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■ *Research Paper*

Applying System Dynamics to Foster Organizational Change, Accountability and Performance in the Public Sector: A Case-Based Italian Perspective

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The goal of this paper is to discuss the role System Dynamics (SD) can play to enhance performance improvement in the public sector. It is remarked how SD can help decision makers to properly perceive the boundaries of the relevant system underlying observed phenomena. To this end, three real cases are analysed to show how SD can facilitate a better understanding of the relationships between the political and the organisational system in the public sector, and how to promptly attain efficiency and improve outcome, given the constraints that the institutional and political systems constitute. Copyright © 2010 John Wiley & Sons, Ltd.

Keywords public management; accountability; performance measurement; balanced scorecard; system dynamics

INTRODUCTION

Applying the System Dynamics (SD) method to foster organizational change, accountability and to support effective decision making in the public sector implies a number of challenges which are interrelated, not only because of the specific complexity of the public sector itself (Bianchi, 2010), but also as a consequence of the idiosyncrasies that characterise a particular geographical area.

Such issues can be referred to four main interdependent sub-systems, that should be taken into account when applying SD to enhance organizational change programs in the public sector, that is the:

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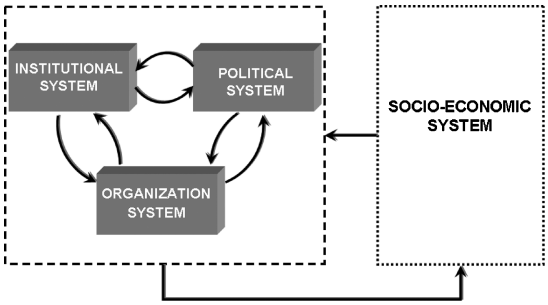

Figure 1 Four main sub-systems affecting organizational change interdependently in the public sector (adapted from Borgonovi, 1996, p. 105)

1. Socio-economic system;
2. Political system;
3. Institutional system;
4. Organization system.

As Figure 1 suggests, the implementation of programs aimed at fostering change, accountability and the improvement of service to users, and to the wider community, could be addressed by predominantly focussing on the organization system (e.g. on processes, roles and responsibilities, planning and reporting, career and reward/incentive schemes), and at the same time be hampered by a lack of attention to the wider socio-economic, political, and institutional systems with whom an organization in the public sector interacts. Although such factors may be considered outside the scope of a traditional organizational intervention, ignoring them may cause a failure in reaching the objectives stated. Such a failure may arise from relying on the hypothesis that improving the organization system itself will, cause an improvement in the overall performance as well. However, this hypothesis may not be valid for a number of reasons.

First, a public sector organization is tightly connected to other independent (loosely coupled) public sector organizations, whose policies may affect (positively or adversely) the implementation of its organizational change programs (Bianchi, 2010). The rules and legislative schemes which define such relationships can be referred to as the *institutional system* that also deals with relationships between the public administration system and external actors (e.g. citizens and private sector organisations).[1]

Second, the above rules of conduct are not only 'coded' by the formal institutional system; in fact, an informal *political system* defines how power is *actually* exerted and how the different roles which are ruled by the institutional system are played. This is affected by the hidden (social) rules of conduct leading to set political priorities in the allocation of resources, and to outlining community goals. Ignoring such a political system may significantly tackle any change program which only takes into account the managerial view of a public sector organization.

Third, since both the institutional and political systems are an expression of the emerging (or leading) culture and values arising from the underlying wider socio-economic systems, any public sector organizational change program ought to take into account what opportunities there exist to affect, in the long term, such a culture and values, possibly with the aim of changing the context (i.e. both the institutional and political system) in which the management operates.

When applied to the Italian context, the above analysis is relevant to a wide scope of challenges associated with an effective implementation of public sector organization change programs, and the use of SD to support them.

In particular, this paper aims at highlighting two challenges, that is the need to:

1. Properly address the relationships between the political and the organizational (managerial) system. On this concern, primary research questions are the following:
   - 1.a How can SD facilitate a better understanding of the (often hidden) relationships between the two systems?
   - 1.b How can SD foster a better communication and strategic dialogue between politicians and managers, with the intent to improve policy making and implementation?
2. Promptly attain efficiency and improve outcome at the same time, given the current constraints that the institutional and political

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systems constitute. In this regard, primary research questions are the following:

2.a How can SD support management to keep under control the key performance variables driving to the success or failure of their organizations?

2.b How can SD support management to improve social reporting on the outcomes generated by implemented strategies?

Based on a case analysis conducted by the authors, in the next sections of this paper, we will provide insights into the challenges listed above. While the three following cases are from quite different contexts (i.e. water public utilities, health care, opera production and staging), their analyses suggest the existence of a number of commonalities that may offer possible answers to the above research questions.

In particular, the first case-study provides an example of a Public Utility (PU) whose lack of efficiency and effectiveness is due to huge political interferences into the organisation system. The second case illustrates financial and social dysfunctions generated into the health care organisation system by setting surgery tariffs at political level disregarding the clinical context. The third case shows how keeping under control the key performance variables in a municipal theatre may allow managers to attain efficiency and improve outcome.

Though the analysis of all the three cases tries to provide insights on both the above sets of challenges, the first two cases primarily address the research questions 1.a, 1.b and 2.b. The third case is more focused on the research question 2.a.

The first two case-studies also differ from the third, if we consider the perspective through which they are framed. In fact, they remark the role SD can play to analyse and diagnose a complex problem by combining a *macro* (i.e. the institutional and political systems) with a *micro* (i.e. the organisation system) view (Bianchi, 2010). The third case emphasises the role SD can play in supporting the implementation of policies aimed to recover efficiency and effectiveness at a *micro* level (i.e. the organisation system).

FOSTERING ACCOUNTABILITY IN PUBLIC UTILITIES: THE 'ACQUA SPA' CASE-STUDY[2]

Introduction

Particularly in the last decade, the debate on the causes of the failure of PU performance improvement programs seems to be focused on two main aspects, that is the intervention field and the reform of legal issues ruling the status of PUs.

Under the first viewpoint, it has been shown (World Bank, 2004) that the core of such interventions has been exclusively on the organization system, rather than also on the wider context in which such companies operate. This narrow focus implies that, to improve PU performance, it is sufficient to undertake a reorganization process aimed to improve outcomes, efficiency, effectiveness and financial balance.

Under the second viewpoint, reforms have been oriented to separate the responsibilities of the three main involved actors, that is: owners, Board and management (Baietti *et al*., 2006). Such goal has been primarily pursued by changing the legal status of organisations, from a 'statutory body' to a limited corporation totally owned by local institutions. This policy, borrowed from the private sector, has proven ineffective since it does not address the public sector's peculiar complexity. In particular, PU ownership has not been separated from external political interventions aimed to satisfy the interest of restricted groups of stakeholders with the intent to gain consensus leading to re-election (Shapiro and Willig, 1990; Shleifer and Vishny, 1994).

To improve PUs performance, it is not sufficient to act into the PU organization per se. On the contrary, it is necessary to outline the relationships between the institutional, political and socio-economic systems, providing the context in which PUs operate. At least in Italy, such relationships often generate unsatisfactory results, in terms of both financial and service performance.

[2]This case-study has been written by Carmine Bianchi, Enzo Bivona, Tiziana Landi and Paolo Ricci.

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Table 1 General characteristics of ACQUA

General characteristics of ACQUA	2005	2006	2007
Population served	450,000	450,000	451,290
Connections	202,748	205,462	208,474
Numbers of employees	409	410	406
Working ratio	64%	64%	64%
Staff per 1000 connections	0.80	0.81	0.82
Staff per 1000 population served	1.77	1.77	1.78
Accounts receivable as a share of annual revenue, expressed in month's sales	76%	89%	88%
Water supply	N/A	69,783,898	67,482,428
Water supply turnover (m^3)	35,836,590	36,149,555	36,376,354
Unaccounted for water (m^3)	N/A	33,634,343	31,106,074
Unaccounted for water (%)	N/A	48	46
Average domestic tariff (€/m^3)	0.63	0.63	0.63
Revenues	€39,709,699	€37,422,815	€35,514,684
Operating costs	€37,801,388	€38,615,585	€44,862,991
Net profit (loss)	€361.854	€27.864,00	€ (9.480.079,00)

A major cause of this phenomenon can be attributed to the high influence of politicians in appointing the PUs Board of Directors to satisfy their own parties' interest and to promote social consensus aimed to re-election.

A related cause of poor PU performance can be also attributed to the wider socio-economic system where such institutions operate. In fact, a political system in which people culture and dominant values are oriented to the search of personnel favour and influence peddling may provide a fertile field for unethical behaviour leading to inequality, inefficiency and poor outcomes for the citizen. Therefore, even the best change-oriented programs focused on the organisation system and the best legislative innovations aimed to regulate the institutional system (in particular, concerning the Municipality-PU relationship) are destined to fail if a systems approach is not adopted.

On the basis of the above remarks, the next section will illustrate a public water utility case-study operating in Southern Italy and show preliminary findings about main factors affecting PU performance. The case-study analysis has been conducted based on the conceptual framework previously used in an international research (Baietti *et al*., 2006) aimed at outlining main external and internal factors affecting public water utilities performance.

By the light of the case-study analysis, some vicious circles leading to PU performance deterioration due to political interferences have been outlined and alternative intervention policies explored.

The ACQUA SpA Case-Study

Introduction and General Description

ACQUA SpA[3] is a joint stock company established in 2003. It is owned by a large number of small municipalities (about 128) located in Southern Italy, and provides water supply and sewerage services to more than 450,000 users. Table 1 reported below summarises main company data.

In order to make explicit main decision making processes affecting PU performance, the case-study analysis has been carried out by taking into account two complimentary perspectives. The first refers to the *institutional environment* in which the PU operates. The second identifies the main *internal factors* affecting PU performance.

[3]The name of the PU has been intentionally disguised.

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The Institutional Environment

The Institutional environment can be associated with two main issues: the *external autonomy* and the *external accountability*. The first relates to the degree of independence of the PU managers from external interferences in decision-making. The second issue refers to the extent the PU responds to external stakeholders on precise performance indicators, based on which incentives are provided.

In terms of *external autonomy*, as ACQUA SpA is a joint stock company, it has a strong formal independent status. The utility is governed by a board of directors consisting of five persons, who are appointed by municipalities. However, since ACQUA SpA is owned by a large number of small municipalities, this often tackles the ability to achieve mutually agreed decisions on Board nominations. Therefore, political parties often take a leading role in designating the members of such boards. This turns the PU external autonomy into a formal state only.

Members of the Board are often appointed on the basis of their 'political affiliation'[4]and rarely on their professional experience. This phenomenon is consistent with the research conducted by Gutiérrez and Menozzi (2008) on 114 Italian public utilities in a 10-year period. In particular, the study demonstrates that unnecessary staff is often hired, through politicians influences on the Board, and such decisions have a negative impact on PU performance.

Such phenomenon can be empirically found in the ACQUA SpA, and explains its significant financial losses recorded in 2007. In particular, by comparing 2006 and 2007 results, it is possible to detect a 5% decrease in revenues and, at the same time, a 14% increase in the total costs. A significant part of such an increase is due to personnel costs.[5]

In order to recover such a negative performance, ACQUA SpA can not autonomously define the water tariff. In fact, water distribution tariff is determined by a national law, based on the investment plan adopted by the PU, and should allow the PU to earn a 7% annual return on capital invested.

Concerning the *external accountability*, the current PU targets (in terms of revenues, water production, distribution, consumption, unaccounted water and new connections), that are made explicit in the annual budget and submitted by the board of directors to shareholders, are quite easily to achieve in comparison to the available resources. For instance, there is not a significant evidence of the effort done by the company to recover the very high percentage (about the 50%) of the annual unaccounted water.

The above remarks also suggest that performance targets are not perceived by shareholders as a way of pressuring the utility to improve its results. Rather, as long as ACQUA SpA accomplishes its main task of providing reliable water services, shareholders do not intervene.

The PU Organization Setting

Among the internal factors that are likely to affect PU performance, the degrees of *internal autonomy* and *accountability*, and *customer orientation* can be taken into account.

The decision making process in ACQUA SpA is highly centralised. Although the company is organised in different departments, each head of these units has a limited decision power and very bounded autonomy. In fact, most decisions are made by the managing director and approved by the board of directors. The board mainly focuses on strategic decision making and the managing director focuses on only operational decisions. The decisions that are typically made by the managing director, and authorised by the Board, are those related to the approval of the procurement of goods and services and the hiring of employees. As a consequence, the above decisions can be influenced by those politicians who appointed the board members.

The high level of influence of political parties through the Board on the PU strategic decisions can be also explained by the low level of

[4]According to Gutiérrez and Menozzi, and the prevailing literature (Faccio, 2005), a director has a 'political affiliation' when he/she has alternatively one of the following roles: (a) an active position (or has been active) in the recent past in the political arena, (b) an official political position (for instance, deputy of the national Parliament, member of Regional, Provincial or Municipal governments), (c) been (or is) candidate for election, (d) a membership in a political party or a friendship with people associated with a political party.

[5]This phenomenon can not be explained by looking at the operational side of the company, as the population served is stable. On the contrary, the increase in (unnecessary) human resources could be interpreted as a result of political pressures on the PU.

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company internal accountability and transparency. For instance, the company does not adopt any system to evaluate employees' performance. Although some managers undertake employees evaluations at their own initiative, these evaluations are not structured. The formal respect of procedures is perceived as more important than meeting performance targets.

Furthermore, ACQUA SpA has a weak orientation towards customers. This can be detected by several factors. First, there is not a formal procedure on how to deal with customers' complaints and response times to complaints are not available. Second, benchmarking is in its infant stage. It focuses on tariffs, water quality, level of services and efficiency. However, its outcomes are not used in company strategic or operational plans. Finally, although the company introduced a customer charter, it does not conduct any market survey aimed at detecting the perception of the level of customer satisfaction.

Vicious Circles Leading to ACQUA SpA Performance Deterioration due to Political Interferences

A feedback analysis can be helpful in highlighting the vicious loops that have been affecting the company performance. On this regard, staffing and procurement processes will be analysed.

Figure 2 shows how overstaffing, that is the hiring of unnecessary (and often unqualified) staff due political interferences into the company management, decreases staff motivation and skills, the level of service provided to customers and PU performance. In turn, the poor PU performance raises municipality subsidies to financially sustain the organisation. At the same time, such public fund intervention empowers municipal political representatives to intervene in the PU decision making process, for instance, by 'recommending' the desired people to hire (see reinforcing loop R1 in Figure 2).

The above interference in the managerial decision making process is also likely to produce a decline in the level of 'PU management autonomy' and, hence motivation, leading to a further drop in PU performance (see reinforcing loop R2 in Figure 2).

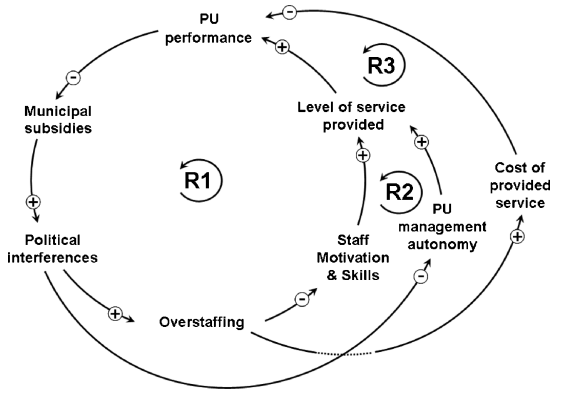

Figure 2 Vicious circles leading to PU performance deterioration due to political pressure to hire desired (unqualified) staff

Finally, overstaffing also produces an increase in personnel costs, without a significant contribution in terms of efficiency or effectiveness. This phenomenon boosts operating costs, which causes a decay in PU results, and reinforces politicians interferences (see reinforcing loop R3 in Figure 2).

Another area of political interferences in the PU autonomy refers to suppliers' selection. This is likely to generate two other vicious circles leading to PU performance deterioration (see reinforcing loop R4 and R5 in Figure 3). In fact, an intervention in the managerial decision process reduces PU managers autonomy, leading to a drastic drop in their motivation. Moreover, this phenomenon increases operating costs (e.g. due to low quality raw materials), and therefore reduces performance. A lower performance, increases debts and the degree of external dependence, and provides the basis for further illegal political interventions on company activities.

Concluding Remarks on the ACQUA SpA Case

Based on the above analysis, it is possible to outline intervention policies to allow the PU to recover sustainable competitiveness and financial equilibrium, at least in the long run. The possible levers on which to act should be related to the sub-

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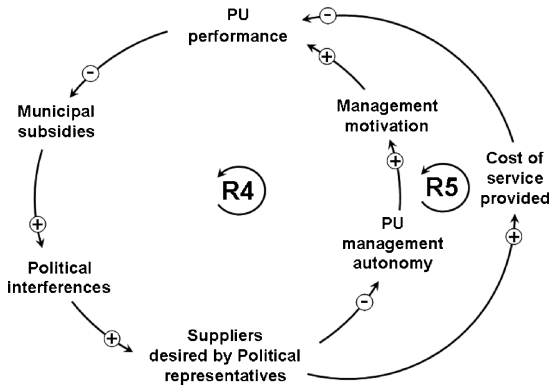

Figure 3 Vicious circles leading to PU performance deterioration due to political pressure into the procurement processes

systems described in Figure 1, that is: the institutional, political and public utility systems.

Figure 4 shows that, in order to counterbalance the vicious effects generated by the reinforcing loop R1, a first balancing loop could be fostered by introducing consistent *changes in the system of rules*, which discipline the roles and responsibilities of various actors operating not only inside, but also outside the PU. As the loop B1 in Figure 4 shows, the need for such policy should be directly related to the level of political interferences. On this regard, therefore, it is critical not only the quality of adopted changes in the system of rules, but also the time and the extent to which the phenomenon of political interferences is perceived as a threat to the survival of the community. As the above B1 loop shows, the positive effects produced by changes in rules determine a reduction in political interferences.

Concerning the second subsystem (i.e. the political one), another balancing loop could be fostered by introducing *new frameworks implying social/political accountability*. The adoption of such frameworks would allow the community to evaluate the effectiveness of political action and related outcome. In order to achieve this goal, however, it is also necessary that the community develops a culture oriented towards the proper role of the PUs in society (e.g. to satisfy citizen's needs), rather than perceiving such companies as a means to opportunistically obtain favours from politicians through influence peddling. As the B2 loop in Figure 4 shows, such a policy can be fostered by a proper and timely perception of poor PU performance and its negative effects on the social costs of poor services. This would determine a drop of social consensus for re-election, leading to a reduction in political interferences.

Concerning the third subsystem (i.e. the organisation sub-system), another balancing loop could be fostered by introducing new mechanisms inside the PU, aimed to improve the *quality of management systems*. Also in this case, such a policy should be fostered by the perception of unsatisfactory PU performance levels. The adoption of proper systems to increase the quality of

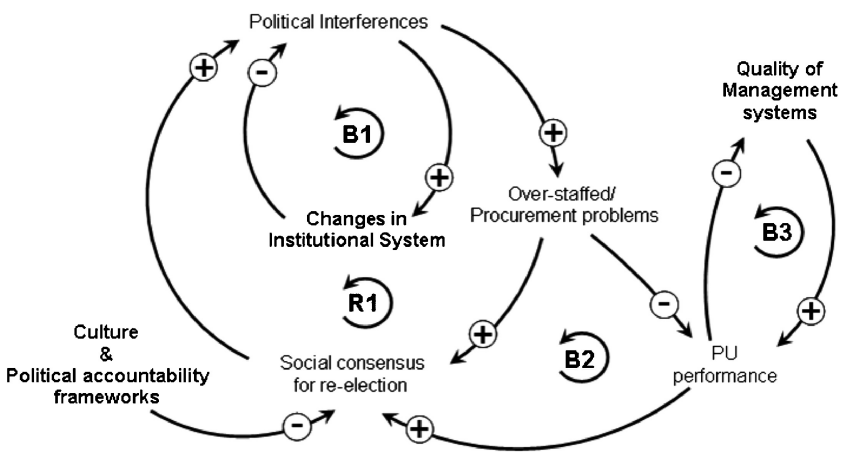

Figure 4 Intervention policies to recover PU sustainable competitiveness and financial equilibrium

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managers, together with reduced political influences leading to higher managerial autonomy (and possibly also supported by the hiring of skilled employees), would determine an increase in PU performance (see loop B3 in Figure 4). In fact, a PU performance lower than a desired level, would determine the need of a higher quality in management systems (e.g. in terms of hiring qualified personnel, improving organisation structure and processes, information, planning and control systems). A higher quality of management systems would contribute to increase PU performance.

LINKING POLITICAL WITH MANAGERIAL AND MEDICAL PERSPECTIVES IN DRG SETTING: FROM AN OUTPUT TO A PATIENT-OUTCOME VIEWPOINT. THE ISMETT CASE-STUDY[6]

Introduction

In Italy the majority of healthcare is provided by the State, funded from general taxation. The provider is called SSN, that is *Servizio Sanitario Nazionale* (National Healthcare System). Italy's health care system is a regionally based national health service that provides universal coverage free of charge at the point of service.

The system is organized at a national and regional level. The national level is responsible for ensuring the general objectives and fundamental principles of the national health care system. Regional governments, through the regional health departments, are responsible for ensuring the delivery of a benefit package through a network of population-based health management Organizations (local health units) and public and private accredited hospitals.

Hospital care has always represented the largest share of health care expenditure and has often been a source of major concern to the central government. In the 1990s the Italian government has established that the hospital payments will be made through a system called DRG—Diagnosis-related group (Hsiao *et al.*, 1986).

The DRG system has been developed and used in USA since 1983, with the purpose to determine how much the Government (Medicare) pays the hospital. It is a system to classify hospital cases into one of approximately 500 groups (also each called simply DRGs), expected to have similar hospital resource use. The DRGs are assigned by a 'grouper' software based on a coding system called ICD-9-CM, indicating diagnoses, procedures, age, sex, and the presence of complications or co-morbidities.

Since patients within each category are similar clinically and are expected to use the same level of hospital resources, this DRG system is used for both hospital payments and for hospital performance measurements.

Hospital Performance Measurements

The DRG system provides a large amount of information and many quantity measurements and a quality measurements can be provided. The most frequent information/indicators utilized are:

Volumes	Patients discharged: inpatient and day hospital/day surgery
Type	Each of the approx 500 DRGs is classified as a medical or a surgical type
ALOS	The average length of stay indicates the duration the patient stay for each classification
Weight	Each of the DRGs has assigned a weight that measures the amount of resources an a average basis that are required for that patient stay
Fee	The DRG fee is the amount of revenue that the hospital will receive for that specific classification

Most of the standard performance indicators that are DRG-related provide quantity type measurements such as volumes, surgical percentages, patient days, occupancy rates, etc.

There are even some quality measurements; probably the most important and most utilized is the DRG weight. This is called even a complexity

[6]This case-study has been written by Carmine Bianchi and Pietro Ferrara.

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index that qualifies the level of complexity of a specific hospital.

This type of performance indicators does not cope the need to include for each classification some process measurement indicators (e.g., drugs, medical supplies, physician decisions, etc.). This need is originated by the conviction that each patient in several cases is unique and his/her treatment therefore could be significantly different inside the same DRG classification.

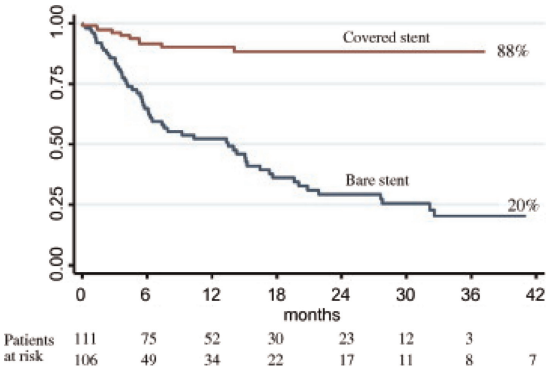

Figure 5 Cumulative proportion of patients free of TIPS dysfunction according to the type of stent received (numbers below the abscissa are patients still free of TIPS dysfunction per each observation period. Patients were treated at ISMETT, Palermo)

Does the DRG Classification Capture the Technological Progress in Medicine?

A puzzling and recurring problem is related to the above issues. To what extent does the DRG foster or hinder technological progress in medicine?

Such question is relevant to the subject of this paper, since it refers to the relationships between the political and organisation system, in the wider public sector. In this case, the political system settles the DRG policy, while the organisation system (i.e. hospitals) manages service provision and related technological implications.

To address the above question, a case example will be considered: the 'trans-jugular intra-hepatic portal systemic shunt' (TIPS).

DRG N. 191 and 192	Major procedure on pancreas, liver plus shunt with/without complication
Procedure	TIPS
Description	This is an interventional radiology procedure called TIPS for the prevention of recurrent variceal bleeding

Beside any consideration of clinical advantage, which is not the scope of this paper, the interest lays on the alternatives of medical supplies utilized for this procedure and their effect on the results for the patient's outcome.

In the beginning, for the TIPS procedure was used a bare stent that presented the disadvantage of requiring a strict surveillance program and repeated reinterventions (several procedures and hospitalization for the patient) for preserving its patency, with a marked increase of the overall cost over that of the initial procedure.

Afterwards, the technological progress in medicine has introduced new and advanced materials, in fact the rates of stent dysfunction and reinterventions have been significantly reduced by the utilization of these new covered stents. The experience at ISMETT,[7] with 106 patients who underwent bare stent and 111 covered stent TIPS, further confirms these results (see Figure 5).

The use of covered stent (nowadays the standard of use) would much improve the cost effectiveness of TIPS. In fact, since the only difference between the two treatments was the number of reinterventions for maintaining the shunt patent, it is conceivable that overcoming this problem would result not only in a marked reduction of the overall treatment cost, but also in an appreciable improvement of the quality of life. In fact, the patient would reduce the times of hospitalization.

From a DRG stand point, which sometimes becomes the hospital perspective, the results could be interpreted significantly differently. The

[7]ISMETT is an hospital based in Palermo and related to the Pittsburgh University, USA. ISMETT is an excellent centre for transplants in the Southern Italy.

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DRG revenue using either type of stents (bare or coated) is the same, but the hospital's cost only for the stent is much different (the bare cost 25% compared to the coated). This is the first potential advantage.

Adopting the bare stent the hospital would probably need to have the patient repeat the procedure every 12–18 months, and consequently earn an extra DRG revenue for each time that patient repeats the procedure. This is the second factor that could incentive the hospital in using a certain protocol.

It is possible that if the hospital would follow a blind path towards the Profit and Loss statement, associated with the weaknesses of the DRG system to detect these differences, the patient outcome would not be addressed.

Implications for Public Policy/Management, and System Dynamics Modelling

DRGs are a well-established provider payment system. Because of their imminent potential of cost reduction, they have been widely introduced by many governments.

But we have seen that there could be potential pitfall of the objectives between the DRG system and patient outcome. The first is a mandatory hospital measurement tool that provides a measure of revenue (cost) and productivity. The second should be the fundamental part of all hospital's mission.

On this regard, a number of questions for policy makers should be considered while drafting the national and regional health plan: *is there a detachment in the objectives between the policy maker (regional government) and the process maker (physician or hospital administrator)*? *Could the performance indicators contemplate the patient outcome?*

A Preliminary Analysis of the Problem Through the System Dynamics Approach

Unintended consequences associated to DRG funding are not a new phenomenon. Particularly in the last decade, several studies have been highlighting the outcomes originated by regulatory policies undertaken by public sector organizations in order to foster efficiency and effectiveness in health care systems.[8]

On this regard, the so called 'DRG-creep' phenomenon has been emphasized by various authors. This implies that 'patients are placed in higher priced DRGs than their actual state of health would warrant' (Christensen *et al*., 2004).

Other unintended consequences of DRG funding have been related to the tendency of some hospitals to increase the volume of patients, in order to maximize the flow of revenues (being DRGs related to the diagnosis that originates a hospital service), or to affect the case-mix (e.g. by encouraging the admission of those patients whose DRG is higher than others) (Mikkola *et al*., 2001; Kamke, 1998; Sheigold, 1986). Early discharge rates have also been referred as common practices in the field (Cantù *et al*., 2008).

Related to this phenomenon, not only a typical problem of goals avoidance driven by opportunistic behaviour following the introduction of performance measurement frameworks, but also a service quality phenomenon arises. In fact, a focus of performance measurement frameworks on only outputs, rather than also outcomes, at least in the perspective of hospitals, has been a primary cause of their inclination to dismiss patients 'too quick' (and often also 'too sick'). For this reason, the Swiss Cantons of Zurich and Berne have recently re-modulated their own DRG system on an outcome, rather than on an input and output-only basis (Draghic, 2006).

Similar problems can be envisaged concerning the previously described theme, that is: capturing medical and technological progress in DRG framework systems. The case-study described above clearly illustrates how anchoring DRGs on only a nominal classification of medical or surgical type, rather than also on the technology used in medical care, can be a major cause of

[8]More widely speaking, health care has proven a fertile field for SD modelling. Though a detailed analysis of the SD literature is not the focus of this study, we may here remind some of the most representative studies covering both *macro* (e.g. regional health care systems; Vennix and Gubbels, 1994; Wolstenholme, 1999) and *micro* (e.g. hospitals; Lane and Huseman, 2008) perspectives of applications. In particular, on SD applied to DRG policies, see: Maliapen and Dangerfield, 2009; Trailer and McLaughlin, 2007.

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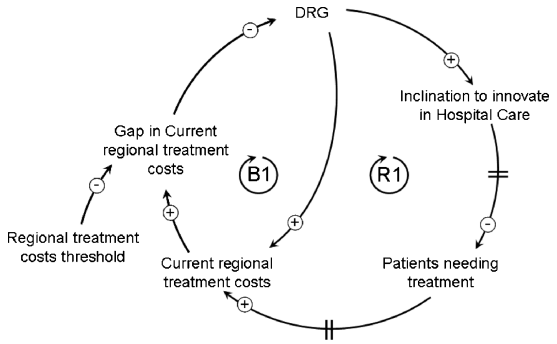

Figure 6 Short and long term effects from myopic DRG setting by Regional policy makers.

unintended negative effects, leading to higher heath care system costs on a longer time perspective.

Figure 6 shows how – according to the current policy – setting a given threshold in regional health care costs implies a reduction in DRGs, if the current regional expenses for healthcare are higher than the budget (i.e. the threshold). The balancing loop depicted in the figure shows the effect that such a policy is meant to generate: the higher costs, the higher the gap will be; a higher gap will reduce DRGs (or will contain them); this would lead to lower costs, that would allow the Regional administration to meet the budget threshold.

In the case here described, this phenomenon is observed in the short term. In fact, such a policy only aims to foster efficiency improvements in the different organizations operating in a regional healthcare system.

Nevertheless, such an indiscriminate cost-reducing – and (more specifically) revenue cutting – policy naturally generates an inclination of hospitals to reduce the quality of their services. In such case, this implies a lower inclination to adopt more sophisticated and innovative surgical technologies, since their costs would not permit hospitals to meet the DRG targets.

Therefore, such a myopic DRG policy is likely to generate a lower inclination to innovate in hospital heath care. This would, in turn, lead – after a delay – to an increase in the stock of patients needing treatment, because of the flow of patients needing reinterventions. Such a phenomenon may determine a new strong increase in the current regional treatment costs.

The above described series of events generates in the long run a reinforcing loop, linking costs to DRGs, and DRGs to the inclination to innovate, to patients needing retreatment and to costs again.

The same phenomena can be depicted through a SD simulation model (Figure 7).[9]

The basic structure of this insight model, consisting of the two interconnected stocks, aims to reproduce the same behaviour observed in Figure 5.

It is hypothesized here that a stock of 100 patients needing treatment is drained by the flow of new treated patients, as an outflow of patients receiving surgical operations (the average recovery time is here an input parameter, equal to 12 months). Such an outflow accumulates into the stock of treated patients, whose initial value has been supposed also 100 people. This last stock is drained by the outflow named 'Patients needing retreatment'. Such variable is the ratio between the 'Treated patients' stock and the average retreatment time associated to the adopted technology: the bar stent technology implies a 30 months, while the covered stent technology implies a 220 months period.[10]

The results portrayed by the simulation model confirm how the current policy (which is – at least implicitly – oriented to adopt the bar stent technology) tends to increase, over a 4-year period, the level of patients needing treatment. Such phenomenon is due to the higher volume of the flow of patients needing retreatment over the same time horizon.

The model also shows that a higher stock of patients needing treatment – for the first policy, in respect to the second one – originates a higher flow of new treated patients, that is a greater number of surgical operations. Therefore, such operations generate unintended higher costs for the regional heath care system.

[9]Model Equations are available on request from the authors.
[10]The above two parameters have been set in a way that – given a stock equal to 100 treated patients – the corresponding survival curves can approximate to those in Figure 5.

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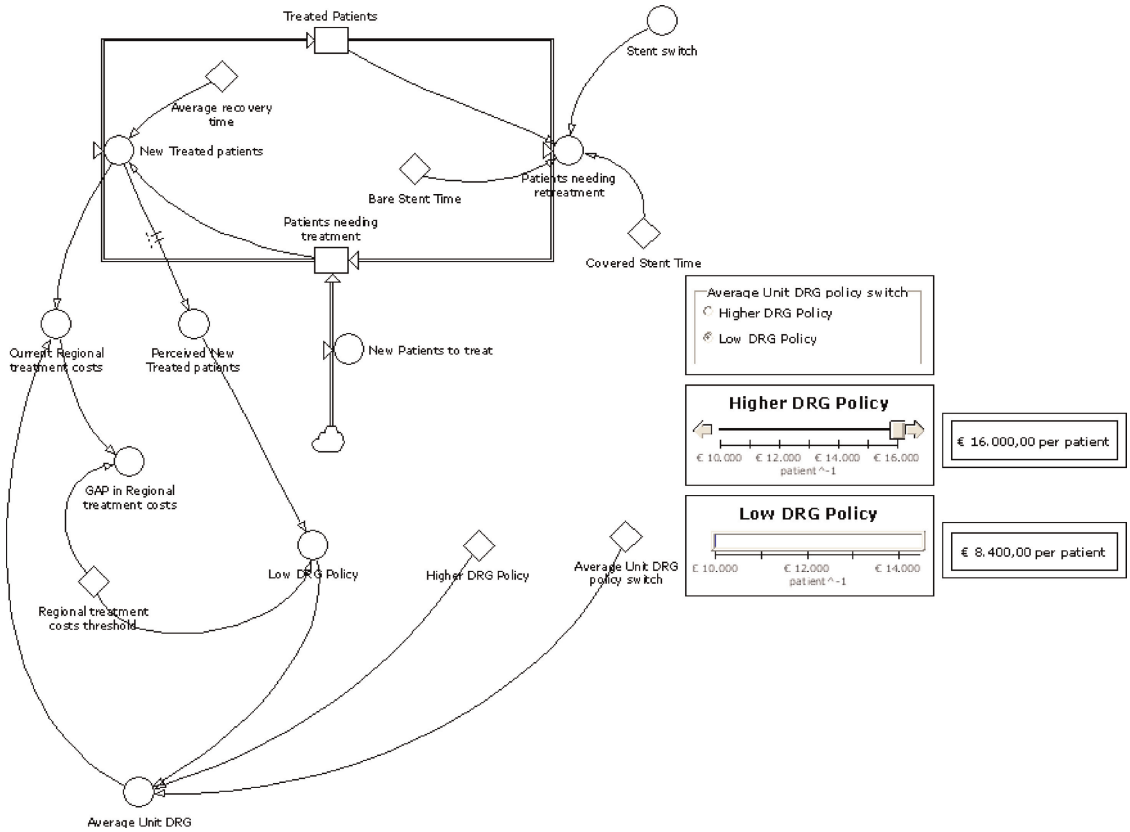

Figure 7 A stock- and flow-diagram model showing short and long term effects from myopic DRG setting by Regional policy makers: Effects of Regional DRG Policies on costs

This phenomenon is more evident if we include in the model another inflow into the stock of 'Patients needing treatment'. Such an inflow corresponds to the new patients to treat, that is to the number of new surgery treatments to make for the first time on patients. The test data for this inflow has been set to a constant of 4 patients per month.

On this regard, Figure 8 shows that while the dynamics of such stock portrays an increasing pattern of behaviour in the first run, it rather declines in the second run. The cause of this phenomenon is associated to the higher stock of treated patients, leading to higher volumes of patients needing retreatment over time. From the second graph of Figure 8 it is possible to observe how the higher value of this stock generates a much higher volume of patients needing a new surgical operation, if the first current policy (bar stent) is adopted.

Key:

Policy 1: Bar stent policy (solid line).
Policy 2: Covered stent policy (dotted line).

The insight SD model also embodies an analysis of the regional DRG setting policies. As shown in the stock and flow model depicted in Figure 10 here we have a threshold for regional treatment costs on the above TIP disease treatment, that is: €70.000 per month.[11]

The corresponding current regional treatment costs are calculated as a product between the flow of new treated patients and the average unit DRG.

[11]This is also a test – rather than – empirical value.

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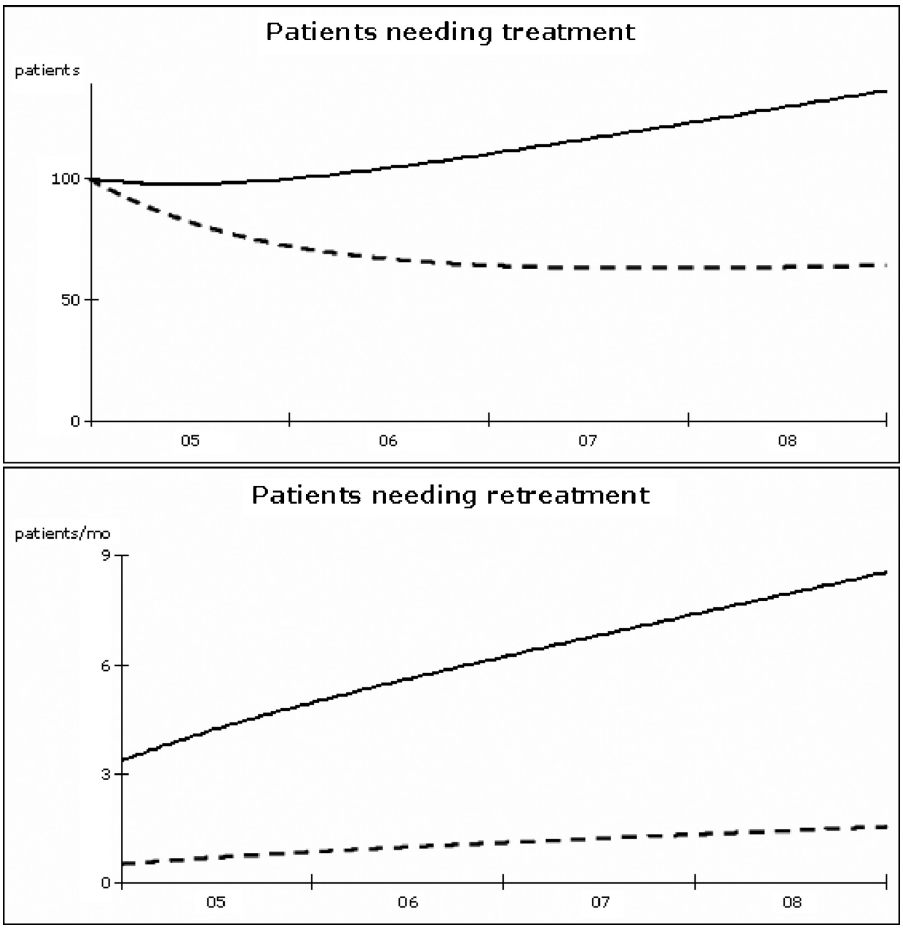

Figure 8 Results from two simulation runs (second version of the SD model)

Based on such threshold, the current regional policy is to initially set the DRG at €8.400 per treated patient.[12] Such a parameter is related to the 'Low DRG policy' factor, which currently determines a high percentage of cases treated through the bar stent technology. The model shows that such DRG is set according to the ratio between the regional treatment cost threshold and the perceived current number of treated patients.[13] Therefore, during the simulation, if the DRG is based on the current approach ('Low DRG policy'), the average unit DRG will decrease if (given a threshold level for TIP disease treatment) the flow of new treated patients will increase.

According to an alternative hypothesis, the DRG on TIP disease treatment recognized to hospitals wishing to adopt the covered stent technology, could be set to €16.000. Although such a substantial increase would not represent a multiple of 4 (i.e. the estimated cost ratio between the two technologies), with respect to the DRG recognized to the hospitals using the older technology, this higher DRG might encourage innovation policies in surgery operations. Simulation results will show now that an even higher DRG would be unsustainable, in consideration of the budget threshold.

[12]Based on such DRG, current regional treatment costs per month, at the beginning of the simulation, meet the budget, that is: €8.400 × 8.33 patients/month = €70.000/month.
[13]Due to the relative difficulty to reduce the DRG in the short time, the observation delay for the 'New treated patients' flow has been set to 5 years.

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From Figure 7 it is also possible to observe that the policy maker may operate through a check button and a slider bar, decisions on DRG policies. Precisely, the simulator 'policy switch' enables one to use either the current policy (implying a low and undifferentiated DRG) or a 'higher DRG' policy. If the player checks this last option, then the simulator will use the (higher) DRG, that is €16.000 per patient, as an input parameter. Alternatively, the basic policy at the beginning of the simulation is to set the DRG at €8.400 per patient.

The simulation results portrayed in Figure 9 show the costs associated with the two policies.[14]

The two simulation runs here show that, although the 'higher DRG' policy implies in the short term much higher costs than the 'low DRG' policy, it becomes more favourable after 2.5 years, because of the lower total DRGs associated to patients retreatment (see 'Gap in current regional treatment costs' dynamics).

In the long run, such a benefit tends to decline, so that – at the end of the simulation – both alternative policy results portray the same 'gap in current regional treatment costs'. Therefore, none of them is able – by itself – to meet the target. While the 'higher DRG' policy is more expensive in the first period and more effective in the second part of the simulation, the 'low DRG' policy shows a just opposite behaviour.

However, it is worth remarking that the declining increase rate of the gap in the current regional treatment costs, related to the 'low DRG' policy, is not due to a higher effectiveness of the outcomes it generates. It only depends on the gradual reduction in the average unit DRG adopted by the regional policy makers – because of the increasing volume of new treated patients – in order to meet the budget threshold (see first graph in Figure 9).

Key:

Policy 1: Bar stent policy (solid line).
Policy 2: Covered stent policy (dotted line).
Threshold for regional treatment costs (small-dotted line).

However, such a lower DRG could prove to be financially unsustainable for hospitals, also in the case of adoption of a more traditional and less expensive technology. Therefore – though the model does not embody such set of possible events – this could determine further inefficiencies (i.e. higher costs for the system) or further drops in the levels of outcomes, which would in turn determine a lower generated value on a regional level.

Such hypothesis opens up the boundaries of our model to the analysis of factors impacting on the outcomes of health care policies. These outcomes can be considered as a measure of the capability of the regional health care system to generate (i.e. to add) value to the community. To this end, the inclination to innovate in hospital care would be a major driver.

Therefore, in the long run, a higher capability of the system to increase the *value of health* (at proper efficiency standards) should be a measure that could lead to a higher potential of a Region to make the acquisition and allocation of financial resources to its health care system sustainable in the long run (see 'R2' reinforcing loop in Figure 10).

Concluding Remarks on the ISMETT Case

The above analysis has shown that both simulations policy results show that the budget threshold is not met. This is not only, unlikely, the result of an insight model with just test data. It is, rather, one of the significant dynamic complex problems that policy makers now face in many Italian Regions.

The second simulation – as said – seems to perform better than the first one, at least in the medium long-run.

However, also the second simulation run does not portray any radical solution to the problem of meeting budget thresholds. In this case, results can be preferable only because the DRG policy can affect hospital behaviour not only on an internal efficiency (i.e. resource consumption),

[14]Here, the simulation time horizon has been extended from 4 to 7 years, in order to better appreciate the expected long-term effects of adopted policies on costs.

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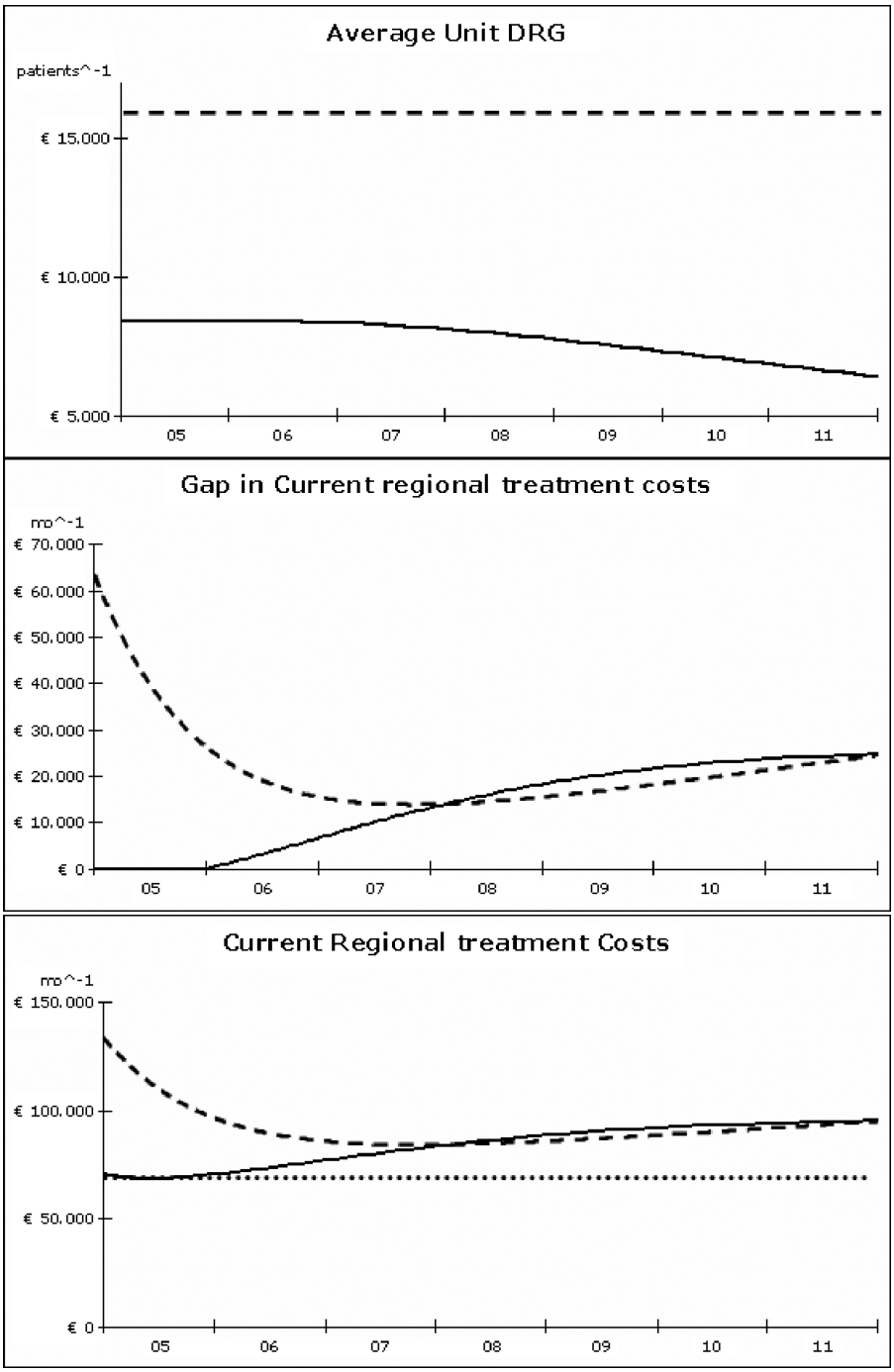

Figure 9 Results from two simulation runs

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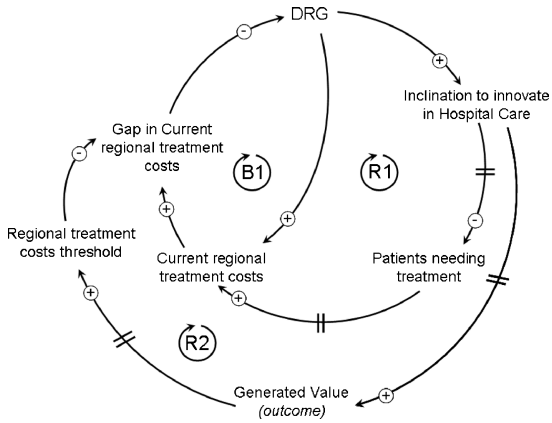

Figure 10 Impact of value generated by health care services on the sustainability in the long run of DRG set by Regional policy makers

but also on an outcome perspective. This last viewpoint, in turn, proves to be relevant also for the efficiency of the regional system.

SD modelling and simulation can substantially help decision makers on a political and managerial level to increase the level of synergy of their own behaviour, with a view to improving the performance of the overall relevant system, that is – in this case – the regional health care system. This is possible through various alternative or complementary ways, which may imply, for instance: assisted simulation sessions centred on insight models, group model building sessions (Vennix, 1996), the development and use of models for planning and the assessment of policy outcomes.

Obviously radical improvements in the system's performance – e.g. in terms of both meeting budget costs thresholds and outcome levels, could be pursued by deeper and wider scope interventions, for example aimed at fostering preventive care, or continuous home-care, so to be able to decrease the two stocks of patients depicted by the model, and therefore the costs of hospital care.

Further applied research – also implying a direct involvement in modelling by decision makers operating in the political, managerial, and medical settings, will be needed in order to better explore such a dynamic complex and considerable problem for our society.

IMPROVING PERFORMANCE THROUGH A DYNAMIC BALANCED SCORECARD FOR OPERA HOUSES[15]

Introduction

Nonprofit art firms, especially performing arts firms, have to deal with a difficult problem: over time costs tend to rise more rapidly then revenues, thus generating a widening budget gap. This is why most of the economic literature (Heilbrun and Gray, 2001) on the subject focuses on how demand can be increased in order to raise revenue and on what performing arts firms can do to lower their production costs.

Since Baumol and Bowen (1966) pioneering study, economics offers an explanation to this problem, an explanation called 'cost disease'. The heart of the cost disease theory posits the inability of performing arts firms to enjoy productivity advances relative to the rest of the economy. The argument can be summarized as follows: It takes 70 musicians as much playing time to perform a Beethoven symphony today as it did when the piece was written. In other words, since the performers' labour is the output, there is no way to increase output per unit of time. However, at the same time, new productivity-enhancing technologies have created huge increases in labour productivity in other sectors of the economy. Now, since wages tend to rise with productivity all over the economy, the upward pressure in the 'progressive sectors' will determine rising wages also in the 'stagnant sectors' (the orchestra). But since musicians' productivity has not changed, these higher wages in orchestra are not compensated by higher revenues. The result is that, over time, costs rise relative to revenue. According to this explanation, the only way for a nonprofit performing art firm to deal with a widening budget gap is to increase external resources, for example actively seeking private grants and donations and/or asking for more government funds.

Besides the cost disease, other arguments have been invoked to justify public support to some

[15]This case-study has been written by Carmine Bianchi and Antonio Cognata.

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forms of artistic activities. The oldest and most often invoked argument is that art, whatever its form, is a public good (Frey and Pommerehne, 1989; Throsby, 2001). According to this argument, art benefits not only those who consume and pay for it, but also all other citizens, who do not necessarily wish to contribute voluntarily to its production or to its preservation. For instance, museums, opera houses, orchestras and art festivals attract tourists and visitors and generate spillover effects on hotels, restaurants and the like. In this way, some people and firms gain a benefit for which they do not pay, and which therefore do not influence the production decisions on art markets.

Art is also said to be a 'merit good', a means of educating the public taste. Rather than accepting consumers' preferences, political decision makers should decide production levels based on the inherent worth of the artistic good. An income distribution argument posits that the consumption of arts should be open to all classes of society and should not be reserved for the rich. Therefore, the government should support the arts in order to make consumption available to those who are not able to pay for them.

Of course, on the subject of government support of the arts, there are also many counter-arguments. Some economists are unconvinced of the relevance of the market failure arguments and of the importance of the supposed external effects. Public choice theorists (Grampp, 1989) argue that government support is often used by some people for their own benefits. Empirical studies have shown that the cost disease is not as severe as argued; that low price elasticity of demand for performing arts makes price increase possible; that technical progress (e.g. DVD or broadcasting) may enlarge audiences. Additionally, careful distributional analysis has shown that in some instances high-income recipients are the major consumers of cultural goods, and thus the main beneficiaries of government support.

Opera is the Queen of live performing arts, and in some way a conventional art form. Today all the major opera houses around the world present relatively similar programmes, produced and performed by a core group of international conductors, stage directors, designers and singers. This has inevitably led to a great similarity in the core product and standards of the opera houses. Therefore, the art-form itself dictates to a great extent the resources and the organizational structures needed to produce opera.[16]

The Massimo Theatre in Palermo

With its budget of about €42 millions and more than 400 employees, the Massimo Theatre is the third largest public opera company of Italy. More than 90% of the revenue comes from public subsidies, the remaining 10% comes from the box office and the sale of other services. Salaries for full-time employees represent more than 70% of production costs.

In the fiscal year 2004 the Massimo Theatre was in a very difficult financial situation: losses for €1.5 millions, short-term bank debts for about €26 millions and production at its minimum. A new management took over at the beginning of 2005 with the aim of preparing and implementing a 3-year plan to restore viable financial conditions.

As said, there is essentially one option available for the opera management to deal with a structural earnings gap: reducing the gap by increasing the share of earning income relative to total operating costs. This strategy can take two forms: increasing the earned income or reducing operating costs. On the latter side, the two most important moves have been to bargain a new contract with the labour unions on a much more flexible base, and to negotiate a bank mortgage to lower debt costs. On the former side, despite the benefits of increasing earned income, there are limits to how far opera companies can go in this direction. In fact, increasing the number of productions brings not only increased revenue, but also increased costs. The strategy followed at the Massimo Theatre was to implement an appropriate production plan with the aim of

[16]For example, to stage Verdi's Aida requires a fairly specific number of skilled performers, a certain type of sets and performance space, wherever it is performed, in order to comply with the conventions of the art form and with the standards of the world of opera.

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maximizing the number of performances, given the structural and organizational constraints.

The first constraint in enlarging the number of performances is the fact that the Massimo Theatre does not have enough facilities to be used for orchestra end stage rehearsals. Since you need to use the venue (the theatre itself) also for the rehearsals, this limits the number of days one can uses it for performances. This is especially true when production is organized according to the Italian system of 'stagione' (the season): a certain number of performances over several weeks, followed by a rehearsal period for the next production after which that opera is performed for the next several weeks, and so on. The typical *stagione* at the Massimo Theatre is usually made by 10–11 productions, 8–9 of which are operas and 2 ballets. Opera productions are divided in three groups: at least 3 blockbuster titles (each of which is staged for 8–12 performances), 3–4 repertory titles (7–8 performances), and 1–2 rare and/or contemporary operas (4–6 performances). Since at the Massimo Theatre patrons subscribe for the whole season, a mix of repertoire is charged for in the package and this can 'cross-subsidise' less popular repertoire with popular operas. Each season, of the whole number of staged operas, usually 3 are newly produced by the house, the remaining are rented from other houses and/or re-used from the Massimo Theatre stock of previous productions.

Supporting Performance Improvement for the Massimo Theatre Through a Dynamic Balanced Scorecard

In order to support planning and performance improvement at the Massimo Theatre, a program implying the development of a Dynamic Balanced Scorecard (Bianchi and Montemaggiore, 2008; Kaplan and Norton, 1996; Linard *et al*., 2002; Ritchie-Dunham, 2001) has been started by the authors.

The analysis is being conducted with the primary purpose to:

1. Define *performance indicators associated to end-results*, with regard to the four dimensions of the Balanced Scorecard (BSC), that is: customer, internal processes, learning & growth, and financial.
2. Understand the key linkages between such indicators and related performance *drivers*.
3. Identify the *strategic resources* affecting performance drivers.
4. Analysing the factors impacting on the accumulation and depletion flows affecting strategic resource dynamics, and particularly: policy levers on which managers can operate, external constraints, and decision makers involved, in-and-outside the firm.

At present, the study has been only conducted with the Director of the theatre. However, when a first version of the dynamic balanced scorecard (DBSC) will be completed, it will be shared with the other managers, with the goal to use it as a planning and performance evaluation/improvement tool, on a current basis.

Main feedback loops have been identified, in order to depict the processes affecting the theatre's performance. Modelling has been initially conducted on a qualitative basis through periodical meetings with the Director. Qualitative modelling has been also supported by the gradual design of the DBSC structure, and therefore by the SD simulation model portraying the BSC.

In particular, the following issues have been focused from the start of the project till now: (1) *decision levers*, that have been included in the DBSC control panel; (2) *performance indicators* (i.e. objectives, measures, and targets) related to the above four dimensions, which have been included in the 'scorecard window' of the SD model; (3) *reference behaviour modes* for key variables. Such behaviours will be reproduced into DBSC graph sections related to strategic resources, performance drivers and end-results, when the SD model will be calibrated.[17]

The simulator depicts the same logical sequence of the planning process for opera production, which was described in the previous

[17]Possible source to calibrate the model will from internal company reports provided by the management information system (e.g. numbers of customers, funding from different institutions, revenues, number of productions and performances).

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section. Therefore, a three-dimensional analysis is done, that is:

1. The *opera mix by type* (blockbuster vs. repertory vs. contemporary/rare) is planned, not only in percentage but also in absolute terms.
2. For each type of opera, *titles by source* are planned. For instance, it is planned how many of the blockbuster operas will be made up by 'new', 'rented', and 're-used' titles; and the same is for repertory and contemporary/rare operas.
3. The *number of performances by opera type* (blockbuster vs. repertory vs. contemporary/rare) is then planned.

The planning time horizon is 3 years. Therefore, each year the number of titles and performances to stage for the coming and the next 2 years is planned. Planning in advance of the next season is crucial to properly manage rehearsals and the acquisition of resources; among them, human resources are the most crucial. In fact, particularly concerning blockbuster performances, it is critical to contract best performers (so called *superstars*) quite in advance, in order to pursue a well balanced quality/cost ratio in the delivered service. Therefore, the model also supports a proper assessment of the *financial sustainability* of the planned seasons. This is not a trivial issue, if one considers the above said financial criticalities (previously defined as 'cost disease') that in general, and more specifically in Italy (particularly in the South) affect the financial equilibrium of a public opera house.

Though the planning time horizon is 3 years, the simulation time is 6 years. This is due to the need to allow the user to figure out over a longer time span the possible effects (i.e. the key variables' behaviour) of adopted decisions in the coming years. This also allows managers to simulate – according a 'rolling plan' mode – how past decisions might require future adjustments, based on the outcomes they are currently generating.

Therefore, by using the simulator, managers are able to adjust and better calibrate their strategies concerning the above three issues, and so they are enabled to review and discuss them several times. This contributes to their own learning processes and to the quality of communication. Furthermore, since simulation results are framed by the DBSC model to show the dynamics of performance, this learning process has also a significant impact on the quality of planning and control systems.

Figure 11 shows three main stock-and-flow diagrams embodied in the model, concerning the three above issues which are relevant for opera planning (i.e. opera mix by type; titles by source; performances by opera type). As it is possible to notice from the model section here provided,[18] the first two structures are depicted as aging chains: the final flow 'Blockbuster titles staged in the current year' depends on the ability of the firm to implement its 3 years plan (Figure 11a). Lack of resources will have a final impact on such a flow, both in volume and in quality of performances. Such quality will also be affected by the opera mix by type. On this regard, Figure 11c shows how the same flow determines the number of performances by type.[19]

The three sequential stocks (and corresponding outflows) relate to the planned season for the years (from left to right) $n+2$, $n+1$, n, where the last year is the current (i.e. the coming year).

The stock-and-flow structure depicted in Figure 11a determines the number of titles by source (i.e. new, rented, reused), depicted in Figure 11b.[20] Here, the flow 'New titles to year 2' in turn affects (together with the planned 'rented' and 're-used' titles) the flow of 'blockbuster titles planned to year 2'.

Therefore, the three subsystems are strictly related each other, and depend on the decisions made by managers through the simulator control panel. As it is possible to see from Figure 12, such panel depicts the same aging chain structure previously described. Therefore, the planner is asked to define the number of titles per type and related mix (new, rented and reused). He/she is

[18]For reasons of synthesis, we have shown here only the 'Blockbuster titles' stock.
[19]For reasons of synthesis, we have shown here only the 'Blockbuster performances' stock.
[20]Also in this case, for reasons of synthesis, we have shown here only the 'New titles' stock.

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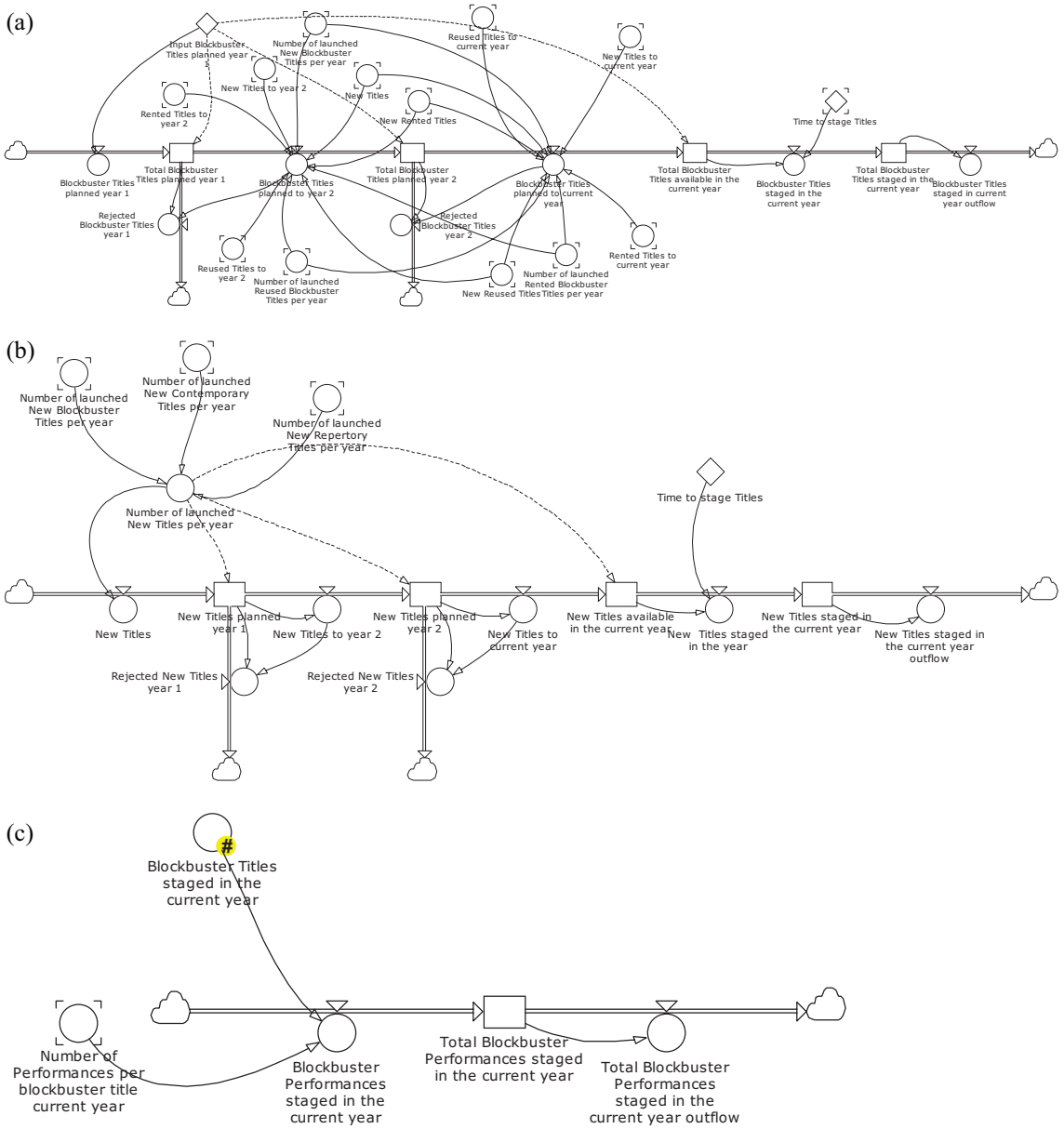

Figure 11 (a) Planning opera mix by type. (b) Planning titles by source. (c) Planning performances by type

also asked to define the number of performances per each type of title in the next 2 years, and (if applicable) the change of the number of performances per title planned for the current year.

Other subsystems of the simulator portray the dynamics of the company human resources, the customer base, and financial resources. As said, such resources feedback into the opera production and performance subsystems, since they may either support or hinder the implementation of plans for opera staging.

The DBSC chart embodied in the model portrays main indicators related to the four BSC perspectives. A section, concerning the 'customer' and 'internal processes' perspectives, is depicted in Figure 13a and b. Both figures

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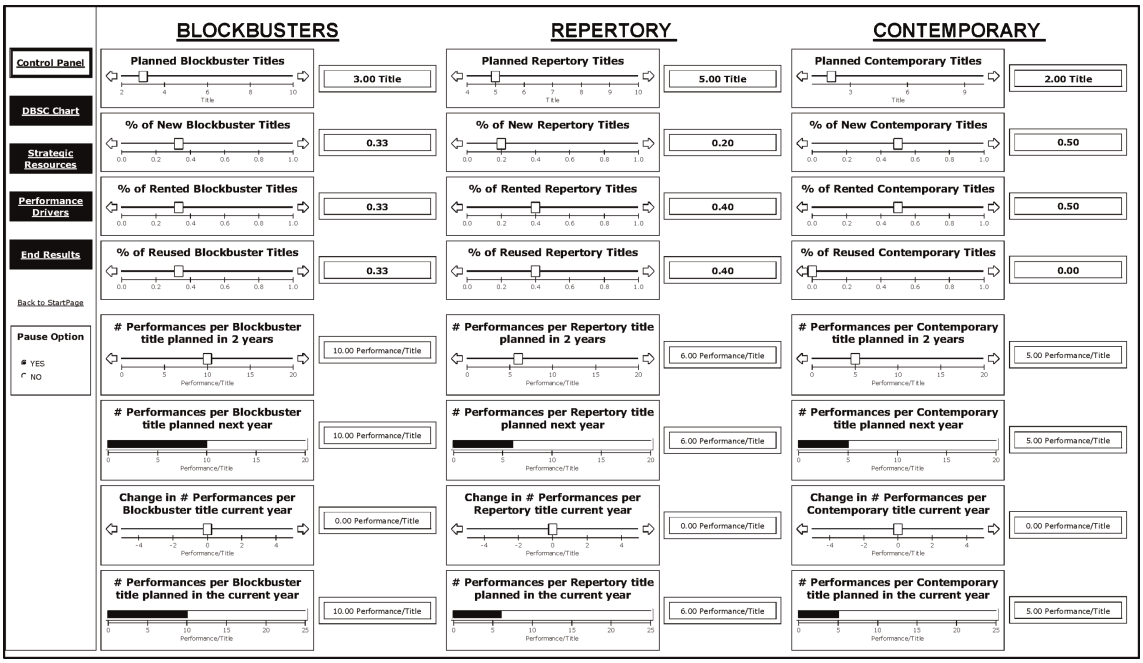

Figure 12 The simulator control panel

embody – according to the BSC framework – main objectives, performance measures, related targets as well as the current level achieved for each of these targets. While performance targets are input variables, and therefore the corresponding value can be changed by the planner at the beginning of the simulation, the 'current situation' values are results of the model, and for this reason have been emphasised in a box with a different colour from targets, since they can not be changed. Comparing targets with current results at each simulation stage and for each set of strategic objectives supports decision makers to make judgements on the way the system responds to the adopted policies. Therefore, it supports to calibrate better decisions through the control panel. This process also supports a deeper analysis focused on the feedback structure of the relevant system underlying observed behaviour from adopted policies. Such analysis, properly supported by a facilitator, is likely to enhance a double loop learning process (Sterman, 1994).

In another section, the simulator separately portrays, through proper time graphs, the behaviour of the strategic resources affecting the above performance indicators. It also shows in separate sections how the above indicators can be distinguished into performance drivers and end-results. Also these two other sections consist of time graphs.

Figure 14 offers a synthetic representation of how planning opera production may significantly affect the future growth of the theatre.

In particular, the positive loop 'R1' shows how an increase in available resources may allow the management to plan for more titles and performances, leading (other conditions being equal) to higher revenues, liquidity and other available resources to foster future growth.

If the loop 'R1' is the growth engine of the theatre, the negative loop 'B1' is a potential limit to such growth. In fact, the more opera titles (and performances) are planned, produced, and staged, the more resources will be consumed. If we particularly consider that opera production planning is characterised by a 3-year time horizon, this means that such phenomenon will reduce (other conditions being equal) the resource endowment to fund the next year plan.

The loops 'B2' and 'B3' refer to the achievement of targets related to planned operas and

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(a)

OBJECTIVES	MEASURES	TARGETS	CURRENT SITUATION
Balancing diversity with repertory	% Repertory titles staged in the current year on total	0.50	0.50
	% New titles on total in the current year on total	0.30	0.30
	% Contemp. & rare titles on total in the current year on total	0.20	0.20
Enhancing the volume of offered operas (titles)	Volume of titles staged in the current year	10.00 Title	10.00 Title
	Volume of titles available in the current year	10.00 Title	10.00 Title
	Volume of titles to stage next year	10.00 Title	10.00 Title
	Volume of titles to stage in 2 years	10.00 Title	10.00 Title
Consolidate our customer base	% Change in subscriptions	0.10 per yr	-0.20 per yr
	% Change in Young Customers	0.08 per yr	0.00 per yr
	% Change in Mature Customers	0.03 per yr	-6.67e-3 per yr
	% Change in Elderly Customers	0.05 per yr	0.10 per yr

Figure 13 (a) Indicators related to the 'customer' perspective. (b) Indicators related to the 'internal processes' perspective

performances. In fact, the higher the gap from the current to the target number of operas, the higher the number the opera titles to plan will be. This will, in turn, decrease the gap in opera titles. The same for the planning of performances.

The 'R2' loop shows the effect of proper opera planning on image and liquidity. A higher number of planned and staged operas (and performances) will increase image. This will help the theatre to attract financial resources from private funders. This will increase liquidity and the available resources to foster sustainable growth.

The loop 'R1' portrayed in Figure 15 is similar to the same previously commented about Figure 14. In this case, the effect of perceived quality as a main driver of customer loyalty is remarked. In fact, a higher production of opera titles will lead (other conditions being equal) to a higher perceived quality by customers. This will turn into a higher image, customer base, and liquidity. More financial resources will allow the

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(b)

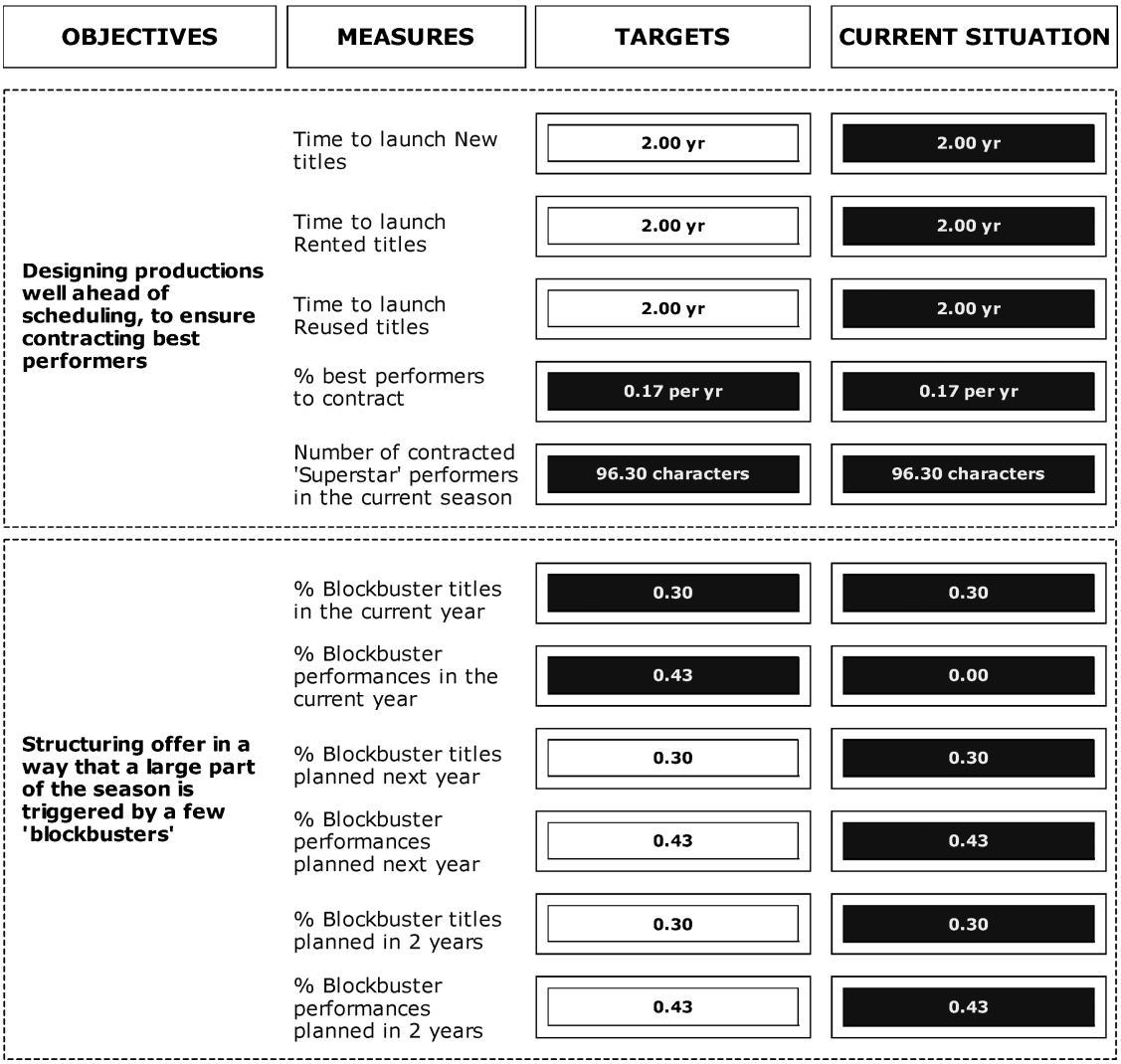

Figure 13 (Continued)

company further growth. This will be possible by both increasing the number of opera titles/performances and increasing the number of contracted superstars that will perform blockbuster and repertory operas. This last option will also allow the firm to strengthen growth (reinforcing loop 'R2').

There is a number of balancing loops to take into account, also on this regard. In fact, an increasing number of operas planned in a season will raise costs. This – other conditions being equal – will reduce liquidity to plan for the next seasons (loop 'B1'). Likewise, an increase in contracted superstars will also raise operating costs and determine a second potential limit to growth (loop 'B2').

Concluding Remarks on the Massimo Theatre DBSC Case

The above case has shown how SD can support management to keep under control the key performance variables driving to the success

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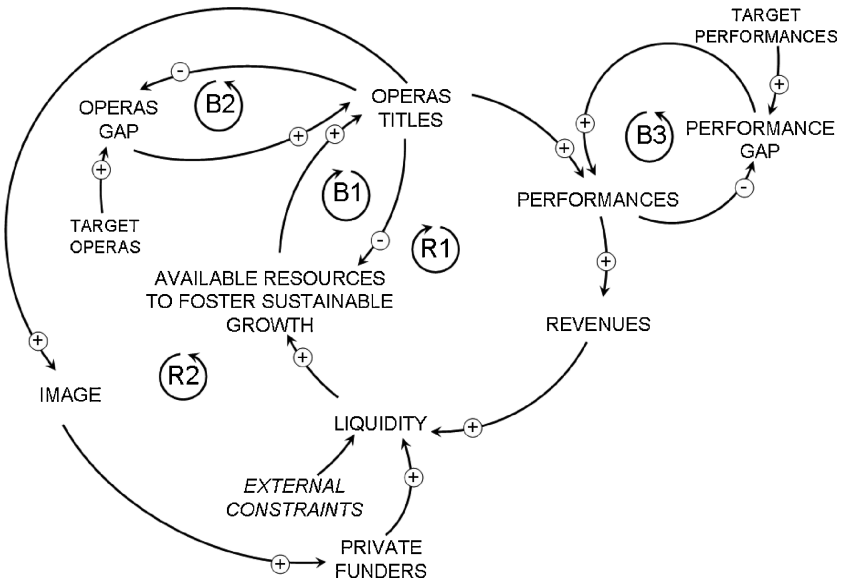

Figure 14 Effects of opera production on financial results and company image

(or failure) of an Opera house, with specific reference to the Massimo theatre case. More particularly, the development of a DBSC is likely to focus management attention on the trade-offs between performance measures related to 'financial', 'internal processes', 'customer' and 'learning and growth' perspectives. It also helps managers to properly perceive trade-offs between short and long term effects of adopted policies, as well as different company sub-systems. Therefore, likewise any other DBSC, such tool is likely to foster a learning oriented-approach to strategic planning and performance management.

However, more particularly in this case, this tool supports managers to perceive and frame specific complexity factors of the public sector, namely: public funding issues (in terms of possible sources, volumes and delays), price policies and stakeholders strategies (municipality, banks, patrons).

Next steps in the development of the DBSC will be gathering actual data to feed the model, conducting simulation runs and calibrating the model on key variables' reference behaviour modes, and involving in using the model manages from different company sectors.

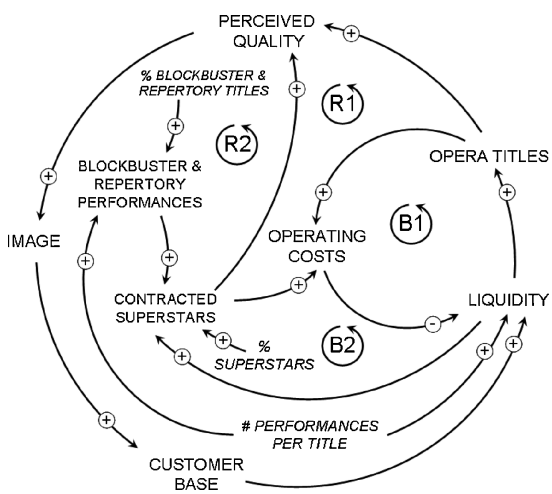

Figure 15 Effects of opera production on perceived quality, customers and financial results

CONCLUDING REMARKS

The three case-studies analysed in this paper, though they might seem so different each other, present a number of common factors, which support the thesis outlined in the introductory section, that is: applying SD to foster organiz-

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ational change, accountability and to support effective decision making in the public sector implies a number of challenges which are contingent, not only because of the specific complexity of the public sector itself, but also as a consequence of specific issues that can be found on a territorial base.

In particular, the role that SD modelling can play to properly deal with the relationship between the political and the organizational system has been discussed both in the public utility and the health care case-studies.

The role of SD to support the management of a public sector organization to promptly recover efficiency and improve outcomes at the same time, based on the current constraints that the institutional and political systems determine, has been the focus of the Massimo Theatre case, but can be – to some extent – recognised in the other two cases.

Further research will be needed to validate the research hypotheses and results here outlined. On this concern, the analysis and comparison of more cases and the development of SD simulation models will be necessary.

However, we believe that the findings originating from the three case-study analysis can provide the reader and different involved actors in the public sector, useful insights on the powerful role SD can play to foster a better understanding of the causes of poor performance, and to critically reconsider and refocus mental models.

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