back the clients own conception of his or her performance by giving encouragement, praise, critics, confirmation and repetition of what the client bring out. Mirroring is also shown in the fact that the client as a response explain and motivate his or her experience, such as giving more precise details of what is happening. When coach and client mirror their respective perceptions to each other (procedures), can communicate this verbally and nonverbally to the other actor (understandings) and can imagine real emotions (engagements), the elements of practices are congruent. Congruence depict coaching value creation, while incongruence depict coaching value destruction.

Legitimizing

Due to the fact that coaching is close to control of performance and ultimately what the client is capable of, there is a need to, at least implicitly communicate the logic of being coached in the first place and good reasons to contribute in the interpersonal interaction. The coach and the client manage this by a distinct legitimizing practice, by which they communicate that coaching as such is legitimate or not. The coach communicates acceptable performance in relation to organizational rules, industry regulations or what is correct and reasonable in different situations. The practice of legitimizing is linked to norms of security, service-minded conduct (to give help), need of the client, situational contingencies and explanations from the coach or the client. At the point when the interactants have established a sense of legitimacy of their coaching undertakings (procedures), and know how this should be displayed in the situation (understandings), together with shared emotional comprehension (engagements), the elements of the legitimizing practice are congruent and coaching value is co-created. Analogously, incongruence co-destroy coaching value.

Picturing

Both the coach and the client are engaged in thinking and talking about alternative scenarios. Using counterfactual thinking they mould and shape the contour of alternatives to what have been done. They formulate alternatives to actual performance, formulate specific goals to achieve,

idealized pictures of future developments, etc. This practice of picturing also includes suggestions from the coach. From both the coach' and the clients' perspective there is an element of personal commitment to future work linked to this practice. By picturing what to expect in the near future the coach propose contours of such a commitment and inversely, the client acknowledge propositions about changes, developments or mere adjustments. Doing so they picture what it holds. To a certain degree both actors specify an alternative to the actual performance. The tricky question is to what extent one are supposed to be specific. The more detailed pictures, the more committed you will be to that picture. When both (implicitly) have negotiated on the level of specification, having in mind possible future expectations (procedures), have the skills to create and form specific pictures of alternatives (understandings) and both are equally committed to accept different modes of doing things (engagements), the elements of the picturing practice is congruent and linked to coaching value creation . If not, coaching value is destroyed.

To conclude coaching practices have the capacity to both value co-creation and value co-destruction. These two are viewed as dimensions of practices as they cut across the six coaching practices identified in the data (previously described). Each practice has its special characteristics but what could be emphasized is that all have an interactive, mutual character. Further, drawing on previous research (Schau *et al.*, 2009), the six practices are divided into three elements of practices: procedures, understandings, and engagements relevant to both the co-creation and the co-destruction of value in coaching.

DISCUSSION

In this section, the ways in which the present paper contributes to the discussion about value formation in service management theory is discussed. The implications of our findings in relation to the practice-theory informed framework that was articulated in the literature review section are specified. Also, in the paper a framework that explains how interactive value formation in workplace coaching takes place in practice are outlined.

Co-creation and co-destruction of value

Our study supports the fundamental notion, in previous research, that value in service settings is collaboratively realized during interaction between actors, for instance in customer contacts (Pralhad and Ramaswamy, 2004; Ramírez, 1999; Vargo and Lusch, 2004) but also in other service relations such as internal service and coaching. Thus, findings in the study are, to a certain extent, in line with the argument that is fundamental to the service-centred view which holds that operant resources—knowledge and skills—are the most important resources for the co-creation of value during interactions, not only between service providers and customers (Lusch *et al.*, 2007; Vargo and Lusch, 2004; 2008) but also in internal service relations, such as instructor-frontline employee relations as in this study.

However, our study also problematizes previous research by suggesting that the interactive value formation process taking place between instructor (coach) and frontline employee (client) is not only a creative process but also a destructive one: value is both co-created and co-destroyed at the coach–client interface. Accordingly, our study suggests that the interaction between coach and client can be understood, or approached, against the backdrop of the notions of value co-creation and value co-destruction and, thus, that operant resources not only co-create but also co-destroy value. Thus, while previous researchers of interactive value formation have argued that co-

destruction only takes place in exchange-based settings (Ramírez, 1999), that the downside of co-creation is a minor phenomenon (Prahalad and Ramaswamy, 2004) or that issues pertaining to co-destruction have been neglected (Vargo and Lusch, 2004), we, in line with Plé and Chumpitaz Cáceres (2010), argue that the co-destruction of value is a significant feature of managerial practices, as shown in this study of coach-client interaction.

The interaction view of value formation (Prahalad and Ramaswamy, 2004; Ramírez, 1999; Vargo and Lusch, 2004), holds that value is realized collaboratively during the interaction between actors and that value co-creation is the only possibility during this interaction. However, the present study clearly shows that value can also be collaboratively destroyed during the coach-client interaction.

Interaction value practices

In addition to introducing the notion that interactive value formation involves both co-creation and co-destruction, we have also identified six interaction value practices: checking, questioning, defusing, mirroring, legitimizing, and picturing. In this respect, our study elaborates on earlier studies of value creation practices (Schau *et al.*, 2009; Echeverri and Skålén, 2011). Our contribution in relation to these is that we have focused on practices that order face-to-face interactions between coach and client. We acknowledge that these are value formation practices in a coaching context—within an internal service relation—and not necessarily in other contexts (e.g. e-commerce, business-to-business sales, service encounters, etc.).

Interactive value formation

As should be clear from the findings, we suggest that all six of the interaction value practices that we identified may foster both the co-creation and the co-destruction of value as the two dimensions are inherent in all six practices. More specifically, our findings indicate that what we refer to as the elements of practices—which are the procedures, understandings, and engagements constituting them—enable both the co-creation and the co-destruction of value. What stands out is the fact that when the elements of practices are *congruent*—i.e. when coach and client are in consensus as to which procedures, understandings, and engagements should inform a specific interaction—value co-creation will be the outcome. Consequently, when the elements of practices are *incongruent*—i.e. when coach and client do not agree on which procedures, understandings, and engagements should inform a specific interaction—value co-destruction ensues. Our conclusion is in line with the conceptual analysis of Plé and Chumpitaz Cáceres (2010). Even though they conceptualize the relationship between co-creation and co-destruction, from a service systems and a resource-based perspective, Plé and Chumpitaz Cáceres (2010: 432, emphasis added) also maintain that: ‘...value co-creation occurs when two service systems have *congruent* expectations of the way in which the available resources should be used in the course of their interactions ...inappropriate or unexpected use of the available resources in an interaction will result in value co-destruction for at least one of the parties’.

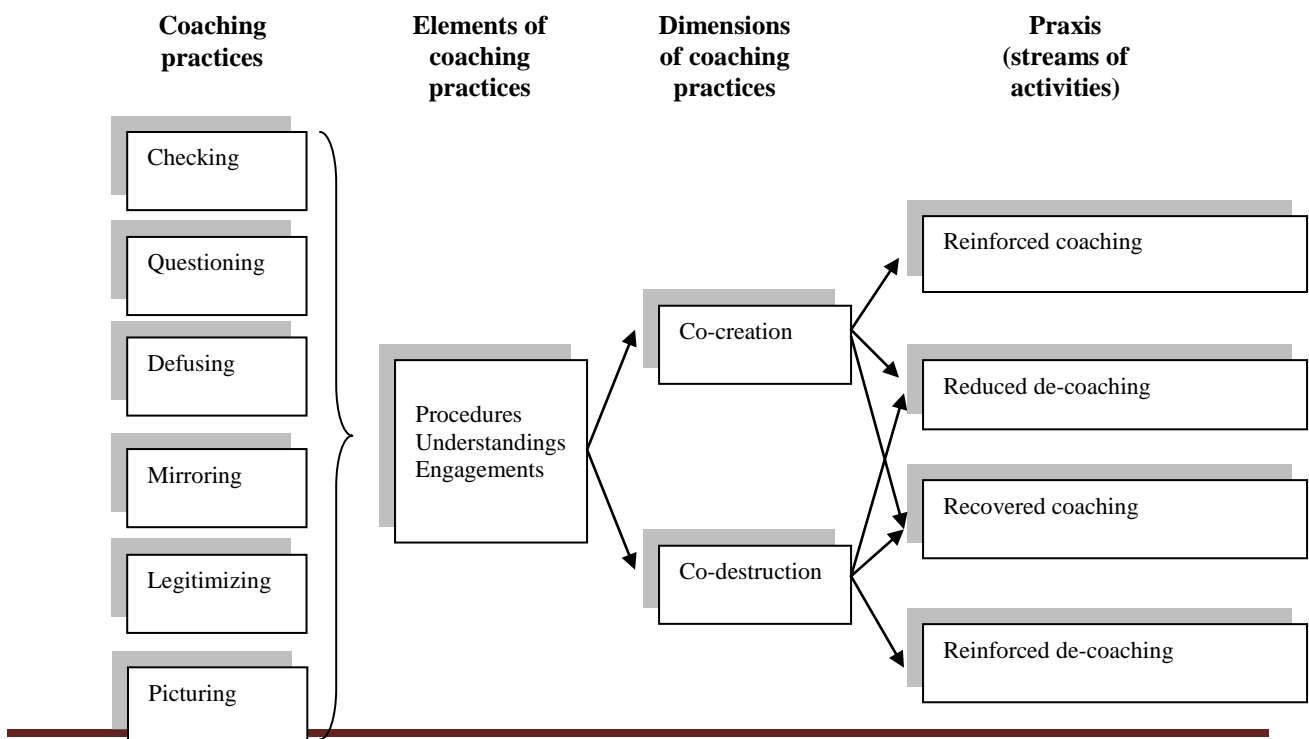
By elaborating on previous marketing and service management research (Schau *et al.*, 2009; Warde, 2005; Echeverri and Skålén, 2011), that has drawn on practice theory, we make a contribution to research by theorizing how interactive value formation takes place. We also contribute towards understanding how value is *inter-subjectively* assessed by agents. More specifically, the paper suggests that interactive value formation—value co-creation as well as value co-destruction—derives from coach and client drawing on congruent (in the case of value

co-creation) and incongruent (in the case of value co-destruction) elements of practices. This implies that we are proposing an alternative position on value formation which goes beyond both the exchange-based view and the interaction view reviewed above; the former treats value objectively by measuring it in terms of money (Bagozzi, 1975; Hunt, 1976; Alderson, 1957) while the latter only treats value subjectively and assesses it relatively from the client’s point of view (Holbrook, 2006; Prahalad and Ramaswamy, 2004; Ramírez, 1999; Vargo and Lusch, 2004). Elaborating on Oliver (2006) and Echeverri and Skålén (2011), we extend the understanding of value as a bidirectional construct that takes the assessment of both coach and client into account. More to the point, our practice theory informed framework suggests that value can be understood in terms of ‘matches’ (congruence) or ‘mismatches’ (incongruence) between socially-available methods—i.e. the possible configuration of practices and elements of practices—that coach and client draw on in order to act and to interpret other actors’ actions. We might think of this standpoint as being positioned between an objectivistic and a subjectivistic position (integrating objectivistic elements of social structures with subjectivistic elements of individuals’ experiences).

Praxis

In this section, we offer a more precise understanding of interactive value formation. We suggest that the six practices we have identified and the two dimensions of practices associated with them—which are the outcome of congruent or incongruent elements of practices—shape the *praxis* (stream of activity) of the human actors involved in coach-client interactions. We make a distinction between four types of praxis. For an overview of the relationships between the different constructs, see Figure 1.

Figure 1: Relationship between coaching practices, elements of coaching practices, dimensions of coaching practices, and praxis.



As Figure 1 illustrates, we suggest four different cases. First, we have the case where the interaction between coach and client is dominated totally by value co-creation. In accordance with the discussion in the previous section regarding value formation, the first case means that coach and client operate with congruent understandings about which elements of practices should be applied to a particular situation. In this situation, the interaction value steadily increases. A typical situation might be when a coach communicates suggestion for behaviour improvement with a positive attitude, defuse criticism due to extenuating circumstances at the client side and this approach is genuinely acknowledged by the client by confirming and formulating implications for future behaviour—and act accordingly. We call the type of praxis characterizing a situation like this *reinforced coaching*.

Second, we have the case where the interaction between coach and client is totally dominated by value co-destruction. During such interactions, coach and client have incongruent conceptions regarding what procedures, understandings and engagements should apply, entailing that the interaction value steadily decreases. This type of interaction can be illustrated by situations where clients are subjected to complains or insensitive remarks and defend themselves by referring to external factors, bad working conditions or depreciate the work of the coach. This type of praxis, which is dominated entirely by the dimension of value co-destruction, we refer to as *reinforced de-coaching*.

However, we have also identified mixed cases, i.e. types of interactions informed by both dimensions of practices—both value co-creation and value co-destruction. We distinguish between these on the basis of differences in how they are initiated and ended. Therefore, the third case is *initiated* when coach and client initially draw on incongruent procedures, understandings, and engagements causing value co-destruction but, during the process of interaction, the elements of practices drawn on by coach and client become congruent, entailing that the interaction ends in value co-creation. This could be illustrated by a client that initially refuse to accept a critical comment during the coaching session on displayed service behaviour, followed by the coach explaining the reasons and implications for customers which in turn makes the client to a certain degree accept and understand the logic behind the critical comment and change behaviour accordingly. We call the type of praxis specific to a typical interaction like this *recovered de-coaching*, due to the recovery-like nature of the interactive value formation shifting away from the co-destruction towards the co-creation of value.

It is also quite possible for this interaction to unfold the other way round. Consequently, the fourth case is initiated when coach and client draw on congruent procedures, understandings, and engagements. Accordingly, the interaction is initially associated with value co-creation. However, during the process of interaction, the elements of practices drawn on become incongruent, entailing that the interaction ends in value co-destruction. This could be illustrated by a client acknowledge constructive comments from a coach on displayed sensitivity to customer needs, followed by the coach further accentuate the details of the criticism in a way that makes the client depressed and not motivated for changed conduct. We call the type of praxis

specific to a typical interaction like this *reduced coaching*, due to the reductive nature of the interaction value shifting away from the co-creation towards the co-destruction of value.

CONCLUSIONS AND CONTRIBUTIONS

The discussion concerning value formation has been at the heart of the marketing research agenda for several decades (Bagozzi, 1975; Hunt, 1976; Alderson, 1957). With the interaction view of value formation, this discussion has been re-invigorated (Prahalad and Ramaswamy, 2004; Ramírez, 1999; Vargo and Lusch, 2004) also in the domain of service management. This paper and its practice-theoretical framing have contributed to this general discussion vis-à-vis value formation. It has contributed in particular to the research into interactive value formation. First, by emphasizing the notion of value co-destruction, it has brought much needed nuance and critique to the overtly positive research into interaction value especially the normative service management discourse. It has shown, based on empirical research, that value is not just something that is co-created at the coach-client interface, but also something that is co-destroyed. Accordingly, we need to stop seeing value creation as the only possible outcome during interactions between coach and client. Value destruction is equally important. Second, this paper has pinpointed six interaction value practices: checking, questioning, defusing, mirroring, legitimizing, and picturing. These provide a baseline for understanding and theorizing interactive value formation in workplace coaching contexts (face-to-face). Third, and building on the first and second contributions, the paper has contributed towards generating a framework explaining how interactive value formation takes place and how value is inter-subjectively assessed by agents during coaching sessions. More to the point, the paper suggests that interactive value formation—value co-creation as well as value co-destruction—derives from coach and client drawing on congruent (in the case of value co-creation) and incongruent (in the case of value co-destruction) elements of practices. In relation to the exchange view, conceptualizing value objectively, and in relation to the interaction view, conceptualizing value subjectively, the paper articulates an inter-subjective middle position. Fourth, as an integral part of the presented value formation framework, the paper makes a contribution vis-à-vis knowledge of how interaction value practices, elements of practices, and dimensions of interaction value practices order praxis, suggesting a distinction between four different types of praxis. (see Figure 1 for a summary).

The paper suffers from several limitations which need to be addressed in future research. First, it is mostly based on retrospective interview data. While co-creation and co-destruction mechanisms during coaching sessions have been reported as interpreted and narrated by both sides, future research needs to more closely observe interactions between coaches and clients in real world. Second, we have studied managerial coaching in the context of service. Future research needs to study whether or not our conclusions are generalizable to other contexts, e.g. long-lasting service contacts, in business-to-business contacts or in e-commerce contexts. Third, our paper draws on a qualitative single case study of an organization operating in a particular context. Future research needs to have a broader scope. This does not imply that future research should rely solely on quantitative data, because micro practices might be hard to detect from a distance. Case studies of other types of organizations, operating in other fields, need to be conducted. Fourth, our paper has started to inquire into the relationship between co-creation and co-destruction in human workplace interaction. This topic needs corroboration in future studies.

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ISO 14001 certification in Swedish firms: A tool for the needy or a symptom of greenness?

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Introduction

Adoption of environmental management systems (EMS) constitutes one of the most important elements of corporate social responsibility (CSR) and corporate sustainability in recent years. To simplify, an EMS is a set of management processes and procedures that allow organisations to analyze, control and reduce the environmental impact of their operations and services to save costs, improve efficiency and oversight and to streamline regulatory compliance (Pawar & Risetto, 2001). Many of the implemented systems are based on the international standard ISO 14001 and certification according to the standard are following a similar path as the development of the ISO 9000-series focusing on quality management. During the period from 1996, when it became possible to certify to ISO 14001, until now about 220 000 organizations worldwide have chosen to certify to ISO 14001 (ISO, 2011). The commercial success of the ISO 14001 standard has led to extensive research focusing on different phenomenon and issues connected to the adoption of EMSs based on the standard.

The most popular area to study for scholars in the corporate environmental management field of research seems to be if EMSs have any impact on the firms' environmental performance. Some of these studies argue that the systems lead to real improvements (e.g. Iraldo et al., 2009; Arimura et al., 2008; Potoski & Prakash, 2005; Russo, 2009) while others are more pessimistic regarding the influence of the EMSs (eg, Melnyk et al., 2003; Hertin et al., 2008, Barla, 2007; Ghisellini & Thurston, 2005). In other words, research in this area has not been able to find a conclusive answer to the question whether EMSs is useful for improving corporate environmental performance.

Another area that is of interest to many scholars is the reasons or drivers for EMS adoption. Overall it seems that firms in general appear to consider a broad range of motivations in the decision to adopt and certify an EMS. For example, Fryxell et al. (2004) found in a sample of 128 facilities that the main drivers for ISO 14001 certification were to ensure regulatory compliance, to enhance the firm's reputation and to improve environmental performance. Similar findings are presented in a study of certified firms within the chemical, mechanical and electronics industry in Brazil where four dominating sources of motivations were identified: pressures from external stakeholders, proaction in expectation of future business concerns, legal concerns and internal influences (Gavronski et al., 2008). A slightly different situation was found among Swedish firms, for which it seemed to be most important to use the certification

to demonstrate their commitment to environmental protection, but a number of other motives such as customer pressure, relations with communities and authorities and environmental improvements were also identified as somewhat important (Poksinska et al., 2003).

Even though the relatively great number of studies focusing on possible benefits of and motives for EMS adoption gives us valuable information, they do not tell us anything about which types of firms that take the step to implement an EMS and choose to certify. In the literature, we can find some important findings also in this area. Just after the introduction of the ISO 14001 standard, Chapple et al. (2001) found in UK manufacturing firms that the larger more powerful firms are less likely to certify to ISO 14001. The results also indicate that firms in less concentrated industries are more likely to become certified. Further the data also suggested that it is the smaller firms and the very large firms that have gained ISO certification and it is the middle of the range firms that are slower on the uptake. In a more recent study, Takuya & Nakamura (2010) studied Japanese manufacturing firms and found that firms are more likely to seek ISO 14001 certification when their operations involve low degrees of complexity. In addition, they found support for the hypothesis that firms facing more uncertainty in their operations, and hence more risk, are more likely to seek certification.

Also these findings are important in order to understand the phenomenon of EMS and ISO 14001 diffusion, adoption and the effects of the systems. However, the initial idea of the standard was to be an effective tool to be used by firms and other organisations so that they could contribute to sustainable development. In order to make a substantial contribution, it is necessary that it is not only the environmental front runner firms that adopt an EMS and seek certification, but also the firms with poor environmental performance since the environmental improvement potential is far greater in these firms. Evidence is lacking regarding which firms, from an environmental performance perspective, that is more likely to adopt an EMS. Is it the firms with the worst environmental performance that really are in strong need of effective approaches and tools? Or is the EMS adoption and ISO 14001 certification only a way to show the stakeholders that the firm already is at the fore front concerning environmental and other social responsibility issues. In this study, we make an attempt to contribute to the answer of these research questions.

Methodology

A review of previous studies with focus on EMSs and their potential impact on environmental performance have shown us that one has to be careful when choosing methodology. The focus should primarily be on changes in environmental performance over time as EMS is a tool for continuous improvement and do not say anything about the level of performance. Furthermore, the studies must include not only firms with an EMS but also firms without systems for comparison. In addition, such a study should be based on more objective environmental data and preferably not on firm representatives' perception of changes in environmental performance.

Research approach

In this study, we have chosen the year 2000 as the base year and studied the change in environmental performance over the period 1994-2000. Figure 1 shows a schematic illustration of the time periods that form the basis for statistical analysis. The basis for analysis has been the change in environmental performance over a three year and a six year period before ISO 14001 certification and the corresponding periods for non-certified firms. Before analysis, the parameters have been normalized to each firm's production rate.

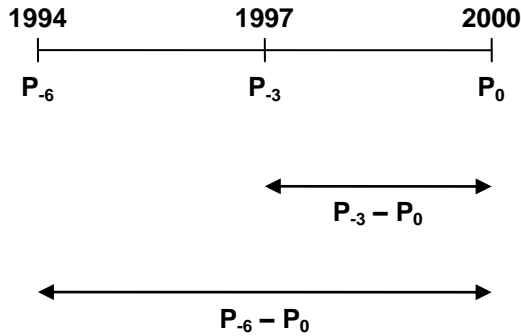


Figure 1 Schematic picture of the time periods over which the change in performance has been measured in certified and non-certified firms (P_{-6} = environmental performance in 1994, six years before the base year 2000; P_{-3} = environmental performance in 1997, three years before the base year 2000; P_0 = environmental performance in the base year 2000)

The change in environmental performance has been calculated for a number of environmental parameters over a short period of time, i.e. the period between 1997 and 2000, and a long period of time, i.e. the period between 1994 and 2000. The parameters that have been the subject of analysis are therefore the following if the designations from Figure 1 are used:

$$\text{Change in environmental performance (short period)} = ((P_{-3} - P_0)/P_{-3}) * 100$$

$$\text{Change in environmental performance (long period)} = ((P_{-6} - P_0)/P_{-6}) * 100$$

Collection of data

To gain access to environmental data that are reported by limited elements of subjectivity, mandatory yearly environmental reports from firms with regulatory environmental permits have been used. Environmental reports have been collected from both ISO 14001 certified firms and firms without systems. We have chosen to study manufacturing firms (NACE code 15-37) where we can expect to find relatively complex environmental impact as well an impact that can be considered significant, which increases the opportunities to find statistically verifiable differences. A list of such firms, created by information from all 21 County Administrative Boards in Sweden, showed that the total number of such firms was 2331. The list was supplemented with information on ISO 14001 certification from all certification bodies in Sweden.

The year 2000 was chosen as the base year because it was the year that the most certified manufacturing firms with a permit got an ISO 14001 certificate. A total of 130 such firms could be found. A comparative sample was created by a random sample of 130 firms taken out of the total population of non-certified manufacturing firms with a permit. Environmental reports for the years 1994, 1997 and 2000 were collected from the firms' environmental monitoring agencies. Documents were received for 217 of the 260 firms (83%). All 217 firms were not included in the study for various reasons, e.g. that not enough necessary documents could be found, the firm has closed down or poor document quality. After the removal of non usable firms, 66 certified firms and 50 non-certified firms remained. Summary statistics of the two samples are illustrated in Table 1. We see from the table that we may suspect that the average firm size is greater for the certified firms, which is also confirmed by a *t*-test conducted at the 0.05 level of significance. This fact should be taken into account when interpreting the results of the study.

Table 1 Summary statistics over the samples of certified and non-certified firms

Parameters	Certified firms	Non certified firms
Count*	56	48
Average	328,625	69,1042
Standard deviation	646,711	99,2421
Coeff. of variation	196,793 %	143,612 %
Minimum	11,0	2,0
Maximum	4694,0	545,0
Range	4683,0	543,0
Std. skewness	17,9473	8,40338
Std. kurtosis	59,714	15,4402

* The number of firms in the table is less than 66 and 50 since information concerning the number of employees was not available for all firms.

Statistical methods

The method we have chosen for comparison of certified and non-certified firms are *t*-test using the computer program Statgraphics Centurion XV. The *t*-test is one of the most common statistical methods used to compare two different samples. It should be noted that for the *t*-test to have full validity assumptions about normally distributed data and equal variances must apply. Therefore, the sample distribution has been tested using standardized skewness and standardized kurtosis. Variances were tested using an F-test, which is a commonly used test to compare variances between groups. When extreme values are present, Grubb's test has been used for identification of outliers.

Results

We conducted a comparative statistical analysis of the change of environmental performance between certified and non-certified firms and set the following null hypothesis and alternative hypothesis which were tested for the shorter period 1997-2000 and the slightly longer period 1994-2000:

H_0 = the change in environmental performance prior to ISO 14001-certification for ISO 14001-certified firms do not differ significantly from the corresponding change for non-certified firms

H_{ALT} = the change in environmental performance prior to ISO 14001-certification for ISO 14001-certified firms differ significantly from the corresponding change for non-certified firms

The change in environmental performance has been studied in six different areas: 1) air emissions; 2) water emissions; 3) resource use; 4) energy use; 5) waste; and 6) overall environmental performance. The results in each area are reported in subsections below.

Air emissions

When analyzing the changes concerning air emissions, all emission parameters were merged into one parameter by calculating the average for the percentage change for all air emissions. Typical air emissions are solvents (VOCs), dust, nitrogen oxides (NO_x) and sulfur dioxide (SO₂), but several other parameters were presented in the reports as well. Air emissions that are linked to energy use has not been included here if the energy used are reported since there is often a linear relationship between energy use and related air emissions. However, if air emissions are specified and the energy use is not, the air emissions are included. Parameters that are only expressed as concentrations, e.g. mg/l or mg/m³, have not been normalized to the rate of production since these values are independent of how much is produced. If a parameter is expressed by the sign < (less than) before the value, then half the value has been used to calculate the change.

1997-2000: About half of the firms have parameters so that they can be included in this analysis (see Table 2), which reduces the possibility to see small differences in a comparative analysis. In Table 2 we see the summary statistics of the two groups of firms. In the table we see that the values of standardized skewness and kurtosis are well within the range -2 to +2, which means we can consider the observations as normally distributed. Furthermore, we see that air emissions are reduced by 22 % for the certified firm, while they are reduced by 17 % for the non-certified firms. The hypotheses were tested by a *t*-test giving the values $t=0.424687$ and $P=0.672753$. The large P-value tells us that we can not reject the null hypothesis. An F-test provides information that there is no statistically significant difference between variances, which means that we can be fairly certain that the *t*-test has full validity.

Table 2 Summary statistics on the change in environmental performance concerning air emissions in the periods 1997-2000 and 1994-2000

Parameters	Certified firms 1997-2000	Non-certified firms 1997 -2000	Certified firms 1994-2000	Non-certified firms 1994-2000
Count	34	22	30	15
Average	21,997	17,1763	20,2691	3,58574
Standard deviation	38,9215	45,2228	55,2507	85,0433
Minimum	-71,5623	-92,1875	-131,305	-195,459
Maximum	99,0354	100,0	97,9213	100,0
Std. skewness	-0,989536	-1,01676	-1,60618	-1,56294
Std. kurtosis	0,129166	0,679847	0,395389	0,417696

1994-2000: Fewer companies reported reliable data for air emissions during the period 1994-2000 compared with 1997-2000 (see Table 2). The values for standardized skewness and kurtosis allow us to consider the observations as normally distributed. In

Table 2 we see that air emissions are reduced by 20 % for the certified firms, while they are reduced by 4 % for the non-certified firms. A *t*-test gives the values $t=0.794133$ and $P=0.431479$, meaning that we can not reject the null hypothesis. It should be noted that an F-test indicates that there is a statistical significant difference between variances, which we should keep in mind when interpreting the results.

Water emissions

Analysis of water parameters have been made in the same way as for air emissions. Common types of emissions include heavy metals, BOD, suspended solids, nitrogen, phosphorus, but several other emissions types are reported. As far as it has been possible, total emissions over the whole year are used in the analysis but when this has not been possible concentrations has been used instead.

1997-2000: As with air emissions, about half of the participating firms have reported some type of emissions to water. In Table 3 we see the summary statistics of the two groups of firms. In the table we see that one of the values of standardized kurtosis is out of range but the value is relatively close to -2 and we can therefore regard the observations as normally distributed. The water emissions for the certified firms are reduced by 4 %, while they are reduced by 2 % for the non-certified firms. A *t*-test gives the values $t=0.100377$ and $P=0.92041$ and we can therefore not reject the null hypothesis. An F-test indicates that there is no significant difference between the variances of both samples, which gives us information that the *t*-test is valid in this case.

1994-2000: The material collected in this study gives us relatively few useful observations of water emissions for the period 1994-2000. We can therefore expect that it may be difficult to see any differences between the two groups of firms. As for the shorter period, we can not be absolutely sure about normality but we are fairly close. The change in performance regarding water emissions for both certified and non-certified firms is negative (-21% of the certified firms and -4 % for non-certified firms). However, the magnitude of the difference might indicate that we indeed have a significant difference, but *t*-test gives the values $t=-0.677724$ and $P=0.501848$, which makes us confident that we can not reject the null hypothesis. An F-test gives us no reason to question the validity of the *t*-test.

Table 3 Summary statistics on the change in environmental performance concerning water emissions in the periods 1997-2000 and 1994-2000

Parameters	Certified firms 1997-2000	Non-certified firms 1997 -2000	Certified firms 1994-2000	Non-certified firms 1994-2000
Count	31	26	28	14
Average	3,51114	2,34016	-20,9175	-3,95059
Standard deviation	48,2738	37,9107	65,3321	95,5738
Minimum	-118,364	-77,6521	-202,695	-220,376
Maximum	77,3538	61,621	74,4264	99,5082
Stnd. skewness	-2,20441	-1,45917	-2,55183	-1,45566
Stnd. kurtosis	1,25549	-0,299368	1,38393	0,232207

Resource use

The change in resource use has been difficult to measure by using environmental reports, because different types of resources rarely are reported. However, three parameters are relatively often included in the reports: chemical use, water use and the use of fuels (mainly diesel oil) for internal transports. The mean value of the change for

these three parameters have been calculated and used in the analysis within the area of recourse use. It is not obvious that an increase in chemical use always is worse from an environmental perspective, because it is often the properties of the chemical and not its amount that will determine its environmental impact. In this study, we have disregarded this and made the assumption that a reduction of the amount of chemical use in general is environmentally sound.

1997-2000: About half of the firms in the samples report information concerning one or more of the three types of resources that are used here. Summary statistics of both groups of firms are illustrated in Table 4. We see from the table that normality of the observations is questionable. We see that the resource use has increased by 1 % for the certified firms and that the corresponding value for the non-certified firms is a reduction by 7 %. A *t*-test gives the values $t=-0.894986$ and $P=0.374841$, which does not give us any reason to reject the null hypothesis. An F-test indicates that there is no significant difference between the variances and the conducted *t*-test is therefore valid.

1994-2000: Only about a third of firms in the samples report one or more parameters within the recourse use area over the period 1994-2000. The values of standardized skewness and kurtosis do not give us any reason to doubt that the observations are normally distributed. The resource use is reduced by 7 % for the certified firms but is increased by 4 % for the non-certified firms. Despite the small count of observations, a *t*-test has been carried out giving the values $t=0.790919$ and $P=0,434318$. The null hypothesis therefore appears to be valid. An F-test shows that there is no significant difference in the size of the variances, which does not give us any reason to doubt the results.

Table 4 Summary statistics on the change in environmental performance concerning resource use in the periods 1997-2000 and 1994-2000

Parameters	Certified firms 1997-2000	Non-certified firms 1997 -2000	Certified firms 1994-2000	Non-certified firms 1994-2000
Count	32	23	21	16
Average	-0,787669	6,56943	6,76977	-4,11004
Standard deviation	29,1634	31,3053	35,7981	47,9671
Minimum	-53,5624	-34,2547	-73,3525	-107,671
Maximum	71,7591	99,8454	71,6438	70,5958
Std. skewness	0,437524	2,51116	-0,570966	-1,31554
Std. kurtosis	-0,0174177	2,0904	0,185387	0,790736

Energy use

When analyzing the change in energy use three different parameters have been used: electricity, fossil fuel and total energy. The values that have been the subject of analysis is a merger of the three parameters where the mean value of the percentage changes for the three parameters have been calculated. The parameter fossil fuel use often consists only of consumption of fuel oil but can sometimes include several fossil fuels such as oil, LPG and natural gas. In such cases, the energy content of the various fuels have been calculated and then added. Parameters that are related to renewable energy sources are not included as separate parameters because an increase in the use of renewable energy sources can often be counted as an improvement.

1997-2000: Compared with the previously analyzed areas significantly more firms (about two thirds) reports of one or more of the parameters we use in the area of energy

use. In Table 5 we can see the summary statistics of the two groups of firms. One of the values of standardized skewness is outside the range limit of -2, but we should still be able to consider the distribution as normally distributed. The certified firms have reduced their energy use by 2 % while the non-certified firms to perform slightly better with a reduction by 13 %. . As before, however, variances are large. Testing of the hypothesis by a *t*-test gives the values $t=-1.36377$ and $P=0.177073$. Thus, we can not reject the null hypothesis. An F-test tells us that we can be relatively certain that the *t*-test is valid.

Table 5 Summary statistics on the change in environmental performance concerning energy use in the periods 1997-2000 and 1994-2000

Parameters	Certified firms 1997-2000	Non-certified firms 1997 -2000	Certified firms 1994-2000	Non-certified firms 1994-2000
Count	48	23	42	17
Average	1,91044	12,7408	8,77962	10,6175
Standard deviation	31,5228	30,8676	36,0609	33,207
Minimum	-84,0138	-60,6253	-100,0	-45,8589
Maximum	73,8145	78,7878	89,2517	77,3859
Std. skewness	-2,30595	-0,814359	-1,40706	0,692318
Std. kurtosis	1,64856	0,541859	1,68256	-0,0914036

1994-2000: A relatively small number of non-certified companies reported energy-related parameters in 1994 (see table 5), which makes a comparison between the groups difficult. We see in Table 5 that the observations in the two samples can be regarded as normally distributed. Furthermore, we see that the mean value of the change in energy use indicates a similar reduction for both certified (9 %) and non-certified companies (11 %). A *t*-test gives the values $t=-0.18121$ and $P=0.856845$, and we are therefore not close to rejecting the null hypothesis. The results are most certainly valid since an F-test indicates that variances are most likely equal.

Waste

Waste-related parameters have been handled in a similar way as energy-related parameters. The parameters hazardous waste, waste to landfill and the total amounts of waste have been used for analysis. The values that have been the subject of analysis are the combination of these three parameters where the mean values of the percentage change for the three parameters have been calculated. An increase in waste going to reuse, recycling, composting or incineration is often counted as an improvement and can therefore not be used directly.

1997-2000: Despite problems in interpreting environmental reports relating to the disposal of waste and quantities of waste, the number of observations that we have been able to use for the analysis are greater than for the other areas. Summary statistics of both groups of firms are shown in Table 6. We see from the table that we should be careful to interpret the results since we can not be certain that the observations are normally distributed. Furthermore, we see that the certified firms have increased their waste production by 7 % but the non-certified firms perform even worse with an increase by 35 %. We might suspect that there actually is a difference between the firms, but a *t*-test does not confirm such a suspicion ($t=1.60024$ and $P=0.112902$). It should be noted that the *t*-test is not fully valid in this case as an F-test indicates that there is a statistical difference between the variances in the two samples of firms.

Table 6 Summary statistics on the change in environmental performance concerning waste in the periods 1997-2000 and 1994-2000

Parameters	Certified firms 1997-2000	Non-certified firms 1997 -2000	Certified firms 1997-2000	Non-certified firms 1994-2000
Count	51	45	40	20
Average	-6,99452	-35,0395	-13,7644	7,67862
Standard deviation	64,3605	104,783	82,9143	53,4432
Minimum	-171,51	-304,789	-243,003	-74,284
Maximum	97,7965	100,0	83,1154	93,6
Std. skewness	-2,5275	-2,72476	-3,11419	-0,451276
Std. kurtosis	0,36797	0,33252	0,919595	-1,18843

1994-2000: The quality of the waste-related data described in the environmental reports from 1994 is much worse than it is in the more recent years. Hence, significantly fewer observations are available to use for analysis for the period 1994-2000 than for the shorter period (see Table 6). The value for standardized skewness for the sample of certified firms are outside the limit of -2, which means we have some problem with the distribution of data. The waste production for the certified firms was reduced by 14 % while the non-certified companies increased their production of waste by 8 %. These results indicate a difference between the two groups of firms, but as before the variances are large and we can not reject the null hypothesis ($t=-1.05023$ and $P=0.297971$). The validity of the t -test is questionable since an F-test indicates that there is a statistically significant difference between the variances.

Overall environmental performance

In order to get a measure of the studied firms' overall environmental performance, all reported parameters in each firm have been merged into one parameter by calculating the mean value of the percentage change for all reported parameters. Although we here use the term overall environmental performance, it is the only the performance that has its origin inside the gates of the firms that are included.

1997-2000: In the analysis of overall environmental performance observations from a relatively large number of firms have been used. In Table 7 we see the summary statistics of both groups of firms. Even though a number of outliers have been removed, we still have difficulties with the values of standardized skewness, giving us some problems with normality. In Table 7 we see that the change in overall performance is fairly similar and we can not suspect that there is a difference between the two groups of firms. Our suspicion is confirmed by a t -test ($t=0.087592$ and $P=0.930408$). However, we have some problem concerning the assumption of equal variances since a F-test shows that it is likely that the variances differ.

Table 7 Summary statistics on the change in overall environmental performance in the periods 1997-2000 and 1994-2000

Parameters	Certified firms 1997-2000	Non-certified firms 1997 -2000	Certified firms 1997-2000	Non-certified firms 1994-2000
Count	55	44	46	28
Average	-6,70933	-7,54042	-12,3384	9,0736
Standard deviation	39,5536	54,8014	51,7699	61,3358
Minimum	-111,112	-156,213	-175,476	-102,124
Maximum	65,4084	94,9692	63,9522	168,046
Std. skewness	-2,4131	-2,43598	-3,35367	0,784868
Std. kurtosis	0,644819	1,73138	2,34742	0,375315

1994-2000: As before, the number of usable observations is much less for the longer time period. We see in Table 7 that we have some problems with normality since the values for standardized skewness and kurtosis for the certified firms are outside the valid range. The mean values for the change in overall performance are -12 % for the certified companies and 9 % for the non-certified, which might indicate that the non-certified firms perform better prior to the base year. Again, we can not be certain of any differences between the firms since the values from a *t*-test ($t=-1.60809$ and $P=0.112192$) does not give us a reason to reject the null hypothesis. An F-test indicates that variances can be considered equal in this case.

Discussion and conclusions

To summarize the results of our study, we have not in any of the analyzed environmental areas been able to find any statistical significant differences between certified and non-certified firms at 95 % confidence level regarding the change in environmental performance prior to ISO 14001-certification or the corresponding period in non-certified firms. The obvious answer to our research questions are therefore that we can not see any significant differences in the change in environmental performance in the two groups of firms, which might indicate that the environmental performance of the firm is not one of the most important motivations when deciding to adopt an EMS and certify to ISO 14001. However, we should be somewhat careful in our conclusions since the used data set gives us some problems. For the most part, our data is normality distributed and variances in the two samples can in a majority of our analyses be considered equal, but we can clearly see in Table 2-7 that variances are great which gives us problem identify significant differences. There might very well be differences between certified and non-certified firms but the nature of the used data does not help us to find those possible differences.

Comparison with previous research

We could not find any evidence that firms that chose to adopt an EMS and certify to ISO 14001 performed better or worse prior to certification than firms that decided against adoption. But what about other studies? Well, as we stated in the introduction, research is lacking regarding which firms, from an environmental performance perspective, that is more likely to adopt an EMS. Nevertheless, some previous evidence does exist. One theory regarding the level of environmental performance in organisations where EMSs are adopted is presented by Florida & Davison (2001) in their study of manufacturing firms in the U.S. According to this study, ISO 14001-certified firms had implemented other voluntary environmental tools to a greater extent than firms without an EMS. This theory is confirmed by Welch et al. (2002) in a study of Japanese firms. The researchers claim that EMS adoption might be a symptom of high environmental performance rather than a stimulant to greater performance. However, the opposite was found by Hamschmidt & Dyllick (2001) in their study of Swiss organisations. According to them, it was firms that were below average regarding environmental performance that sought to implement an EMS. In a slightly more recent study of a great number of manufacturing firms, a dissertation from University of California, again evidence was found that eventual adopters were improving their compliance faster than non-adopters before ISO 14001 certification (Toffel, 2005). In addition, it was concluded that prior to adoption, eventual adopters were reducing their air emissions while non-adopters were not.

Limitations of approach and methods used

As already mentioned, we have some problems with great variances in the data set. However, there is every reason to believe that the approach taken in this study to try to exclude the effects of factors other than the introduction of EMSs that can affect environmental performance is accurate. In contrast, it is far from obvious that the way we have chosen to quantify environmental performance is optimal. When different parameters have been merged into one, it is the mean value of the change in environmental performance that has been analyzed without any assessment made of each parameter for its potential environmental impacts. Such an assumption that all parameters have equal influence is of course a rough estimate. It is also not optimal to rely on parameters that are reported in environmental reports when trying to seek changes in environmental performance, because it is not possible to choose which parameters that are reported. The parameters included in the reports are not comprehensive but represents only what the firm and its monitoring agency have agreed upon. Parameters with its environmental impact outside the facility such as products or transports are rarely reported.

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VALUE-BASED PERFORMANCE EXCELLENCE MODEL FOR HIGHER EDUCATION INSTITUTION: A CONFIRMATORY FACTOR ANALYTIC (CFA) APPROACH

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Abstract:

Research paper:

The purpose of this article is to construct-validate an instrument of Value-Based Performance Excellence Model for Higher Education Institution (HEI) in Malaysia that involved 6 value indicators which are leadership values, culture values, productivity values, employee values, stakeholder values and performance results values. 10 universities comprised of 2 types of universities i.e. the Research University and Focused University were involved in the study. About one thousand questionnaires were distributed which resulted of 474 questionnaires were returned for analysis. Structural Equation Modeling (SEM) technique through Confirmatory Factor Analysis (CFA) approach was deployed to address the aim of this study by using Analysis of Moment Structures (AMOS) software. The results of CFA for the hypothesised CFA Value-Based Performance Excellence Model revealed the fit statistics that were adequate for CFI = 0.933, TLI = 0.927 and RMSEA = 0.077 as they were within acceptable threshold values. In conclusion, the CFA model fitted the data well and there is no proof that the model is incorrect based on the fit statistics. Implications of the study was significant to HEI and in particular Ministry of Higher Education Malaysia to consider and empower the value-based assessment approach as part and parcel of university assessment for achieving total organisational excellence.

Keywords: *leadership values, culture values, productivity values, employee values, stakeholder values and performance results values.*

1.0 INTRODUCTION

Factors of leadership, cultures, productivity, employees, stakeholders and performance results are interrelated and crucial to any organisations. Many studies focused on these criterias signifying its importance (Mokhtar et al., 2003). Nowadays, intangibles performance indicators has become apparent in organisational performance measurement (Mokhtar et al., 2008; Ab Hamid et al., 2010a). This implied that the sole measurement process on tangibles criteria is no longer standing alone but has to be complemented. Therefore, this study intended to measure the intangibles parts of performance through values indicators that embeds the 6 performance indicators of *leadership, cultures, productivity, employees, stakeholders and performance results* in organisation especially Higher Education Institution (HEI). Obviously, there exists gap in measuring all of those indicators in terms of intangibles aspect (Nooreha et al., 2001,

Mokhtar et al., 2003, Fazli, 2004) and in this study it focused on the core values that underpin the criterias.

This research is a part of a larger study of Value-Based Total Performance Excellence Measurement (VBTPEM) (Mokhtar et al., 2003); that are conducted at HEI in Malaysia that concentrate on 6 performance criteria as mentioned previously and named as Value-based Performance Excellence Model for HEI. Therefore, this study would gauge the instruments developed through hypothesised measurement model of Value-based Performance Excellence Model for HEI by using Structural Equation Modeling (SEM) technique through confirmatory factor analytics (CFA) validation in terms of its construct validity and reliability. Also, higher level of validity i.e. discriminant validity among the latent construct of performance values indicators are established. Specifically, this study would address the following research questions:

- a) What are the perceptions that constitute a valid construct of Value-based Performance Excellence Model for Higher Education Institution (HEI)? Are the respondents responses influenced by the 6-factor as hypothesised by the researcher?
- b) Does each indicator has a nonzero loading on the hypothesised (targeted) factor?
- c) Does the factor reliably influence the variability of its indicators?
- d) Are the error terms uncorrelated?

2.0 LITERATURE REVIEW

Core values are the inner driver for the well-being of organisations if it wants to propel in the rapidly changing and competitive world. Values have gained attention in many studies, particularly in the field of leadership (Russell 2001). There is no hesitation that values give different meaning to individuals and even in the organisation. Nevertheless, standard values that becomes norm in the organisation must be strengthened and empowered to all organisational staff at all levels. Of import, is the attitudes and behaviors of a leader should reflect the values inherent in the organization (Currie et al., 2009) as leadership would spearhead and navigate the organisation towards excellence.

As emphasized earlier on, leadership is the utmost criteria that mostly affect any organization. The threat of corruption and abuse of power is a sign of less of integrity, stability and would jeopardise the national security (JKTU, 2009). Therefore, core values have to be empowered and instill into leadership for achieving total organizational excellence (Mokhtar et al., 2003). Although this effort might take time but it must be initiated through value-based leadership as this is significant in its realisation, (Abdus Sattar et al., 2010). We have identified 6 core values namely *truthfulness, trustworthiness, sincerity, sense of direction, commitment* and *competency* (Ab Hamid et al., 2010b) as a measure of leadership values.

The second criterion that is of paramount importance is the organisational culture (Matin et al., 2009; Pettigrew, 1979; Schein, 1990;2004) that is vital for organisational performance measurement. It forms the overall organisational traits and characteristics or simply said it describes each member of staff therein. Youngblood (2000) stated that even an organisational culture overshadows the leadership for organisational success. Zaini Ujang (2009) also supported that it is a crucial factor in HEI such as the university

as it is respected due to its cultural and academic environment that stimulates the mind, intellectual testing, test the creativity and knowledge-friendly and not merely the academic programs offered. Therefore, we have identified 6 core values or organisational culture to be practised in HEI such as *citizenship, consultation, caring, trust, respect and quality*.

Thirdly, productivity is another very important factor for organisational effectiveness. Fundamentally, productivity can be defined as a measure of the amount of output obtained from a certain amount of input (Mokhtar et al., 2003; Kapyla et al., 2010, Baines, 1997b; Sahay, 2005, Johnston & Jones, 2004). In another words, we can say as the optimum usage of various organisational resources in order to achieve the desired outcome. Baines (1997a) reiterated that factors affecting the productivity index should be understood; and therefore we propose several core values in order to support and measure the HEI productivity which are *efficiency, collectiveness, non-exploitative, economy of scale, frugality and timeliness* (Ab Hamid et al., 2010c).

Fourth, is the focus on organisational employee. Burke & Hsieh (2006) mentioned that it is of import to emphasize on employees on how to motivate and reward them in order to enhance motivation and performance. Mokhtar et al. (2003a) defines employee as the focus of the initiative to make employees think positively towards the organization and getting the work done. Therefore, in order to empower value-based employee criteria we derived the core values of employees that consist of *fairness, consultative, mutual trust, acknowledgement, altruism and empowerment*.

Next, the performance criteria is the stakeholder values. Stakeholder relationship is an asset which lever their values through relationship that would lead to wealth creation in the organisations (Philips, 2006). He added that relationships that have value can optimise the long-term shareholder values. Therefore, the following are the core values that are meant for shareholders values of organisational excellence i.e. *respectfulness, non-discriminatory, mutual interest, responsiveness, social responsibility and interdependence*.

Finally, in most studies found that non-financial metrics can be successful in enhancing organisational performance. Therefore, we pointed out 6 core values for performance results values as follows i.e. *profitability, noble values, intellectual capital, market value, stakeholder satisfaction and reputation*. Following the core values identified, we develop an instrument for measuring the Value-Based Performance Excellence Model for Higher Education Institution (HEI) in Malaysia. We also adopted and adapted the instrument from the previous questionnaire as in Mokhtar et al. (2003a) and Fazli (2004). The following diagram is the conceptual framework of the hypothesised Value-Based Performance Excellence Model for Higher Education Institution (HEI).

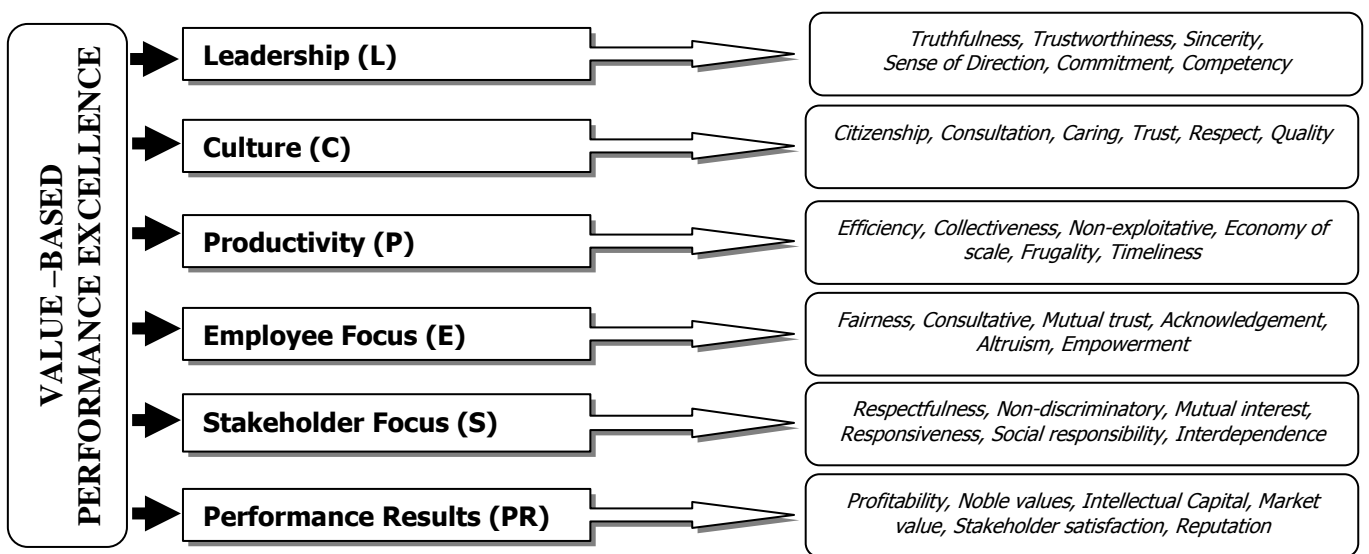


Figure 1. Value-based Performance Excellence Framework for Higher Education Institution (HEI) in Malaysia

3.0 METHODOLOGY

Based on the previous studies (Nooreha et al., 2001; Mokhtar et al., 2003 & Fazli., 2004), an instrument i.e. the questionnaire has been developed (partially adopted and adapted). There were 36 core values that have been identified by the researcher through a focus group discussion with the experts panel in addition to the literatures studies. Furthermore, the core values were initially established in the previous research with Institute of Islamic Understanding of Malaysia (IKIM). This body is a government agency that is fully committed to the notion of Islamic values and universal values and therefore, the core values were deemed to be appropriate after being thoroughly discussed on. However, a few core values were replaced in order to suit with the HEI environment for the purpose of this study. For every core values, 2 items are developed to measure the specified core values. It is imperative to note that core values are intangibles and therefore we need to transform into statistical indicators so that we can find the best measurement items to represent them (core values). In total, there are 72 items developed and would be averaged among two of them so that we can run the next analysis for only 36 items.

11-point Likert scale were used which showcased '0' as 'not visible' and '10' as the 'most visible'. The indication used is in terms of visibility of the core values whether exists or not in the institution according to the 6 performance criteria which are *leadership values, culture values, productivity values, employee values, stakeholder values* and *performance results values*. Performance results values is also referred to as university performance values. The wide range of Likert scale is used in order to let the respondents feel to rate based on their perceptions that are occurring in their university environment freely. This is vital in ensuring the respondents would give their sincere and truest answers as smaller gaps of indication would probably lead to condone their wisdom of rating.

The questionnaires were distributed with the assistance of Ministry of Higher Education, Malaysia to the respective selected universities. The universities were divided into 2 categories which are the *Research University* (RU) and *Focused University* (FU). The RU consists of Universiti Malaya (UM), Universiti Putra Malaysia (UPM), Universiti Sains Malaysia (USM) and Universiti Teknologi Malaysia (UTM) while FU are Universiti Malaysia Pahang (UMP), Universiti Tun Hussein Onn Malaysia (UTHM), Universiti Teknikal Malaysia Melaka (UTeM), Universiti Malaysia Perlis (UniMAP) and Universiti Malaysia Kelantan (UMK). A letter of support from the Ministry is issued to all universities involved through their respective Registry to formalise the distribution process of the questionnaire. About 1000 questionnaire were distributed and each university entitled to receive 100 questionnaires. The registrar of each university would instruct one key personnel who would be in charge of this distribution process from the very beginning until being posted back to the Ministry for analysis. The person-in-charge is required to identify the university staff from academic and non-academic line across departments/units/faculties as potential participants of the study randomly. Only Malaysian and permanent staff are considered for the study and involved Grade 41 (in terms of professional qualification) and above. Besides that, they also need to satisfy the minimum of 2 years of service experience in the respective university. The university is allotted a month to complete the questionnaire administration and must return to the Ministry as soon as possible.

As a result, a total of 697 questionnaires were returned to the ministry for further action. This accounted for 69.7% of response rates which are more than satisfactorily. However, a thorough check was done on all questionnaires and only 474 questionnaire were valid to be analysed and referring to Krejcie and Morgan (1970), the number of samples is more than enough for making generalisations. Among others is due to many rejected questionnaires as many empty responses were given. This means that too many missing values were found and the researcher cannot afford to rely on this responses and therefore were dropped in the next round of analysis. The data were coded and saved into Predictive Analysis SoftWare (PASW) version 18.0 (previously known as *Statistical Package for Social Sciences* (SPSS)). At first, the data were explored in terms of detection of outliers in the dataset. By doing the data screening process for outliers, Mahalanobis distance values were examined. In this study, Mahalanobis distance values ranged from 2.038 and 261.929 whereas the critical value with 36 degree of freedom is 67.99 at $p = 0.001$. Henceforth, the Mahalanobis distance which are greater than the critical value were the outliers in the dataset and deleted from further tests. This resulted in the deletion of 72 cases leaving 402 datasets to be analysed.

In addition, the skewness and kurtosis distribution were also explored and within the acceptable limits of normality assumption. This can also lead to a conclusion of multivariate normality assumption if univariate normality assumption is met (Kline, 2011). However, the researcher indentified the Mardia multivariate kurtosis coefficient was 389.3 and was within the acceptable threshold value of $p(p + 2) = 1368$, where p is the number of observed variables which was 36. Thus, maximum likelihood estimation technique is appropriate to be used as the estimation technique in CFA. In the next section, we will disuss on the CFA that basically to test the consistency of the hypothesised model with the empirical data obtained from the samples from the university's staff in Malaysia.

4.0 CONFIRMATORY FACTOR ANALYSIS (CFA)

Confirmatory factor analysis (CFA) was used to determine the construct validity of the questionnaire items of the latent constructs of *leadership values*, *culture values*, *productivity values*, *employee values*, *stakeholder values* and *performance results values*. It means how well is the construct explained the variables under the construct (Hair et al., 2010). After all, whenever the researcher bases his/her study based on sound theoretical justification, a method of confirmatory mode is very much delighted. Basically, there are many reasons for the use of CFA and among others are to empirically test a measurement model or in another words, to construct-validate the measurement scale. We may also put it differently as to clarify the meaning of constructs by establishing the extent to which a measurement model reproduces the data. Schmidt et al. (2005) also mentioned that CFA is for verification of the psychometric properties of the hypothesised measurement model.

4.1 Model specification - The hypothesised CFA model

The model to be tested postulates a priori that Value-Based Performance Excellence Model for Higher Education Institution (HEI) in Malaysia is a six-factor structure composed of latent constructs which are *leadership values*, *culture values*, *productivity values*, *employee values*, *stakeholder values* and *performance results values*; it is represented schematically in Figure 1 in terms of latent constructs. However, the items were loaded onto respective factors latent factors. Each of the factors were measured by 6 variables i.e. the core values that have been specified to represent each latent construct. Each of these observed variables is regressed onto its respective factor (Byrne, 2010). In addition, the reliability of each item is influenced by random measurement error.

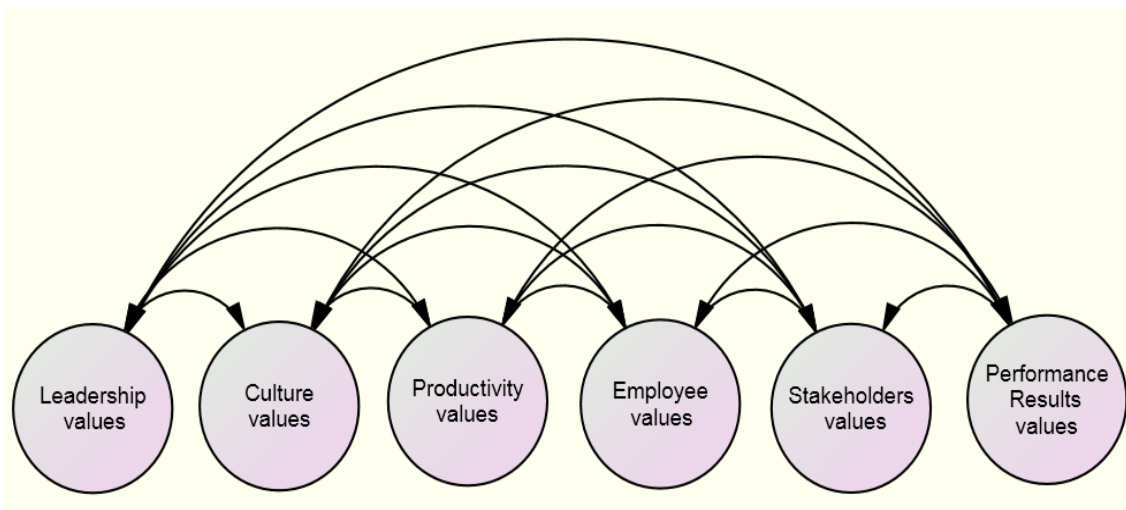


Figure 1. Hypothesised CFA model of Value-Based Performance Excellence Measurement

5.0 RESULTS

In this section, the researcher discussed the assessment of the model adequacy beforehand and proceeded to the explanation of the CFA result of model as a whole and substantiated the findings with the test of discriminant validity as put forward by Fornell and Larcker (1981).

5.1 Assessment of Model Adequacy

The fit indices of the hypothesised measurement model as in Figure 1 revealed the $\chi^2 = 1937.868$ (df = 579), p -value = 0.000, Normed chi-square = 3.347, CFI = 0.933, TLI = 0.927 and RMSEA = 0.077 (as summarised in Table IV). The χ^2 statistics means to test the consistency of the hypothesised model with the empirical data. It determines if the nonzero in the residual matrix could have occurred simply due to chance. However, this kind of fit statistics are sample size-dependent. As the number of sample size increases, the tendency of the chi-square test to become significant becomes apparent (Hair et al., 2010, Byrne, 2010). Therefore, another way to interpret this result is by dividing the chi-square value with its degree of freedom that produced the normed chi-square statistics. The value of below than 5 could be regarded as within acceptable fit. Next, the index of CFI and TLI is the incremental fit indices that indicates the improvement in fit of the hypothesised model over a baseline model. The cut-score for these fit statistics are greater than or equal to 0.90 that indicate good-fitting model. The value of RMSEA marks insignificant discrepancies between the observed covariance and implied matrices and thereby supporting the degree of fit (Mohamad Sahari, 2001). It includes correction for model complexity that approximates the discrepancy that could be expected in the population. This means that it estimates the lack of fit of the hypothesised model to the population covariance matrix. This implied that if a RMSEA value of zero indicates the best fit approximation of the population covariance matrix, while higher values of RMSEA signify poor fit.

All of these fit statistics exceeded the recommended threshold values of normed chi-square < 5, CFI and TLI > 0.90, RMSEA < 0.08 except for the significant p -value. However, p -value is the chi-square test that is influenced by the sample size. Given that the sample size in this study (402 respondents) considerably large, therefore, the researcher may opt for other fit statistics in order to reach a conclusion for the model fit; as we should not depend on one type of fit statistics only (Hair et al., 2010; Byrne, 2010). As the number of samples and the model complexity is concerned, we may impose a rather lenient or less strict criteria for evaluation on drawing a conclusion of model fit (Hair et al., 2010). Also we may resort to find the ratio of normed chi-square (χ^2/df) = 3.347 although Kline (2011) discouraged the use of this index. Hence, the results of CFA supported the adequacy of the hypothesised model. Summary of the fit statistics is shown in the following table.

Table IV. *Goodness-of-fit statistics*

Fit statistics	Hypothesised model
CMIN	1937.868
df	579
CMIN/df	3.347
<i>p</i> -value	0.000
GFI	0.770
CFI	0.933
TLI	0.927
RMSEA	0.077

The interfactor correlations among the latent constructs were below 0.90 except for *productivity values - employee values* and *productivity values - stakeholders values* which are $r = 0.910$ and 0.934 respectively. Therefore, we suspect that this factors might raise the issue of multicollinearity in the model. However, we may proceed for further analysis cautiously. Before we interpret the results of analysis, the researcher considers the reasonableness of the parameter estimates. Firstly, there are no offending estimates found such as negative error variances and illogical correlation coefficient. Also, the standardised residuals matrix are within the acceptable values of $|4|$ (Hair et al., 2010). Besides that, all the factor loadings are of practical importance and statistically significant. Also, we can say that the prespecified core values attached to each values indicators as latent constructs are consistent with theory. After all of these are examined, we can then proceed with the discussion of the construct validation analysis.

5.2 Construct validation

Basically, construct validation is a process of providing empirical evidence that the data or responses effectively and accurately measure a given construct. In another words, it refers to the degree to which a direct measurement represents an unobserved latent construct. Two types of validity tests are examined which are the convergent validity and discriminat validity. The convergent validiy refers to the degree to which the latent variables correlate with each other namely the proportion of variance that the items share in common. From the CFA result in Table I, we observed that the factor loadings of all observed variables or items are greater than 0.7. This showed more than an adequate factor loading (Hair et al., 2010). The factor loading ranging from 0.763 to 0.955 and succinctly the construct validity for the CFA model is supported. This indicates that all of the constructs conform to the construct validity test which means that all items belonged to the specified core values indicators. To be specific, convergent validity is asserted. Also, the variance extracted (VE) from each construct is more than 0.5 that further support the convergent validity. The proportion of variance explained or squared multiple correlation (SMC) also referred to as indicator reliabilty is more than 0.5. This showed that the items contribute as much as greater than 50% of variance explained and is not due to measurement error.

Basically, whenever the correlation of the items within the same construct is relatively high it is said to have the construct validity. Besides that, the factor loading or the regression weight and the squared multiple correlations (SMC) of the items are significantly correlated to the specified construct would also contribute to the crystal-clear understanding of construct validity. In addition to this, the item that best explain

the construct is the items that have higher loadings on the same construct and this can be referred to Table I. Next, we examine the construct reliability as a whole for every 6 latent constructs in this study through the calculation of composite reliability (CR). By referring to Table I, the CRs are shown and surpassed the cut-off point of 0.7. This is an indicative of good construct that is reliable. In order to strengthen the construct validity and reliability, we conducted higher level of validity tests by establishing the discriminant validity test on the hypothesised CFA measurement model of Value-based Performance Excellence Model for HEI.

5.2.1 Discriminant validity of constructs

Discriminant validity is the extent to which each construct is truly distinct from other related constructs in which the indicators are better associated with their respective latent variables. Simply said, the absence of cross-loading would support the discriminant validity. In fact, we may investigate the presence of the cross-loading in the analysis output but we may also resort to empirical calculation. According to Fornell and Larcker (1981), average variance extracted (AVE) should be more than the correlation squared of two constructs to support discriminant validity. AVE is a measure of the error-free variance of a set of items that is the amount of variance captured by a latent variable in relation to the amount of variance due to its measurement error (Fornell & Larcker, 1981). Correlation squared is also referred to as shared variance among the two latent constructs. Table I shows the result of the calculated variance extracted (VE) and Table II is the average variance extracted (AVE) matrix that is the average of VE values of two constructs while Table III is the comparison of AVE and the shared variance in the bracket.

Table I. Variance extracted and composite reliability for latent constructs

Constructs	Core values	Factor Loadings	SMC=r²	error	CR	VE
Leadership values	<i>Truthfulness</i>	0.819	0.671	0.329	0.970	0.844
	<i>Trustworthiness</i>	0.925	0.856	0.144		
	<i>Sincerity</i>	0.951	0.904	0.096		
	<i>Sense of Direction</i>	0.943	0.889	0.111		
	<i>Commitment</i>	0.929	0.863	0.137		
	<i>Competency</i>	0.938	0.880	0.120		
Culture values	<i>Citizenship</i>	0.853	0.728	0.272	0.963	0.814
	<i>Consultation</i>	0.894	0.799	0.201		
	<i>Caring</i>	0.920	0.846	0.154		
	<i>Trust</i>	0.941	0.885	0.115		
	<i>Respect</i>	0.935	0.874	0.126		
	<i>Quality</i>	0.868	0.753	0.247		
Productivity values	<i>Efficiency</i>	0.858	0.736	0.264	0.948	0.753
	<i>Collectiveness</i>	0.911	0.830	0.170		
	<i>Non-exploitative</i>	0.891	0.794	0.206		
	<i>Economy of scale</i>	0.893	0.797	0.203		
	<i>Frugality</i>	0.765	0.585	0.415		
	<i>Timeliness</i>	0.881	0.776	0.224		
Employee values	<i>Fairness</i>	0.763	0.582	0.418	0.950	0.762
	<i>Consultative</i>	0.907	0.823	0.177		
	<i>Mutual trust</i>	0.906	0.821	0.179		
	<i>Acknowledgement</i>	0.910	0.828	0.172		
	<i>Altruisme</i>	0.878	0.771	0.229		
	<i>Empowerment</i>	0.866	0.750	0.250		
Stakeholders values	<i>Respectfulness</i>	0.865	0.748	0.252	0.962	0.807
	<i>Non-discriminatory</i>	0.834	0.696	0.304		
	<i>Mutual interest</i>	0.898	0.806	0.194		
	<i>Responsiveness</i>	0.935	0.874	0.126		
	<i>Social responsibility</i>	0.948	0.899	0.101		
	<i>Interdependence</i>	0.906	0.821	0.179		
Performance results (University Performance)	<i>Profitability</i>	0.804	0.646	0.354	0.963	0.813
	<i>Good values</i>	0.873	0.762	0.238		
	<i>Intellectual capital</i>	0.912	0.832	0.168		
	<i>Market value</i>	0.912	0.832	0.168		
	<i>Stakeholder satisfaction</i>	0.955	0.912	0.088		
	<i>Reputation</i>	0.946	0.895	0.105		

Note: CR is Composite Reliability, VE is Variance Extracted

Table II. Average variance extracted (AVE) matrix

Constructs	1	2	3	4	5	6
Leadership values (1)	1.00					
Culture values (2)	0.829	1.00				
Productivity values (3)	0.799	0.784	1.00			
Employee values (4)	0.803	0.788	0.758	1.00		
Stakeholders values (5)	0.826	0.811	0.780	0.785	1.00	
Performance results values (6)	0.829	0.814	0.783	0.788	0.810	1.00

Table III. Correlation and correlation square matrix

Constructs	1	2	3	4	5	6
Leadership values (1)	1.00					
Culture values (2)	0.777 (0.604)	1.00				
Productivity values (3)	0.760 (0.578)	0.862 (0.743)	1.00			
Employee values (4)	0.736 (0.542)	0.845 (0.714)	0.910 (0.828)	1.00		
Stakeholders values (5)	0.753 (0.567)	0.827 (0.684)	0.934 (0.872)	0.877 (0.769)	1.00	
Performance results values (6)	0.659 (0.434)	0.756 (0.572)	0.863 (0.745)	0.796 (0.634)	0.874 (0.764)	1.00

Note: Correlation is significant at 0.01 level (2-tailed), values in brackets indicate correlation squared.

Each AVE value is found to be more than the correlation squared except for the correlation square of *productivity values - employee values* and *productivity values - stakeholders values*. which is slightly higher than the AVE value and the difference is 0.082 and 0.062 respectively. Nevertheless, we treated this difference as small but however we put some caution on our interpretation of analysis as we may proceed cautiously to conclude that the discriminant validity is supported. However, this situation has been expected as we suspect a bit high inter-correlation between these 2 constructs and it is no surprising that as these latent constructs are deemed to be under another factor i.e. *Organisational Focus* (OF) as referred to Mokhtar et al. (2003b) and Fazli (2004).

6.0 CONCLUSIONS

Simply said, the CFA model of Value-Based Performance Excellence Model for Higher Education Institution (HEI) in Malaysia that consists of a six-factor structure model is construct-valid. All research questions put forward has been answered through the analysis. We may also say that this CFA measurement model is good as the associated error terms in the model are not correlated. Based on the fit statistics, the implication of this model implied that it does not prove that the model is correct but rather it provides evidence that the CFA model fits the data reasonably well and there is no proof that the hypothesised CFA model is incorrect. Therefore, we can simply say that the HEI must possess the core values as specified in order to bring the university for accelerated excellence as the respondents responses are influenced by the six-factor as hypothesised. In conclusion, the fit statistics indicate an acceptable fit for the CFA model. Also, this instrument could be used for the HEIs in assessing their performance intangibly through core values given that the instrument is construct-valid and reliable. Future research may re-examine this model through Bayesian CFA modeling to strengthen the results as suggested by Arbuckle (2009) and Byrne (2010) and also embark on invariance analysis between the group of RU and FU to further strengthen that the CFA model for HEI is group-invariant.

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³ In order to avoid normative terminology, and inspired by the conceptualization offered in two recently-completed doctoral theses (Korkman 2006; Ots 2010), the paper use the notion of value formation rather than, for instance, the co-creation of value. Non-interactive value formation and interactive value formation are notions coined by Echeverri and Skålén (2011).

⁴ Since the author question the one-sided focus on the co-creation of value in previous research, the paper use the more neutral and open notion of the interaction view when referring to this research.

⁵ Treated as coaches in the present case.