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D.E.M.S.

The Determinants and Barriers of e-Government Adoption in the Municipality of Palermo

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Another day, another dollar

Abstract

The pressing innovation in the Information & Communication Technologies (ICT) generates new opportunities for creating networks and for developing new businesses. Even the discipline of public administration recognizes these opportunities in terms of improving tax administration and government efficiency, reducing the regulatory cost of citizen compliance, and avoiding overall frauds and errors.

This thesis explores the factors that influence the adoption of e-services by citizens in the municipality of Palermo, Italy, distinguishing the factors that are ascribed to the generalities of local government from those that are linked to the territorial context. It also explores alternative policies to overcome the criticalities that emerged from this analysis, providing guidance for the municipality to benefit from the implementation of e-Government.

In order to carry out this research, a multi-method approach was applied to the case study of Palermo because the adoption of e-government cannot be separated from its implementation. Therefore, Institutional Theory serves to highlight the barriers hidden behind the strategic choices and the adaptation of the Technology Acceptance Model (TAM) helps to identify the determinants of adoption.

The municipality of Palermo must overcome two major challenges in order to advance the adoption of e-services by citizens, which were

identified from a survey of 389 respondents. They are the lack of a real awareness of the e-services provided by the municipal administration and the lack of a substantial relative advantage in using the digital channels in place of the traditional ones.

System Dynamics, a particular kind of dynamic simulation, is then used to provide the necessary feedback structure for identify the determinants. As a result, this thesis concludes by recommending the implementation of selected policies aimed to expand the adoption of e-services in the municipality of Palermo.

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List of contents

Abstract III
Acknowledgements V
List of contents VII
List of figures IX
List of tables IX
Introduction 1
Objectives and Research Questions 4
1. Background and Boundaries of the Research 7
1.1. e-Government Studies: Looking for a Common Framework 7
1.2. Drawing the Research Boundaries: e-Services Adoption and Citizens' Perspective 15
1.3. Technological Innovation is Not Enough… 18
1.4. The Improvement of Public Management through Policy Learning 20
1.5. Trust: A Controversial Factor Influencing e-Government Adoption 23
2. Research Design & Methodology 27
2.1. A Multi-Method Approach to e-Government 27
2.2. How a System of Rules Influences Social Behavior: Insights from Institutional Theory 29
2.3. Research Hypotheses 31
2.4. Introducing the Model: System Dynamics basic tools. 37
3. e-Government Adoption in Palermo: State-of-the-Art and Forgotten Promises 47
3.1. Building the System of Rules: the Italian Regulatory Framework 47
3.2. Presenting the Case- Study: e-Government Projects Implemented in the Municipality of Palermo 51
3.3. Testing the Key-Determinants of e-Government Adoption using Technology Acceptance Model (TAM). 57
3.4. Fixing the Feedback Structure: System Dynamics Modeling and Policy Design 66
3.5. Results and Discussion 77
3.6. Trust and the Effect of the Latest Financial Crisis 78
3.7. Limitations 80
Conclusion 82
Recommendations for Research 84
References 85
Normative References (chronological order) 93
Web References 93

Appendix A. Survey 95
Appendix B. Equations of the System Dynamics model 99
Appendix C. Equations of the System Dynamics model with policies .101

List of figures

Fig. 1 Conceptual model for measuring e-Gov (Luna-Reyes et al., 2012)..... 14
Fig. 2 Technology Acceptance Model (Davis, 1989)..... 32
Fig. 3 TAM adaptation 33
Fig. 4 Representation of SD elements 40
Fig. 5 Example of Bass Model (CLD)..... 42
Fig. 6 Example of goal-seeking behavior 43
Fig. 7 Example of exponential growth 43
Fig. 8 Example of S-shaped growth 44
Fig. 9 Example of Bass Model (SFD) 45
Fig. 10 Information delay (SFD) 45
Fig. 11 TAM adaptation as modified after the analysis..... 64
Fig. 12 Reference Mode 66
Fig. 13 CLD of the e-Gov adoption in Palermo 67
Fig. 14 SFD of e-Gov adoption in Palermo (explanatory model) 70
Fig. 15 Simulation of the explanatory model 72
Fig. 16 A critical feedback of the model 72
Fig. 17 Implementation of a communication policy (SFD)..... 74
Fig. 18 Perceived Workload (CLD)..... 75
Fig. 19 SFD of e-Gov adoption in Palermo with policies 76
Fig. 20 Potential effect of policies implementation..... 76

List of tables

Tab. 1 Demographic characteristics of respondents…….. …….36
Tab. 2 Active users per age, gender and geographic area (September Report AUDIWEB)…… 37
Tab. 3 Reasons for using the mnicipal website or not…… 58
Tab. 4 List of constructs and items in the survey…….. 60
Tab. 5 Characteristics of registered users…….. 62
Tab. 6 Correlation table…….. 65
Tab. 7 TIT & TIG per age categories…… 80

Introduction

The pressing innovation in the ICTs generates lots of new opportunities for creating networks and for developing new businesses. Even the Public Administration (PA) sees new opportunities in term of reducing the cost of regulatory compliance for government customers, improving efficiency and tax administration and avoiding frauds and errors. Moreover, citizens and businesses could now improve their capacity of solving their own bureaucratic problems online.

Notwithstanding these positive effects, recent literature started recognizing that innovation in the ICTs also implies new challenges and hindrances for each public institution with peculiar features depending on the governmental level of the institution and on the socio-economic environment of the intended target population.

Another element of complexity is the lack of resources. e-Government strategies can reduce administrative costs in the long term but needs conspicuous investments for the implementation. Assuring the essential amount of resources (material but also human) for the whole length of the project is not always easy.

Last but not least, the introduction of e-Government services has a remarkable impact on performance and public policy design. Not only because of the technological innovation per se, but because the role of all

the actors involved has changed. Decision-makers (both politicians and managers) as well as the users must accept their new responsibilities in contributing to development of new sustainable policies. The process of integration is never easy and will be given the deserved attention in the pages of this thesis.

Abstracting from the public sector, it is possible to observe that, in general, the *model of rational behavior* has changed, has evolved toward networks. On average, people can easily access more information (now the problem is to select the relevant information!) and, above all, access the reaction of other people to the same information. This phenomenon affects the creation of their judgment. The preference of an individual cannot be the one he would have come to with his own reasoning if he assumes that the majority of people, who already expressed another preference, were better informed.

According to Ormerod (2012), the impact of incentives, of the assessment of costs and benefits of different actions, on individuals, has been overtaken by the effect of social interaction across network and "network effects require policy makers, whether in the public or corporate spheres, to change radically their view of how the world operates."

As a direct consequence, policy learning and performance management must evolve and gain in flexibility. The participation of the

users (citizens, businesses and other stakeholders) appears to be crucial for the success of e-government implementation. In fact, it is not helpful to provide a digital tool if the population is not using it.

The involvement of other actors in the design of new policies and in the introduction of innovations may turn out to be a possible source of creativity and deeper understanding of a complex system through the amalgamation of different underlying learning.

But decision-makers could deal (and this probably happened and still happens most of the times) with a different situation where only a small portion of the population is running ahead innovating and going global while most of the community is not ready to switch to new technologies.

Of course, there is not a universal receipt for the success of an e-Government project. The "ingredients" may vary due to different context. However is possible to identify common factors influencing the adoption although with different intensity.

This thesis aims to understand the determinants and the barriers to the adoption of the e-services in the Municipality of Palermo, a mid-size municipality (650.000 inhabitants, www.anci.it) located in southern Italy. The focus will be placed on the adoption process from the citizens' perspective.

The presented case study will show how an e-Government project had been already started in the Municipality of Palermo in 2002 but the population was not aware of the ongoing process. In January 2013, after a difficult moment for the city (the occurrence of the effects of the latest economic crisis and a period of compulsory administration due to the resignation of the major), a new website and a new portal have been released. So it is a crucial moment to understand what direction the municipality will take with regard to e-Government. It is a good opportunity to test how the citizens perceived the change and what problems have not been solved yet.

Objectives and Research Questions

Measuring e-Government in order to evaluate different policies is not easy because of all the immaterial values involved. Nonetheless it is important to capture the feedbacks underlying given e-Government systems. The empirical data show that, from January 2013 (when the new website and e-services portal became available to the users) the website did not registered a sensible increase of visitors, and the portal recorded only 10.000 certified users (September 2013) over a estimated catchment area of about 200.000 potential users.

In order to explore citizens' perception, a survey was developed, uploaded on the official municipal website and disseminated trough the social networks (Facebook, Twitter). 389 answers provided this study with a representative sample of the attitudes of people toward the digital interaction with the municipal administration.

In a nutshell, this study attempts to answer three main research's questions:

RQ 1. What are the implementation strategies used by the city of Palermo to develop, implement, and expand its e-Government portal for offering cost-effective e-services to its citizens?

RQ 2. What are the specific barriers to citizen use of the current e-services being offered by the city of Palermo, responding to the low rate of certification on the e-Government portal?

RQ 3. What are the areas of improvement for identifying suggestions and strategies for increasing the rate of adoption?

The present dissertation is developed in four chapters. The area of investigation is defined in Chapter 1, where a literature background is also provided. Particular interest was dedicated to the determinants of e-Government adoption in the literature. Above all, trust. It is always important to outline the content of a research but it is even more important in a field where a shared framework is missing like in the case

of e-Government studies. The first chapter also focuses on the paradigm shift of Public Management and on the fundamentals of policy learning.

Chapter 2 introduces the methodologies used. The analysis is conducted with a multi-method approach that combines: Institutional Theory, Technology Acceptance Model Analysis (TAM) and System Dynamics (SD).

The case- study is analyzed in Chapter 3 where, first of all, the Italian regulatory framework is depicted and the two projects described: "if we are to understand e-government, we need to see it as being embedded within the context of the changes that are affecting public management more widely" (Worrall, 2011). Afterwards, all the analyses are carried out. The results of the survey are included in the TAM. The hypotheses confirmed by the TAM, are consolidated in the structure of the SD model.

The final chapter draws together the analyses and the results of this research. It places them back into the general context of e-Government studies and demonstrates the valuable new insights that this work has developed. It also suggests ways in which this research can be continued in the future.

1. Background and Boundaries of the Research

1.1. e-Government Studies: Looking for a Common Framework

In 2003, the European Commission defined e-Government as *the use in public administration of information and communication technologies (ICT) teamed with organizational change and introduction of new skills, aimed at improving both public services and democratic processes and strengthening public policy support*.

The term e-government became a sort of "umbrella term" including several declinations of it such as citizen participation and e-procurement, smart cities and interoperability. Nowadays, the fast rate of innovative changes implies the need to better define the subject of every study.

e- Government is fully recognized as a new field of research. A growing body of research is interested in e-Government and its multiple facets, trying to build a common framework of analysis. Even though researchers have already been focusing on the subject for more than a decade, this last challenging purpose of building a unique framework has not been fully achieved yet.

In order to define the boundaries of this research, it is important to understand what is going under the e-Government "umbrella". First of all, it is essential to clarify that three aspects of the discipline must be

distinguished in its development: implementation, adoption and use. Later in the work, it will be evident why this premise is important. In the process of building a common framework, at the beginning, the attention was focused on the implementation, on the role of the administration in drawing up and making available the services. The effort of the administration tended to assume a bureaucratic profile.

The real purpose of e-Government, instead, is to improve the administration, to involve the citizen and allow them to propose their own solutions. The adoption happens if citizens are enough Internet-skilled, if they perceive a convenience in using digital channels in place of the traditional ones and if they feel secure in using e-services (Belanger & Carter, 2008).

The adoption of e-services is not the ultimate goal. Governments must create the conditions for the continuance of use. These concepts that appear obvious are the result of years of experience around the world. These achievements are now developed in the second and third generation e-Government projects. Therefore, the reader must be aware of the complex identification of the role of e-government in the society when examining the background of the present research.

Some of the causes of the difficult categorization of the discipline can be found in the variety of activities and processes of public administration at different level and in different context. The processes

are critical due to “the extraordinarily complex goal structure of public administration; the high degree of legal structuring of administrative work; (and the fact that a big) amount of work that can only be performed in cooperation with other agencies is rather high” (Wimmer, 2002; Lenk et al. 2002).

It is clear that the need for a framework is driven by the need to measure, the need to compare different strategies to understand which one is the best in order “to maximize the acceptability of results, rankings should be based on well understood and supported frameworks and indices, and sound computational procedures” (Rorissa, Demissie, Pardo, 2011).

Many authors and international organizations (United Nations, World Bank), at the beginning of the last decade (while e-Government was rising as an independent topic) tried to build their frameworks according to the stages of development. Jayashree & Marthandan (2010) and Rorissa, Demissie & Pardo (2011) list and analyze the most cited.

For the purpose of this thesis (since also the first project of the municipality of Palermo followed the same categorization for the planning of its services), it is useful to review the one of the United Nations (UN, 2001) and the one of Hiller & Belanger (2001). Both of them include five stages.

The starting point is similar: both of them basically refer to the function of simple information delivery through a website. The main difference is that the model of the UN is oriented to the integration of the e-services toward a one-stop portal. On the other hand, Hiller & Belanger (2001) are focused on the users and the goal is to allow them to participate in political issue online (voting, participating in surveys, etc.).

The following reproductions of the two models are adapted from Jayashree & Marthandan (2010). The United Nations and American Society for Public Administration (UNASPA, 2001) model is structured as follows:

1) *Emerging presence:* institution of government websites that provide formal but limited and static information;

2) *Enhanced presence*: the websites become dynamic and updated;

3) *Interactive presence*: government websites act as a portal to connect users and service providers;

4) *Transactional presence:* users have the capability to conduct complete and secure transactions, such as renewing visas, obtaining passports and updating birth and death records through a single government web site;

5) *Fully integrated presence*: governments utilize a single and universal website to provide a one-stop portal in which users can immediately and conveniently access all kinds of available services.

On the other hand, Hiller & Belanger (2001) identified:

1) *Simple information dissemination:* this first step is not different from the UN's one, it is about providing simple information on institutional websites;

2) *Two-way communication*: this second step contemplates an interaction between governments and users, but it is about communication and forms not about transactions;

3) *Service and financial transaction:* the government is ready for completing transactions online both with citizens and businesses;

4) *Vertical and horizontal integration:* this step expresses the concept of *interoperability* among the institutions of different level and areas in order to provide the users with a unique front- office;

5) *Political participation:* the last step is about the promotion of political participation through services such as online voting and surveys.

More recently, several authors (Bannister, 2007; Sørum et al., 2009; Andersen et al., 2011) criticized the maturity stage model asserting that it is valid just to measure the effort of central governments without considering the impact, the actual benefits on the population. After almost two decades of e-Government implementation, the stage of development is not a relevant categorization anymore. It can be helpful in the planning of new services but it does not make the difference at the

national level since most of the countries, especially in Europe and in the US, have already reached the fifth stage.

Different is the approach of Wimmer (2002) that tries to look at the multi-disciplinary nature of e-government integrating all the features of different subjects. She imagined her framework as "hodgepodge" of different views of e-Government, abstraction layers, and progress of public service (Rabiaiah & Vandijck, 2009). Her holistic approach considers e-Government as "socio-technical systems" integrating four perspectives namely: strategic framework; public services, processes and workflow; interaction and Information Technology.

Some years later, Moon and Norris (2005) proposed an explanatory theoretical framework for e-Government in which its adoption is determined by (i) an institutional variable, (ii) government capacity, and (iii) a managerial innovation orientation (Garcia- Sanchez et al., 2012). Rabiaiah & Vandijck (2009) criticized all the previous frameworks because of the lack of the aim of "developing a framework that abstracts the e-Government strategy". So in their work, they chose to offer "a comprehensive view of the e-Government program". They included both the front- office and back-office perspectives in a modularized framework that allows "flexibility, estensibilities and customizability".

A new approach was recently designed by Luna-Reyes, Gil-Garcia, & Romero (2012). It considers the specific functions of e-Government and it is applicable at all the institutional levels.

Their approach (fig.1) distinguishes determinants, characteristics and results in a cause-effect relationship. Among the determinants, they list the quality of information, the technological infrastructure, as well as legal and organizational features so to underline the all-round development necessary to the success of a project implementation. It must be noted, though, that the list includes only implementation determinants. The user perspective is implicit in the variable "potential demand" but without deeper analysis on people's perceptions.

The characteristics "provide a way of measuring the success of initiatives in terms of how they meet technical requirements such as usability, quality of information, privacy, or security" (Luna-Reyes, Gil-Garcia, & Romero, 2012). The characteristics also indicate the level of sophistication achieved. They are divided in four main areas: e-services, e-management, e-democracy and e-public policy.

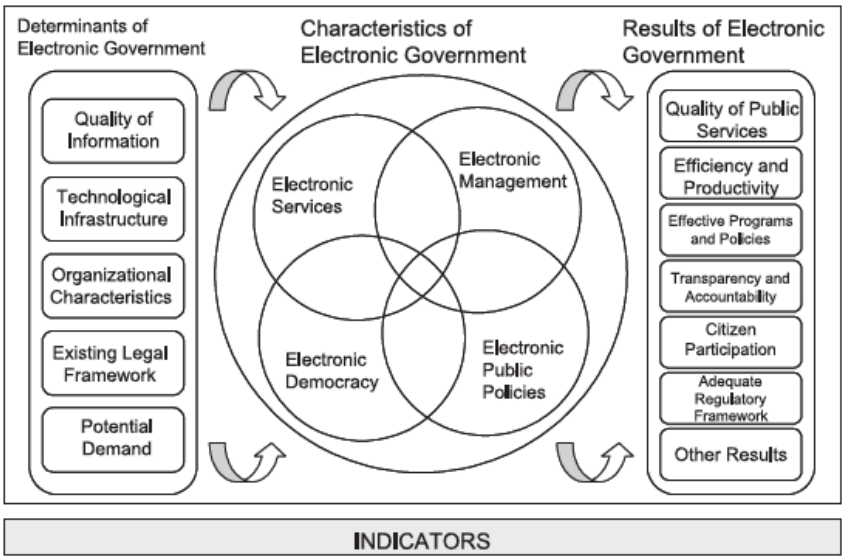

Fig. 1 Conceptual model for measuring e-Gov (Luna-Reyes et al., 2012)

And, finally, the outcome of the process is outlined: "the results represent the benefits that have been identified as effects of electronic government. They provide a simplified indication of the impact of electronic government and the value created by these initiatives. This value could be measured by assessing multiple results" (Luna-Reyes, Gil-Garcia, & Romero, 2012).

However, basically, the benefits of e-government can mainly be brought back to time's savings and fraud and errors' reduction. Time is an indicator of responsiveness (Andersen et al., 2011; Scott et al., 2009). Its net benefit can be measured calculating time's savings for retrieving information (personal contact vs. web browsing) also considering a better- integrated information system (Andersen et al., 2011; Scott et al., 2009). The same authors identified a reciprocal time's savings problem

where for both, businesses and government, time is positively correlated with cost: the more time spent, the more costly the delivery (of services)/ retrieval of information.

1.2. Drawing the Research Boundaries: e-Services Adoption and Citizens' Perspective

After the listing of different frameworks, it is possible to highlight some issue to face when analyzing e-Government.

First of all, it is important to define the *institutional level of analysis*: national, regional or local. These three levels (that can assume different name according to the systems of law) face different needs and expectations.

At the national level, the main issues regard democracy and national citizenship. The national level gave governments the input to start the process of digitalization and to change the systems of rules; but it is still to far from citizens' perception, from their every-day life.

Some are skeptical about indexes and rankings of nations arguing that they "tend to be meaningless and serve the sole purpose of enhancing governments' chances of achieving high international rankings" (Bannister, 2007; Andersen et al., 2011).

At the regional level, the focus is shifted to interoperability: connecting the levels, standardizing the services. The regional level

serves as a bridge to link the standardized national guidelines to the territorial peculiar context.

At the local level, and here the reference is to the municipalities, the citizen finds its first institutional interlocutor that must be able to solve its primary and most practical needs. Obtaining certificates and licenses, paying taxes, enrolling their children in school. When formulating and expressing their perception on e-Government, citizens mostly consider this third level.

Second of all, it is important to define the *specific functions to analyze*. It is important to distinguish between e-services and e-participation (so if it is a matter of e-Government or e-Governance).

As a third point is necessary to define the *perspective assumed*. The choice is between supply and demand sides, Public Administration or users' perspective (Reddick, 2005).

The PA perspective focuses on the implementation of the services without considering that "in the public sector, particularly in the case of e-Government initiatives, at least two parties will be involved in the system design: public managers as suppliers, and citizens, businesses, and other stakeholders as demanders. This characteristic transforms the goal-definition problem in the design of systems of rules from a single-designer problem to a multi-designer problem" (Gil-Garcia & Martinez-Moyano, 2007).

In a nutshell, referring to the three issues listed above, it is appropriate to remark that the definition of the area of investigation of this thesis will characterized in the following way:

1) the institutional level will be the local level;

2) the focus will be placed on the e-services adoption;

3) the perspective assumed will be the one of the users (citizens, businesses and other stakeholder) with the ultimate goal of providing the decision-makers with insights on the perception and expectation of their territory. In this way they will be able to redesign their role according to the new need of the society.

The importance of e-Government at the local level and of users' perspective has often been underestimated. The adoption of e-services by citizens, in particular, is a main issue on which researcher are focusing to identify the key-determinants of the phenomenon of adoption and in order to find out what can make the difference between a successful and an unsuccessful e-government project. However, as there is not a unique framework, also a unique model to assess every project is missing.

Most of the authors agreed on the main factors of the adoption but the empirical evidence showed that these factors have a different impact in different contexts.

1.3. Technological Innovation is Not Enough…

The introduction of ICT in Public Administration does not automatically imply a correct implementation of e-Government services. It is already clear in the literature that ICTs are basically tools and that a managerial vision of the implementation strategies is essential for the success of e-Government projects.

That notwithstanding, ICTs are often introduced without a good strategic plan with the result that some employees do not exploit the potential advantages of the innovation (because they are not skilled or simply because they had no instructions) and the investments go lost.

And this can happen everywhere. If, on the one hand, it is true that the bigger municipalities should be advantaged because of scale economies, it is even true that the recent financial crisis determined a severe lack of resources, so the coordination may be better in little towns where all the offices are in the same building or in a neighborhood.

West (2004) argues that e-government "has fallen short of its potential to transform government" in the area of service delivery (D'Agostino et al., 2011, West, 2004).

As already mentioned, the case study will show how an e-Government project had been already started in the Municipality of Palermo in 2002 but the population was not aware of the ongoing process. This experience is consistent with the study of Corradini et al.

(2010) stating: “that often services are available but ignored by citizens. In our hypothesis this situation can be justified since defined service delivery processes do not sufficiently take into account social aspects and mainly focus just on technical aspects.” They add: “Our opinion here is that, in the development of GDSs, the focus has been put too much on technological aspects, where requirements coming from social and anthropological domains have been too often ignored. As a result services are available and often they rely on advanced technologies, nevertheless they are not used since citizens do not grasp the advantage of using it, and in particular in less urbanized areas, they feel more comfortable in accessing services via traditional channels.”

Also van Veenstra & Janssen, when analyzing different migration strategies from traditional to digital channels, fear that the population may remain unaware of the implementation of new services.

The choice of changing the technology before than the organization could help in forcing the employees in adopting the new channels abandoning their hold habits. The pitfall, however, is that “it may be costly to implement new technology first without training employees to use IT, which may result in a slow process with high costs, in which clients do not notice any of the changes” (van Veenstra & Janssen, 2011).

Bannister & Connolly (2011) cite Heintze and Bretschneider (2000) and their intuitive findings that ICT in the public arena merely

improves efficiencies, but does not lead to meaningful organizational change or to increased democratic participation.

1.4. The Improvement of Public Management through Policy Learning

Innovation in the public sector cannot be the result of casual change. As already mentioned, the introduction of new technologies does not mean to innovate an institution.

Innovation in the public sector should be the result of a reasoned introduction of new procedures, activities or responsibilities that may or may not be linked to the introduction of a new technology.

For this reason, it is important to introduce the concept of *policy learning*. The birth of e-Government raised many managerial questions that should have been solved before the implementation of its technical tools.

Policy learning refers to "a change in thinking", not any change in thinking but a structured, conscious change in thinking about a specific policy issue (Kemp & Weehuizen, 2003).

"Policy learning is a form of collective learning, since policy is designed and implemented by a range of organizations" (Kemp & Weehuizen, 2003). The same authors specify that policy learning is a complex kind of collective learning since it usually involves several

organizations.

Sabatier (1993) distinguished three types of policy learning: *instrumental*, which is about new technical tools; *conceptual*, that implies a change of perspective on critical issue and leads to the development of new concepts or principles; and *social*, this last type being about values, missions, goal, responsibilities, etc (Kemp & Weehuizen, 2003; Sabatier, 1993).

e-Government is a deep change that requires instrumental learning but also conceptual and social learning.

Interacting with citizens, businesses and other governments and providing digital services requires new infrastructures and tools as well as it requires a new managerial approach: "Some argue that e-government could change the paradigm of public service delivery at the local level (Ho, 2002), indicating a potential relationship between e-government initiatives and local managerial innovations" (Moon & Norris, 2005).

Last but not least, a social environment ready to accept this change in thinking is needed. This issue is stressed in Codagnone, Wimmer (2007): "on the one hand changing public values might result in higher level of transparency and accountability of governmental processes and on the other hand it means people are more likely to lean toward something that is immediately tangible and valuable to them

(convenience) rather than something that may be more fundamentally important but is only conceptual until something goes wrong (privacy)".

But, above all, they reveal a crucial point: *changing public values results in new roles of the individuals in the society*. All stakeholders possess knowledge and expertise that can provide valuable input when developing e-services (Kamal et al., 2011).

This phenomenon is emphasized at the local level, if local governments are more sensitive to citizens' needs as devolution scholars argue, the situation described above may imply a change from self-imposed initiatives searching for solutions (administration-performance), to externally imposed requirements by citizens, their representatives, and other stakeholders (politics-accountability) (Gil-Garcia & Martinez-Moyano, 2007).

Some stakeholder groups are more affected by the e-service in their activities than others. This is important to consider when deciding how to involve different stakeholder groups, making best use of their knowledge and expertise within an efficient e-service development process (Axelsson et al.).

Bannister & Connolly (2011) recognize the broadness of the concept of transformational government (change of process, structure, responsibilities, etc.) so that the question becomes "*how much transformation and of what type?*"

1.5. Trust: A Controversial Factor Influencing e-Government Adoption

Trust has been generally defined as "a set of expectations shared by all those in an exchange" (Zucker, 1986; Srivastava & Teo, 2009). This first definition describes the concept with reference to the relations among people or organizations or institutions. But trust can also be referred to an object of use and so it would be defined: "a set of expectations that tasks will be accomplished reliably" (Sitkin and Roth, 1993; Srivastava et al., 2008).

The concept of trust in the context of the PA is even more complex to define. It does not usually refer to a personal risk but, as remarked by Bannister & Connelly (2011) "it is more likely that they are judging the competence of the government to do something right or to do the right thing". The concept increases its complexity when considering the financial crisis depending on how much citizens consider the government responsible for the crisis and its effects on the economy.

Worrall (2011) focused on the approach toward e-Government, highlighting the absolute need of trust (declined in different facets such as technology, identity and time-savings issues) when adopting the e-services: "citizens are not likely to use e-Government provided services unless they have trust in the systems, unless they feel that their privacy

and security are not at risk and unless the feel that there is some compelling reasons for them to do so".

Common factors affecting trust have been identified but "there is no agreement in the literature as to the characteristics that influence the generation of a trust response" (Bannister & Connelly, 2011).

Srivastava & Teo (2009) studied the nature of trust in e-government, coming to the identification of two dimensions of the phenomenon:

- Trust in government (TIG);
- Trust in Internet technology (TIT).

According to Zucker (1986) trust in government emerges from three factors: 1) Characteristics of the individual (i.e. his or her social–cultural background); 2) Professional standards and public statements of ethical standards (institutional trust); and 3) Experience (process trust). […] Process trust emerges from continual satisfactory experiences. (Belanger & Carter, 2008).

Belanger & Carter (2008) conclude that both TIG and TIT are influencing adoption of e-services. Srivastava et al. 2009 conclude that TIG is influencing e-government success but not TIT.

Detlor et al. (2013) did not find supporting evidence for the "influential effect of trust on end user uptake of electronic government services and websites". However, they suggest that one possible

explanation may be the nature of the community municipal portal (CMP) investigated.

Until this moment, the analysis of trust has been done starting from the assumption that trust (or different trust categories) is influencing the use of e-government.

And, among many others, Srivastava & Teo (2009) as well as Belanger & Carter (2008) get to the conclusion that trust is a necessary ingredient in order to achieve the desired objective in the e-government implementation. "As technology continues to become ingrained in society, citizens' perceptions of the accuracy and reliability of e-services will increase in importance. If government agencies expect citizens to provide sensitive information and complete personal transactions online, they must acknowledge and enhance citizens' views concerning the credibility of e-government services" (Belanger & Carter, 2008).

But, on the other hand, Morgeson sees the potential of e-government in building trust in government. He considers an inverse influence: "e-Government is seen as a potentially transformational medium, a mode of contact that could dramatically improve citizen perceptions of government service delivery and possibly reverse the long-running decline in citizen trust in government […] Put differently, this causal mechanism suggests that the use of government Web sites may lead to positive attitudes toward e-government, which, in turn, may

encourage improve trust or confidence in government generally (Tolbert and Mossberger, 2006; Morgeson).

Both theories are strongly supported by empirical studies, both of them are valid but provide a partial view of the structure of the phenomenon. The literature mainly observes the impact of trust on e-government use or e-government on trust while both impacts should be simultaneously considered.

With the help of System Dynamic (a dynamic simulation methodology that will be better explained in the third chapter) this thesis will explore the two-ways relationship linking the variables of the phenomenon.

Same reasoning can be done in reference to the relationship between trust and users' satisfaction, which is another important issue when studying the process of e-services adoption.

Srivastava et al. (2009) reports controversial argument in literature. Satisfaction has been regarded as an antecedent of trust, shaped by previous experiences of the users. Other authors described satisfaction as an output of trust.

In this study's hypotheses, there is not a unique cause and a unique effect. Both variables are acting as cause and effect creating a *feedback loop* with strong implications on policy making.

2. Research Design & Methodology

2.1. A Multi-Method Approach to e-Government

Several methodologies are used in the literature to analyze the adoption of e-Government in different contexts. AlAwadhi & Morris (2009) listed some of the most used methodologies of technology acceptance, namely, the Theory of Reasoned Action (TRA- Fishbein & Ajzen, 1975), the Theory of Planned Behavior (TPB- Ajzen, 1991), the Technology Acceptance Model (TAM- Davis, 1989), the Diffusion of Innovation (DOI- Rogers, 1995) and the Unified Theory of Acceptance and Use of Technology (UTAUT- Venkatesh et al., 2003). All these methodologies share an attention to the attitude of the user that can determine the success or the failure of a project.

Moreover, Structural Equation Modeling (SEM) is widely used in the e-Government context e.g. Belanger & Carter (2008) but also Verdegem & Verleye (2009).

Gil-Garcia & Pardo (2006) suggested that a multi-method approach should be preferred. In fact, they wrote: "*Using multiple methods has the potential of gaining knowledge about different aspects of a phenomenon under study, and therefore, an overall better and more complete explanation.*"

And a multi-method approach was indeed chosen to develop the present work.

First of all, Institutional Theory is utilized to present the case study and to serve as a general framework.

In order to allow a comparison with other works (e.g. Wangpipatwong et al., 2008; Srivastava et al., 2008; Carter & Weerakkody, 2005) and to understand in depth the correlation among the involved variables the thesis includes a TAM analysis with a survey to the population.

Finally these data are integrated in a dynamic model.

It is possible to find several similar approaches to e-Government studies in the literature (although the perspectives assumed are rather different).

Institutional Theory and System Dynamics are used together by Luna Reyes & Gil Garcia (2011). They chose this combined approach in order to mix a strong theoretical basis with an innovative research method that allows the researchers to analyze the problem in a dynamic perspective. On the one hand, institutionalism helps in investigating the relationships among technology, organizational factors, institutional arrangements, and the socio-economic context in which they are embedded. They argued: "studies with this view propose that there is a recursive and complex relationship between information technologies

and social structures and, as a consequence, the results of ICT projects are highly uncertain and cannot be easily predicted". On the other hand system dynamics helps dealing with this uncertainty proposing alternative dynamic projections of the results.

Another useful example of multi-method approach to e-government studies is the one of Aloraia et al. (2011). These authors studied the acceptance of technologies in Iran. Their starting point was the traditional TAM but they decided to extend the model in order to perceive the continuity in the usage of these technologies. According to the authors was "also important to consider the simultaneous habit to new and old systems of technologies […]. It is significant to note that technology acceptance does not occur at a single point of time but rather it happens in the process of time".

For these reasons they introduced a System Dynamics model that was built on the basis of the TAM and its variables.

2.2. How a System of Rules Influences Social Behavior: Insights from Institutional Theory

The phenomenon of e-services adoption is complex and dependent on different strategies of implementation, on peculiar regulatory frameworks and socio-economic environment and cultural profiles of potential users in the territory.

For this reason, it is relevant to present the case study of the municipality of Palermo with a 360° overview on the normative, social and economic background. The choice of Institutional Theory as a framework answers this need of completeness.

In fact, "Institutional Theory attends to the deeper and more resilient aspects of social structure. It considers the processes by which structures, including schemas; rules, norms, and routines, become established as authoritative guidelines for social behavior. It inquires into how these elements are created, diffused, adopted, and adapted over space and time; and how they fall into decline and disuse." Scott (2004).

Luna- Reyes & Gil-Garcia (2011) applied this method to e-government studies (studies of e-portals in Mexico) because institutional theory is a strong integrative approaches that recognize the importance of the context in which ICTs are embedded. By concentrating on higher levels of analysis when using institutional theory, IT researchers would be able to better understand and to explain: "how regulative processes, normative systems, and cultural frameworks shape the design and use of technical systems" (Mignerat & Rivad, 2005; Orlikowski and Barley, 2001).

Of course, it is always easier to investigate on the regulatory and normative profiles since most of the data come from written document. Moving toward the cultural profile, the interpretation is based on

informal mental models, schemas and beliefs. Morecroft defines mental models as a "dynamic pattern of connections comprising a core network of "familiar" facts and concepts, and a vast matrix of potential connections that are stimulated by thinking and by the flow of conversation" (Morecroft, 1994, p. 7). The cultural profile, especially the mental models, is more difficult to be depicted since often created without a real awareness of the individual.

2.3. Research Hypotheses

TAM analysis will be then introduced. This methodology is ideal for the municipal context and in order to make the results comparable with similar studies. Correlation tables out of TAM analysis are easy to read and can communicate very well even to people who are not at ease with calculations.

The grounding of TAM is that two specific beliefs, namely *perceived ease of use* and *perceived usefulness*, influence the users' behavioral intention to adopt a technology (Venkatesh, 2000**)**.

Davis defined the *perceived ease of use (PEOU)* as "the degree to which a person believes that using a particular system would be free from effort", meaning the perception of how easy is to learn to use a new technology, (Davis, 1989).

The *perceived usefulness (PU)* is a different concept defined as "the degree to which a person believes that using a particular system would enhance his or her job performance", (Davis, 1989). This second belief is formed after the adoption of the technology and expresses the perceived advantage in using the new technology in place of the older one. This variable is also influenced by the perceived ease of use that contributes to build the relative advantage in using the new technology.

In Davis' model, these two beliefs (influenced by external variables) determine the attitude toward using the new technology and consequently the actual use of it, (Fig. 2).

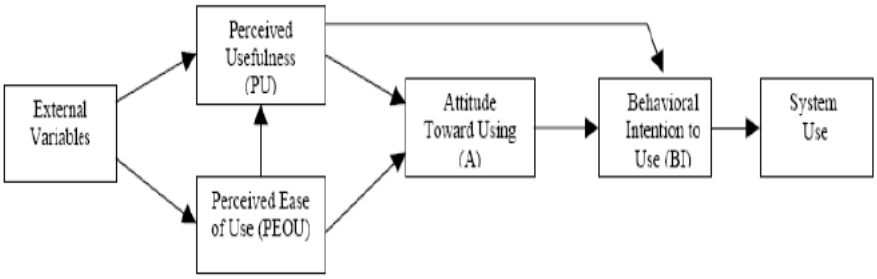

Fig. 2 Technology Acceptance Model (Davis, 1989)

For the purpose of this study, the model was modified according to implicit suggestions from the reviewed literature (see fig.3). As Detlor et al. (2012) suggested in their work, the choice was "to investigate the impact of the model constructs on individual self-reports of actual use, rather than a person's intention to use".

The survey tested the actual use. The idea was to make the survey brief and to let the people surveyed focus on what they could experience. "This decision was consistent with previous TAM-based studies which contend that a variety of measures of system use are all acceptable proxies for use, and employ only one of these as a means to simplify already complex research models" (Detlor et al., 2012; Petter et al., 2008).

The variables to be tested were obtained from an adaptation and integration of the models of Belanger & Carter (2005), Carter & Weerakkody (2008) and Teo et al. (2008).

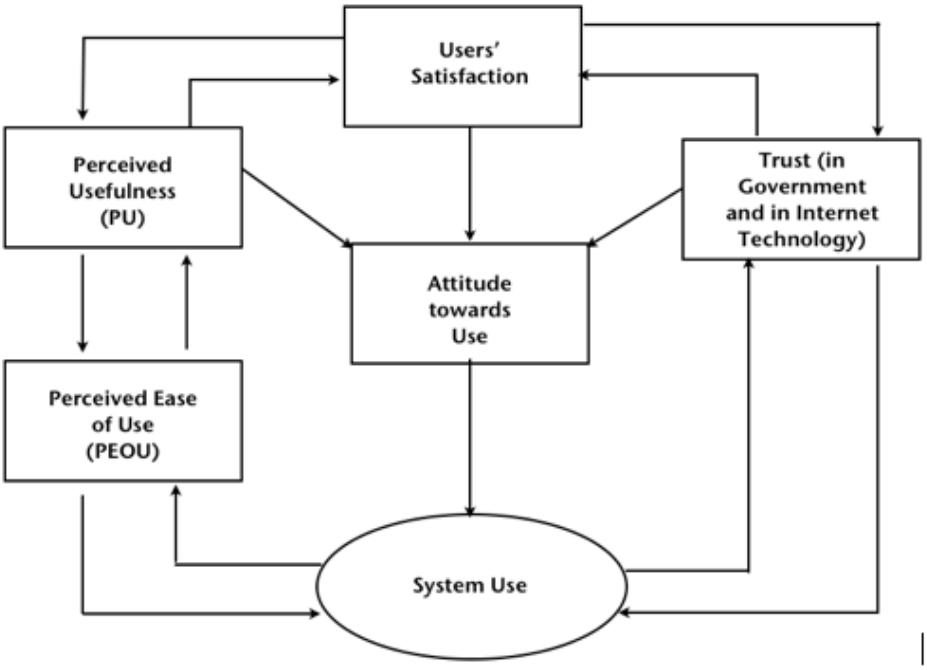

Fig. 3 TAM adaptation

Important in the research model are the *feedbacks*. Not only the model considers the effect of the key variables on the *System Use*, it also assesses the effect of the use (and that means the adoption of e-services by the population) back on its determinants.

In fact, the more people adopting e-services, the more positive externalities in terms of knowledge, experience, trust and satisfaction are spread out.

The hypotheses underlying to the described model can be made explicit as follows:

H1: Perceived usefulness of e-Government websites will positively influence citizen's use of e-Government websites. PU =>USE

H2: Perceived Ease of Use of e-Government websites will positively influence citizen's use of e-Government websites. PEOU =>USE

H3: Users' satisfaction of e-Government websites will positively influence citizen's use of e-Government websites. SA=>USE

H4: Trust in Government will positively influence citizen's use of e-Government websites. TIG => USE

H5: Trust in Internet Technology will positively influence citizen's use of e-Government websites. TIT => USE

H6: Perceived ease of use and perceived usefulness of e-Government websites are strongly related. PEOU =>PU

H7: Trust in government will positively influence users' satisfaction of e-Government websites. TIG=>SA

H8: Trust in technology will positively influence users' satisfaction of e-Government websites. TIT=>SA

H9: Perceived Usefulness and Satisfaction are strongly related. PU=>SA

H10: Perceived Ease of Use and Satisfaction are strongly related. PEOU=>SA

In order to identify the significant determinants affecting the adoption in the peculiar context of the municipality of Palermo a survey was delivered through the official website of the municipality[1].

The survey (Appendix A) was prepared with reference to the work of Wangpipatwong et al. (2008), Elling et al. (2012) and Detlor et al. (2012).

It was published on the official homepage of the municipality of Palermo in June 2013 and spread out with the help of social networks. In September 2013, after three months online, 389 respondents had filled the questionnaire. The sample (Tab.1) appears to be quite representative including all the age groups and a good representative of all the kind of occupations (unemployed included).

[1] It can still be found online: http://www.comune.palermo.it/questionario_e-gov.php.

Characteristics		Frequency	Percent
Gender	Female	251	64.52%
	Male	138	35.48%
Age			
	18-24	31	7.97%
	24-35	163	41.90%
	35-60	165	42.42%
	>60	30	7.71%
Highest Level of Education	Junior High School	5	1.29%
	Senior High School	150	38.56%
	Bachelor's Degree	234	60.15%
Occupation	Student	67	17.22%
	Private Sector Employee	65	16.71%
	Government Employee	80	20.57%
	Self Employment	93	23.91%
	Unemployed	47	12.08%
	Other (Retired)	37	9.51%

Tab. 1 Demographic characteristics of respondents

More than the 80% of the respondents are aged between 24 and 60 years and most of them earned a bachelor's degree. Age categories are consistent with AUDIWEB September 2013 report (www.audiweb.it/dati/index.php) in Tab.2 except for a greater presence of the 24-35 categories that is explained by the spreading of the survey through social network as Facebook and Twitter. There is a higher presence of women in the sample compare to the statistics.

Internet Active Users in Southern Italy and Islands (.000)						
AGE	GENDER				TOTAL	%
	MEN	%	WOMEN	%		
2-10	47	2.03%	34	1.86%	81	1.96%
11-17	115	4.97%	85	4.65%	200	4.83%
18-24	287	12.41%	218	11.92%	505	12.19%
25-34	428	18.50%	427	23.35%	855	20.64%
35-54	1009	43.62%	882	48.22%	1891	45.65%
55-74	419	18.12%	177	9.68%	596	14.39%
>74	8	0.35%	6	0.33%	14	0.34%
All	2313	55.84%	1829	44.16%	4142	100.00%

Tab. 2 Active users per age, gender and geographic area (September Report AUDIWEB)

All the occupational categories are well represented with a slight majority of self-employees and government employees.

2.4. Introducing the Model: System Dynamics basic tools.

Finally, the variables used in TAM are transferred to a System Dynamics Model in order to explore alternative future scenarios and design effective policies.

System dynamics (SD) was developed as a method for designing policy solutions based on computer simulation of problematic endogenous feedback structures (Wheat, 2010).

The founder of the theory, Jay W. Forrester, an electrical engineer, initially conceived SD as a business management tool. But the SD methodology was soon applied to public sector issues (Wheat, 2010).

In general people analyze their problems looking at them as the direct consequence of a previous action without considering the possible delays. Most of the time, this bias is overcome with the help of rules of thumb.

A simple (almost trivial) example is the one of an "unknown" shower. When regulating the temperature of the water, people get hurt or freeze before finding the right regulation. This happens because they are not conscious of the delay between the order sent turning the handle and the regulation inside the tubes.

Likewise, when implementing a strategy in a complex system, both in private and public organizations something puzzling happens: often new strategies are put in place before the previous one had given its results, generating a misperception (if not a big confusion) in the minds of the decision-makers.

Traditional perspectives fail to describe the interaction processes and resulting emergent properties, in which the state and its novelties change over time (Lin & Lee, 2006).

Therefore, whereas the human brain does not perceive the process of accumulation (Bianchi, 2009), and tends to recognize problems as a direct series of events, this methodology can help providing a dynamic view of all the forces acting in the system at the same time.

This methodology is therefore appropriate in order to solve problems in complex systems characterized by the following features (Bianchi, 2009):

1. A structure characterized by counterintuitive dynamics;
2. Levers that can be use by the decision-makers in order to influence the results toward the desired objectives;
3. Sensitivity of the results to the effect of exogenous variables;
4. A frequent opposite behavior of the variables in the short versus the long run;
5. Relevant delays of the system to the deliberated policies.

The first thing a System Dynamics student learns is that given behaviors (*reference mode* of the problem in object) are related to given structures.

System Dynamics offers two kinds of representation: causal loop diagrams (CLD) and stock and flow diagrams (SFD). The first one is qualitative and is aimed to focus on the causal relationship among the variables. The other one is quantitative and is aimed to emphasize the physical structure of the system in object.

The models are realized with softwares *ad hoc* (iThink, PowerSim, Vensim, etc.). While the concept of causal loop diagram is very immediate and easy to be understood (see fig.5), the stock and flow diagram requires a brief description of the elements included:

- Stocks: availability of resources at a given moment in time,

- Flows: flows of materials or information over a period of time;
- Auxiliary variables: variables that help the calculation, mostly indicators, parameters or constants.

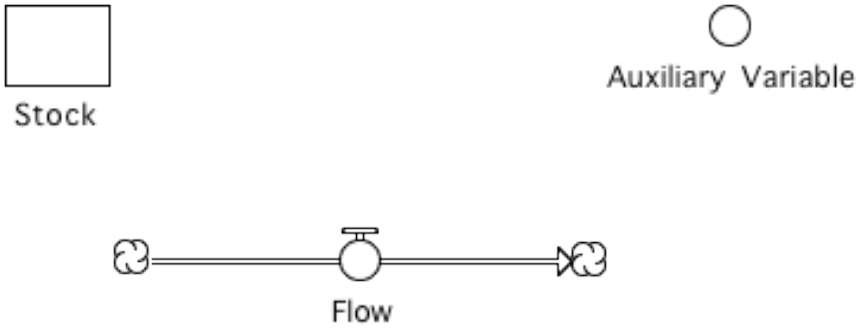

Fig. 4 Representation of SD elements

Sterman (2000) suggests that the first step in modeling should be the elaboration of the hypotheses and the definition of the boundaries of the system (endogenous, exogenous and excluded variables). The hypotheses imply causal relationship among the variables that bring to a first CLD. After the achievement of a good CLD, it is possible to proceed with a SFD completing the model with data.

It must be noted that qualitative models are usually less detailed than the corresponding quantitative ones. This happens because the main goal in a CLD is to communicate the existence of feedbacks and too many details could induce the observer in loosing the important messages of the diagram.

It is important to start testing the hypotheses and relationships from the beginning and to keep testing them over the all period of modeling.

This is the process that has been followed for the present research. The hypotheses are those among the ones listed in the previous paragraph that will have been confirmed by the TAM analysis in the next chapter. The key element is the adoption of e-Government and in particular, the adoption of the e-services that is possible to complete online.

The subjects are therefore the *Users* (those who already adopted the e-services) and the *Potential Users* (those who are active on the Internet and perform purchases online but do not interact with the PA). The objective of the PA is to make *Potential Users* become *Users*. In order to achieve the object, it is important to understand the combined effect of the variables in the system.

By analogy with the other study of spreading of innovation (or disease) the key figure of the simulation is an adaptation of the Bass Model.

In fig. 5, two feedback loops can be observed. The one on the left is marked with a B which stands for Balancig Loop. The one on the right is marked with a R which stands for Reinforcing Loop. The attributes of reinforcing and balancing are not synonimuos of positive and negative. A reinforcing loop is a loop that is feeding itself, a balancing loop is a loop that is draining itself.

Likewise the + and – marking are not standing for good or bad but for direct and indirect relationship.

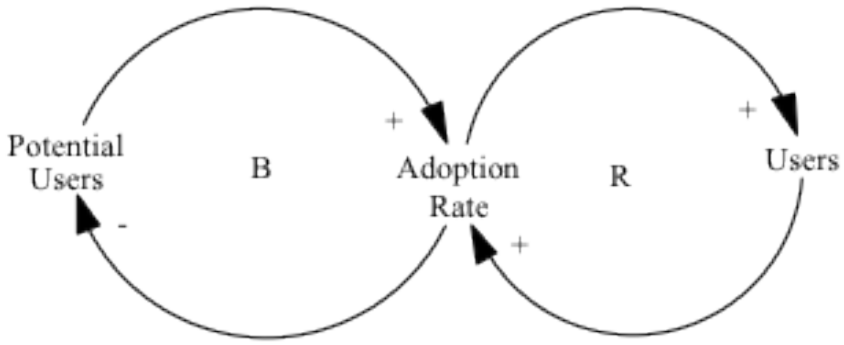

Fig. 5 Example of Bass Model (CLD)

Fig. 5 must be read as follows. The balancing loop on the left tells the observer that the more is the *potential users*, the more the *adoption rate* will be but the more the *adoption rate* the less the *potential users*. In fact, if, on the one hand, more people ready to adopt could assure a big flow toward the stock of *users*; on the other hand, the flow *adoption rate* is draining the stock of *potential users* that will tend to 0, a steady-state, an equilibrium point. This is what is called a "goal-seeking behavior" and is typical of a balancing loop. Isolating the effect of the balancing loop on the stock of potential users, the result would be the curve in fig. 6 that tends in an asympthotic way to X-axis.

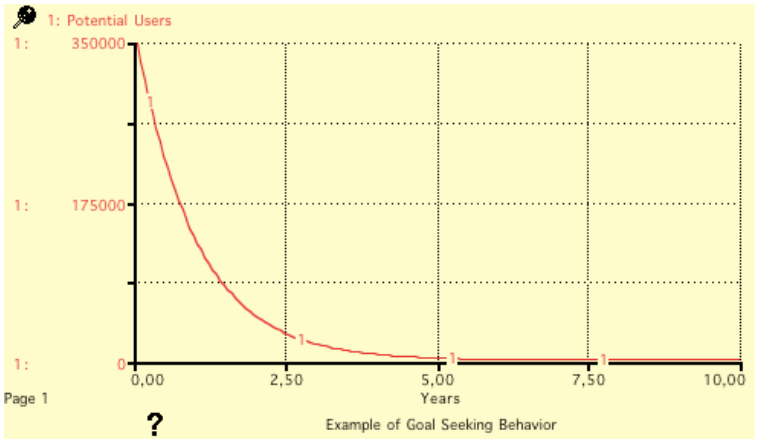

Fig. 6 Example of goal-seeking behavior

Different is the behavior of the reinforcing loop (marked with "R" in fig.5). A high *adoption rate* implies more *users* and more *users* imply an higher *adoption rate* generating the an "exponential growth" curve as shown in fig. 7. This cycle will boost itself until the emergence of a limit to growth (in this case, the complete depletion of the *potential users* because all of them became *users*).

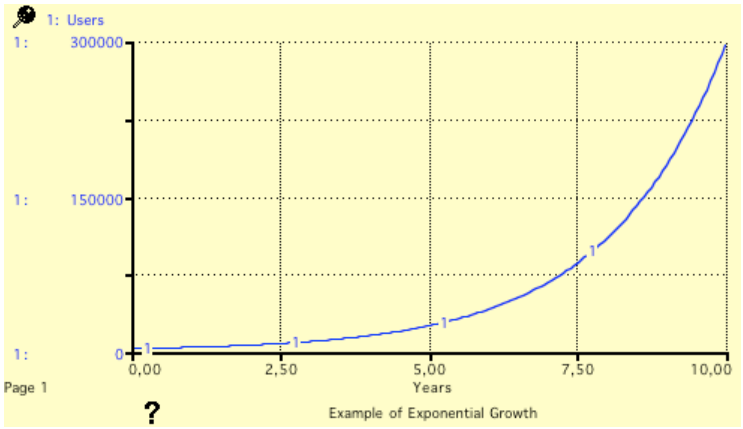

Fig. 7 Example of exponential growth

The combined effect of the two loops together depends on which loop is dominating over the simulation period. Since the stock of

potential users is full at the beginning of the simulation, the draining effect is not evident and the reinforcing loop is dominating. But when the stock of *users* start filling up, the strenght of it is reduced and the draining effect reduces the flow. The result is a S-shaped growth curve (fig.8).

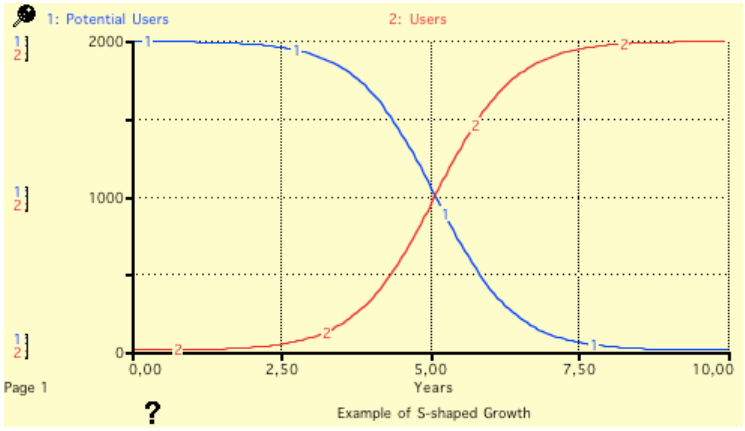

Fig. 8 Example of S-shaped growth

Of course, in order to obtain the curves, is necessary to translate the qualitative model into a quantitative one. Fig. 9 shows the Stock and Flow Diagram (SFD) corresponding to the structure described above in the CLD in fig.5. And, as previously explained, containes more details to allow a correct calculation of the behavior of the variables.

Before going in depth into the modeling process, there is another element, a typical SD structure (that will be often recurring in the model) that must be explained: the *information delay* represented in the Stock and Flow Diagram in Fig. 10.

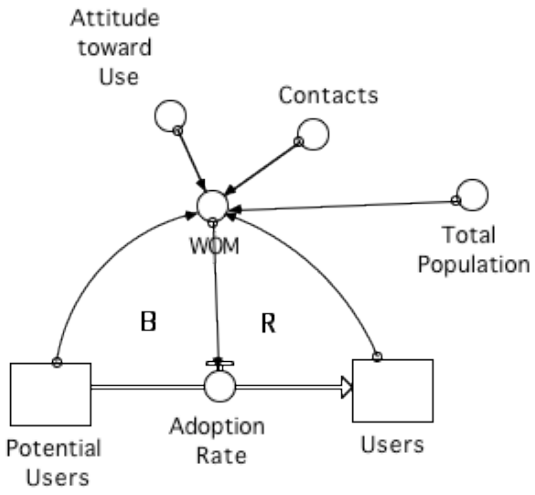

Fig. 9 Example of Bass Model (SFD)

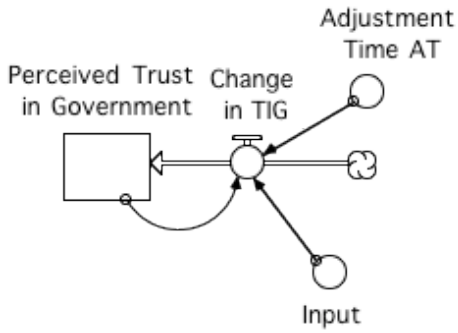

Fig. 10 Information delay (SFD)

The structure of information delay expresses the time that takes "to gather the information needed to form judgments, and people do not change their minds immediately on the receipt of new information. Reflection and deliberation often take considerable time. We often need still more time to adjust emotionally to a new situation before our beliefs and behavior can change" (Sterman, 2000).

In Fig.10, it is possible to observe how the *perceived trust in government* (a variable randomly chosen among the information delay in the SD model in the next chapter) is a represented as a stock.

But, how is possible that something immaterial as a perception is represented as a stock (see definition par.2.4)? The justification of this technical choice lies beneath the concept that a perception, a belief expresses a "state of the system, in this case a state of mind" (Sterman, 2000), that is to say, something that can be evaluated at a given moment in time. The larger is the difference between the *input* and the perception in the stock, the greater the rate of adjustment (in this case *Change in TIG*) will be. The Adjustment Time (AT) measures the period after which a perception is updated.

Change in TIG= (Input (TIG) – Perceived TIG)/AT

After reproducing the structure that originates the problematic reference mode, it is possible to proceed with the formulation of alternative solutions, the design of alternative policies.

The secret of many modelers is to interview all the key actors in the system to figure out if their mental model is missing important feedbacks, the perception of some delay, the existence of counter intuitive dynamics. These eventualities will be verified in the next chapter.

3. e-Government Adoption in Palermo: State-of-the-Art and Forgotten Promises

3.1. Building the System of Rules: the Italian Regulatory Framework

Every system of rules should evolve within the society. It should even anticipate the possible evolution of the society in terms of culture, habits and, of course, technology.

Over the last decade, mainly due the regulations provided by the EU, the Italian regulatory framework has been reviewed and integrated in order to improve communication between government and citizens of the country. Although in Italy the issue of information from the Public Administration (PA) toward citizens had already been raised in the early '90s, Lisbon Strategy gave new impulse to the process of improvement and development in this field.

Law n.150/2000 recognized information and communication as key tools for obtaining legitimacy in government actions. The aim of this law was to innovate the means of information and communication through the adoption of new technologies. It mandated the existence of Citizen Relation Offices ("URP") in order for the Local Authorities to be closer to the citizens; it also required internal Press Agencies to guarantee the constitutional right to information. The birth of URP

expressed a clear intention to bring PA closer to the citizens and to listen to their problems and suggestions.

In 2004, the Parliament enacted law n.4, better known as Stanca's Law, in order to break down the existing virtual barriers. Stanca's Law introduced the concept of *accessibility*[2] and increased control over it. But the focus was placed on human equality (and equity) and not on the right to information. In its essence Stanca's Law provides instructions for the design of the web sites of the PA, particularly for application of predefined rules among the public managers, paying attention to the law requirements more than to the underlying idea of progress and efficiency.

A complete code regulating the subject, the Code of Digital Administration (Decree No.82/2005), was finally issued in 2005. It is a "constitution" of digital world stating rights and duties of users. It includes and reorganizes the entire discipline and provides with the legal basis for the actions.

CAD was renewed for the first time in 2010 (with Decree No.150/2009 better known as Brunetta's Decree) after the introduction of *transparency* and *performance evaluation,* which led to accepting this system as a winning practice for the progress in public administration. It

[2] *Accessibility* is defined by law as "the ability of the computer systems, in the forms and in the limits allowed by the technological knowledge, to disburse services and to furnish usable information, without discriminations, also from those people that need assistive technologies or particular configurations because of their disability" (Law n.4/2004, art.2 c.1 lett.a).

was also emphasized that *transparency* should be achieved through a *total accessibility* to public documents.

It must be noted that Italian regulatory framework (together with its executive documents) is the result of a *top-down* approach, which appears to be in contradiction with the e-government assumptions. The listed laws prescribe a compulsory content for public web sites and require implementation of ICT tools in order to assure the availability of online public service. The focus is on the service delivered, namely on what the institution should provide the society with.

On the other hand, little attention is paid to the citizens' actual use of the content that is tremendously low. Businesses and citizens are often unaware or highly confused regarding their role in this new *digital* civil society. While in the past they were just asked for political consensus, the progress in the public administration required them first for control over the administration performance and now they are even called to participate in shaping the services and participating in the decision-making process. The question is: are they willing to participate? Moreover, are they enough skilled to participate? Would not this participation involve just those who propose themselves, "active citizens"? These questions are even more relevant at the local level and manager should deal with these issues. Clearly, policy learning assumes different profiles.

Recent literature put emphasis on the need for a more *user-centric approach*. In fact, the logic of E-Government suggests a partial shift of control to the citizens that with their feedback can contribute to improving the system and completing the actions of the government. This shift of control cannot happen unless the citizens feel comfortable with the provided tools. Therefore after assuring accessibility, it is compulsory to work on *usability*. The improvement in usability should be carried on as a result of the interaction with the users.

As suggested by the European Commission (2010), users should be "helped to become self-sufficient, to become a part of the solution, or even a provider of it". Moreover they should perceive an added value (or *relative advantage*) in using these tools and contribute to the adoption process encouraging others to do the same.

In 2012, the technocrat government led by Prime Minister Monti put in place some regulatory actions aimed to foster development and growth after the financial crisis. These actions focus on the need for *simplification* and *transparency* to be achieved also through digital solutions. Common goals are the reduction of administrative cost, simplification of authorization procedures and rationalization of procedures.

The Decree no. 5/2012 issued the National Digital Agenda that recalls the objectives of the European Digital Agenda. The Decree no.

83/2012 suppressed DigitPa (the previous institutional body in charge of digitalization) and issued an autonomous agency, Agency for a Digital Italy, which covers DigitPa's functions of control and coordination but is also responsible for the diffusion of use of ICT, for the process of editing technical rules to standardize the language (interoperability) and for service quality control. Moreover, an increasing interest in educating people to operate in a digital world, demonstrates the awareness of the role of the society in achieving the desired results.

3.2. Presenting the Case- Study: e-Government Projects Implemented in the Municipality of Palermo

While elaborating this thesis, the author witnessed the implementation of the second e-Government project of the municipality of Palermo and the new institutional website. The present paragraph describes both of the projects with their peculiarities to assure a good understanding of the strategies implemented and of the hindrances met by the decision-makers.

This moment of change can be considered a big opportunity for testing the improvement in the implementation and, as a consequence, adoption of the e-services.

The first e-Government project for the municipality of Palermo was presented in June 2002 to take part to the notice of funding issued in

2001 for e-Government implementation by the Italian Department of Technological Innovation. It was called "M.A.I.A.", Italian acronym for "*Miglioramento delle Applicazioni e delle Infrastrutture Applicative per il governo della città di Palermo*" (the name refers to the improvement of tools and infrastructure of the municipality of Palermo but is not intuitively bringing back to the imagine of a web portal and this obstacles the adoption) and was shaped as a web portal to allow an easier access to the municipal services for citizens and businesses. The project was approved in November 2002 and co-funded by the Department of Technological Innovation with 340.000 euro. The General Administration of the municipality allocated 1.221.000 euro for the project execution.

The project was committed to the Information System Department of the municipality with the technical support of an ICT company, *Sistema Palermo Informatica S.p.A.* (SISPI) in February 2004. At that time, SISPI was a subsidiary of the municipality of Palermo that owned 51% of the shares.

It was clear to the national Department of Technological Innovation (presently enclosed in the Department of Public Administration and Innovation) that infrastructures and human resources were not ready to support a complete digitalization of public services and the failure of the national project for electronic ID cards (mainly because

of a lack of funding) implied the need for new investments on the digital identification process. What the Department actually expected was a first move toward the achievement of local digital administrations in terms of infrastructures, ICT facilities and culture.

This is the reason why MAIA's objectives, in this first attempt, were downsized to three main goals:

1) Arrangement of ICT facilities;

2) Coordination of the *back-office* to provide a unique *front-end*;

3) Delivery of a municipal web portal.

First of all, it was necessary to build the infrastructures (networks) and to purchase the facilities (servers, storage, etc.) needed in order to offer a *new service model*.

The second goal consisted in providing citizens a one-stop shop, a unique *front-end*. It was not important how the process was executed in the *back-office* (traditional or digitalized) but the service had to be delivered on time.

A unique front office was a big challenge for an administration of a large size municipality as Palermo, where each sector used to have its own documents recording system. Presidential Decree 445/2000 prescribed a single document recording system, a unique Protocol Identifier, but has not been realized yet. Moreover, even though it was not required to set up a digital back office, it was necessary to improve

the communication among the offices in order to guarantee the possibility for the citizens to be allowed to follow their own procedures. In order to answer this need, SISPI S.p.A. realized an intranet called Intr@com where all the public employees could register and work .

As a third goal, Sispi SpA started the implementation of a web portal available to citizens and businesses. The portal included all the major "ingredients" of e-Government strategies. The choice to maintain the traditional channels alive was present and clear in including the Intr@com. However, it is not clear which institutions were included in this Intranet and what kind of relationship was undertaken with the external ones.

The portal also provided a brief description for each of the 53 services toward businesses and citizens that were classified in the portal according to the *life-event approach*. The following municipal reports acknowledged that works were proceeding and defined the content of the portal in detail. In spite of that, MAIA was not complete yet and only limited available areas were reproduced in the website www.comune.palermo.it. Curiously, the website was independent from the Information System Department of the municipality and from Sispi Spa and presented different version of the available forms creating confusion among the users. The creation of the website had been

assigned of a Webmaster directly depending on the Vice President of Cabinet to the Mayor of Palermo: the lack of coordination was evident.

In 2004, MAIA Executive Plan, namely "Rapporto Esecutivo B1" (Information Systems Department of the Municipality of Palermo, 2004) defined the main operational measures to be undertaken: specific training for 184 employees, a weekly monitoring of user satisfaction, a classification of the 53 available e-services among the 4 interactivity levels on basis of the ones suggested by the European Commission (information, unidirectional interaction, bidirectional interaction, trans-activity).

In 2011, the City Council approved a new project described in the municipal resolution of the 31st of May 2011 as the "*natural prosecution of M.A.I.A. portal [...] that place itself inside a dynamic planning strongly oriented towards evolutionary strategies of the Municipal Department of Information System fostering direct services supply to citizens, businesses and other administrations"*.

The new project consists of the realization of a new web portal "Portale dei servizi on-line – Sistema di autenticazione e servizi on-line di livello 4". As the name suggests, this new plan aims to improve the authentication process and to make all the services to achieve Level 4 in the interactivity scale (fulfillment of the procedure online).

It was again put in charge of SISPI SPA (from 2009 totally hold by the municipality of Palermo). The funds, an amount of 1.199.000 euro, will be provided by the Regional Department of Family and Social Policy to rely on the European intervention strategy 6.1.4.1. PO FESR Sicilia 2007/2013. The implementation should be completed by the end of 2013.

The Webmaster, though, is still independent and this could generate confusion in the division of the responsibilities and lack of coordination in the answer to the citizen.

Some interviews to managers of Sispi Spa and of the Information System Department of the Municipality of Palermo confirmed also the existence of two important critical points in the innovation of the administration.

First of all, a big issue is the acceptance of the new channels of interaction within the organization: every single agency fears an overload of inquiries that would not be able to face the first days of implementation of a new service with bad consequences for the reputation of the office.

Moreover, and this is maybe the worse problem, there is a cultural resistance of the employees who perceive the digital channels as an increase of their workload in the short-term.

It is maybe too early to decree the success or failure of the second-generation project but monitoring the perception of individuals with respect to the change could allow important strategic adjustments.

Measuring e-Government in order to evaluate different policies is not easy because of all the immaterial values involved. Nonetheless it is important to capture the feedbacks underlying given e-Government system.

3.3. Testing the Key-Determinants of e-Government Adoption using Technology Acceptance Model (TAM).

The hypotheses for the TAM (see par. 2.3) were tested via a survey on the official website of the municipality of Palermo that was completed by 389 respondents between June and August 2013.

Having already seen the composition of the sample, it is possible to proceed analyzing the usage behavior of the respondents.

Tab. 3 makes explicit the percentage of use and the reasons that enhance or hinder the use of the e-government municipal website. More than 60% of the respondents use the website but only a 10 % completes procedures online. Most of the respondents only look for information.

	Frequency	Percent
Do you use the website to interact with the municipality?		
Yes	250	64.27%
No	139	35.73%
If yes, what for?		
1) Find information	228	58.61%
2) Download form	163	41.90%
3) Complete the procedures online (***Registered Users***)	63	16.20%
4) Other	41	10.54%
If no, why?		
1) I do not trust the instrument	17	4.37%
2) The information I find are not updated nor reliable	33	8.48%
3) I need to go to the office anyway	**59**	**15.17%**
4) I do not feel the need to interact	46	11.83%
5) Other	19	4.88%

Tab. 3 Reasons for using the mnicipal website or not

A low use rate is not alarming *per se*. "By their very nature, community municipal portals, as well as traditional local government

websites, may always experience low frequency of use. After all, how reasonable is to expect citizen to utilize such sites on a daily or even frequent basis?" (Detlor et al., 2013). The problematic issue rises, on the other hand, when low use rates are associated with a low users' satisfaction.

The main reason that hinder the use of the website is the fact that the users need to complete their procedures in a municipal office anyway, so they do not perceive a relative advantage in using the digital channel in place of the traditional one.

A second reason is that some users do not feel the need to interact with the public administration.

It is crucial to understand if people do not need to interact because someone else carries out their activities and they prefer to get the information elsewhere or for other deeper reasons. In fact, as stated by the European Commission (2012) "an expressed lack of interest could relate to a number of things: lack of knowledge and skills, a genuine lack of interest, lack of an appropriate offer or not wanting to report financial reasons".

The constructs included in the survey are listed in table 4. This table also provides important information on the variation of trust in government and trust in technology in the last years to get a perception of the evolution of trust.

As it is possible to observe, there was a sensible increase of trust in technology (now accepted in people every-day life for information and e-purchases).

Construct	Items		Mean	Modal Value	Standard Deviation
Trust in Technology (old)	TT1	I trusted using the Internet in the last 5-3 years	1.56	1.00	0.87
Trust in Technology (new)	TT2	I trust using the Internet at present	7.43	8.00	1.88
Trust in Goverment (old)	TG1	I trusted the government in the last 5-3 years	2.10	2.00	0.63
Trust in Goverment (new)	TG2	I trust the government	3.48	1.00	2.14
Perceived Usefulness (PU)	PU1	The website provides useful information	5.73	6.00	2.24
	PU2	The website provides reliable information	5.84	6.00	2.29
	PU3	The new website is better than the older one	6.41	6.00	2.43
Perceived Ease of Use (PEOU)	PEOU1	The website is easy to navigate	4.65	6.00	2.34
	PEOU2	The homepage is visually appealing (easy on the eyes)	4.86	6.00	2.52
Interest in Interacting with PA	IPA1	It is important to interact with the PA	7.11	10.00	2.71
	IPA2	It is important to interact with the municipality	5.84	6.00	0.80
Security	SE1	I feel protected in the use of the website	5.53	6.00	2.50
Satisfaction	SA1	I am satisfied with the services provided on the website	5.01	6.00	2.29

Tab. 4 List of constructs and items in the survey

On the other hand, the table reports a slight increase of trust, which could be good signal in a period of crisis. But the value is still too low with a mean of 3.48 and a modal value of 1 in a scale from 1 to 10.

It must be noted that, while the mean of the constructs of *perceived usefulness* assume values close to 6.00, the constructs of *perceived ease of use* do not. Despite the design of a new website, the citizens are not comfortable with the homepage and the navigation tools.

In general, citizens do not feel fully secure and are not fully satisfied.

The choice of analyzing the "actual use" in place of the "intention to continue using" the e-Government website (see par. 2.3) allows to obtain data that are based on the current situation and that are less influenced from the feelings of the moment. But the answer can just be "yes" or "no" without any indication on the continuity of the use.

However, analyzing the mean values of the preferences of the respondents that are users (**registered users** – see tab.2- that can complete procedure online) and comparing it to the preferences of the total population of respondents, it is possible to verify how the users are characterized from higher degrees of *perceived usefulness, perceived ease of use, satisfaction, interest in interacting with the PA* and *perceived security* (Tab.5). This is consistent with hypotheses H1, H2, H3.

Item	Mean of all respondents (A)	Mean of registered users (B)	B-A
TIG(new)	3.4758	3.9206	0.4448
TIT(new)	7.4275	7.7778	0.3503
PU1	5.7328	6.8254	1.0925
PU2	5.8499	6.9523	1.1025
PU3	6.4071	7.2698	0.8627
PEOU1	4.6539	5.5397	0.8857
PEOU2	4.8651	6.1270	1.2618
IPA1	7.1196	8.3175	1.1979
SE1	5.5318	6.5556	1.0237
SA1	5.0153	6.1905	1.1752

Tab. 5 Characteristics of registered users

Trust in government assumes a slightly higher value in the group of the registered users compared to the total of the respondents. For *trust in technology* the difference is not that relevant. These results do not surprise with reference to *trust in technology* since the mastery of the Internet is now widespread, pervasive among the citizens even in

Palermo. On the other hand, the low value of *trust in government* among the registered users was not expected since most of the previous literature tested trust and found it to be crucial for the adoption of e-Government. As already seen in paragraph 1.5, Worrall (2011) excludes the adoption of the users "unless they have trust in the system". Belanger & Carter (2008) and Srivastava & Teo (2009) also conclude that trust is an essential factor of adoption. The possible causes of this result were investigated more in depth and will be discussed in paragraph 3.6. Therefore, H4 is partially confirmed, H5 do not find confirmation.

As it is possible to observe in the Correlation Table (Tab. 6), there is a consistency in the data with regard to *perceived usefulness* and *perceived ease of use*. PU1, PU2 and PU3 are strongly correlated among each other as well as PEOU1 and PEOU2.

The strong correlation between *perceived usefulness* and *perceived ease* is consistent with hypothesis H6.

H7 and H8 do not find confirmation. In fact, it seems that *trust in government* and *trust in technology* are not correlated to *users' satisfaction*.

On the other hand, *perceived usefulness* and *perceived ease of use* appear to be strongly correlated to *users' satisfaction*, consistently with H9 and H10.

The survey also provided some additional information.

While the *interest in interacting with the PA* (IPA) is a dominant characteristic among the respondents that are already registered users, it does not seem to be correlated to the other sensible variables.

Security (perceived protection against unintended or unauthorized access, change or destruction of the digital identity and privacy) is an important factor influencing the adoption. In the System Dynamics model, it will be hidden behind the quality of the system.

After the analysis of the results, the proposed scheme of TAM must be redesigned to serve for the construction of the System Dynamics model (Fig.11). The links between satisfaction and trust do not exist, and trust in technology does not influence the adoption of e-Government.

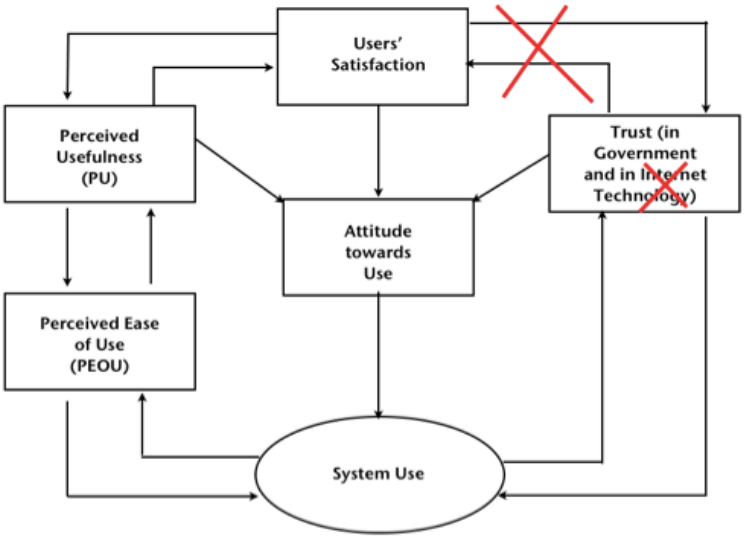

Fig. 11 TAM adaptation as modified after the analysis

	TT1	TT2	TG1	TG2	PU1	PU2	PU3	PEOU1	PEOU2	IPA1	SE1	SA1
TT1	1	-	-	-	-	-	-	-	-	-	-	-
TT2	-0.08484	1	-	-	-	-	-	-	-	-	-	-
TG1	0.07462	0.11687	1			-	-	-	-	-	-	-
TG2	0.01612	0.13526	-0.09725	1		-	-	-	-	-	-	-
PU1	0.01237	0.24156	-0.00368	0.3104	1	-	-	-	-	-	-	-
PU2	0.00748	0.27654	0.02662	0.2547	0.80673	1	-	-	-	-	-	-
PU3	0.02749	0.36982	0.045397	0.2085	0.65704	0.66219	1	-	-	-	-	-
PEOU1	0.0346	0.14929	0.027843	0.2777	0.76304	0.66692	0.61631	1	-	-	-	-
PEOU2	0.02607	0.23403	-0.01673	0.2719	0.74619	0.65576	0.64874	0.7901	1	-	-	-
IPA1	0.02456	0.32147	-0.00729	0.1332	0.37874	0.38441	0.39629	0.25464	0.33486	1	-	-
SE1	0.00296	0.26463	0.04058	0.3286	0.67288	0.70245	0.61553	0.60576	0.62876	0.39938	1	-
SA1	-0.00044	0.29823	0.041098	0.2925	0.78447	0.73954	0.65304	0.77163	0.75362	0.34597	0.66697	1

Tab. 6 Correlation table

3.4. Fixing the Feedback Structure: System Dynamics Modeling and Policy Design

The results of the TAM provided better information on the validity of the hypotheses formulated at the beginning. As already mentioned, the hypotheses constitute the structure underlying to a reference behavior of a System Dynamics Model.

Once again, it is worth reminding that the investigation is directed to understand the dynamics of e-services adoption. From the beginning of January 2013 till the end of June, 10.000 citizens created a registered account for accessing the portal of the municipality. The number of users is increasing slowly. What a modeler should expect, at this point, is the basic structure of a Bass Model, where the reinforcing loops that foster the spreading of the innovation are not fully activated. The *reference mode* (the curves of *users*) is not the S-shaped growth that would be desired but an almost flat curve.

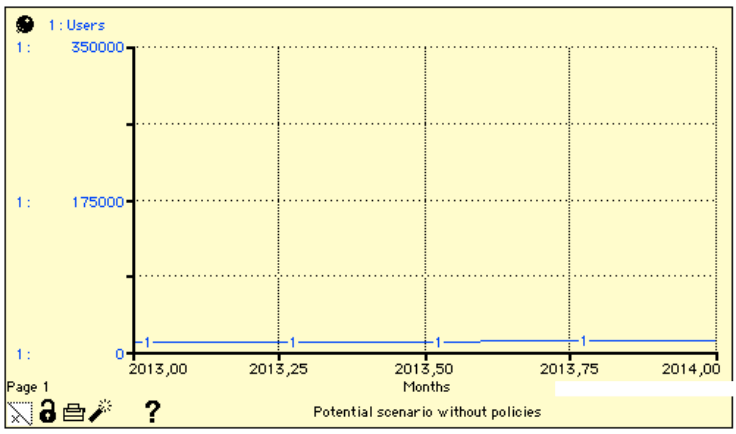

Fig. 12 Reference Mode

Since the boundaries of the research had already been outlined for the TAM analysis, the process of modeling started from the design of a CLD on the basis of the known relationship among the variables.

The spreading of an innovation (as well as the spreading of a disease) can be represented with a Bass Model, widely used by hi-tech firms. This basic structure has already been explained in the previous chapter. The Bass Model is constituted by the loops B1 and R1 in the CLD in Fig.13.

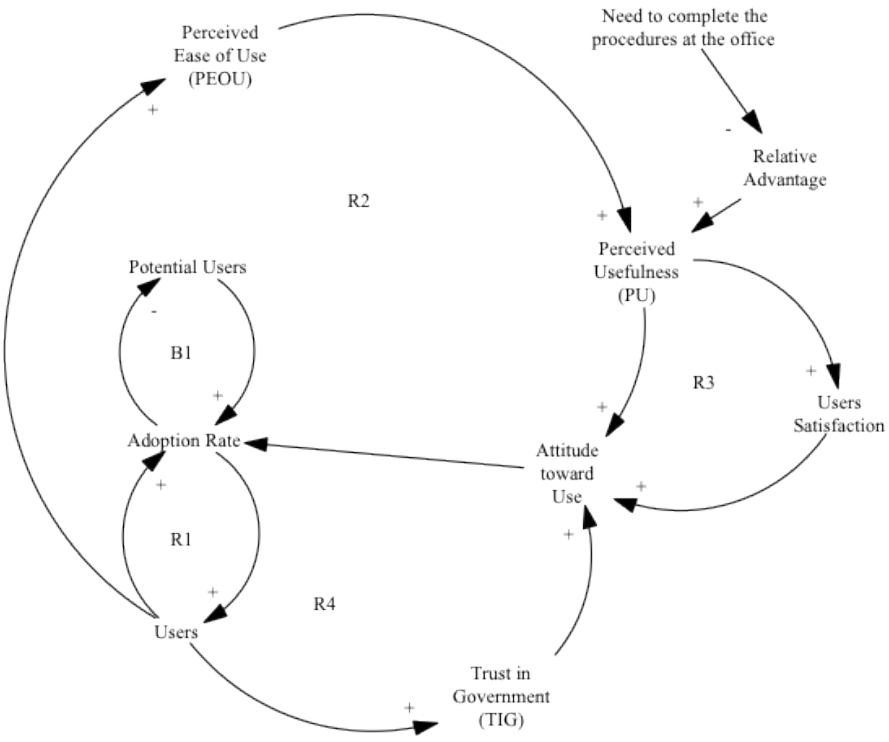

Fig. 13 CLD of the e-Gov adoption in Palermo

The *Adoption Rate* is driven by the *Attitude toward Use* that is a result of *Perceived Usefulness, Users' Satisfaction* and *Trust*, key elements in the other three reinforcing loops of the model. Each loop will be now analyzed in detail here below.

R2 is a loop driven by the perception of the quality of the system in terms of usability and relative advantage in using the digital channels in place of the traditional ones. It is a reinforcing loop that must be read in the following way:

+PEOU => +PU => +Attitude toward Use => +Adoption Rate => + Users => +PEOU.

Perceived Ease of Use (PEOU) is the result of the perception of the completeness of the content developed and available, of the tools for navigating the website and easily find the information needed, and of the accessibility to the portal for the registration. PEOU is also influenced by the number of users. The reason for this relationship is simple: the more people use the website and register to the portal, the more people learn to do it, acquire the skills and teach other potential users.

Following in the analysis of the loop, the higher is *PEOU*, the higher is *PU*. It is worth reminding again Davis' definition of *PU*: "the degree to which a person believes that using a particular system would enhance his or her job performance" (Davis, 1989). This belief is built on

PEOU (in order to enhance performance the system must also be easy to use) and on the *relative advantage*.

Relative advantage is a measure of the perception of the convenience of using the digital in place of the traditional channels. It is an index calculated as complementary of the *need to complete the procedure at the office*.

Relative advantage= 1 – Need to complete the procedure at the office

The index *need to complete the procedure at the office* expresses the percentage of procedures started online that must be completed at the front- office nullifying the convenience of the digital interaction.

Finally *PU* influences the *attitude toward use*, which influence the *adoption rate* and, intuitively, the *users*. The *users*, as already mentioned, will influence *PEOU* back.

R3 goes through the same path of R2 but it also includes the boosting effect of *users' satisfaction* on the *attitude toward use*. The magnitude of this expansive effect is calibrated consistently with the results of TAM analysis-

Last but not least, R4 is the loop of Trust in Government. On the basis of the findings of TAM it is possible to write:

+TIG => +Attitude toward Use => +Adoption Rate => +Users => +TIG.

Now that the feedback of the system are clear, it is possible to proceed with the construction of the *stock and flow diagram*. The starting point is again the Bass Model.

The number of the *registered users* was known: about 10.000 people (end of August). The number of the potential users have been estimated with the help of the webmaster and the reports from Audiweb (www.audiweb.it). It has been set at 340.000 people. The total population (*potential users* + *users*) has been assumed to be constant.

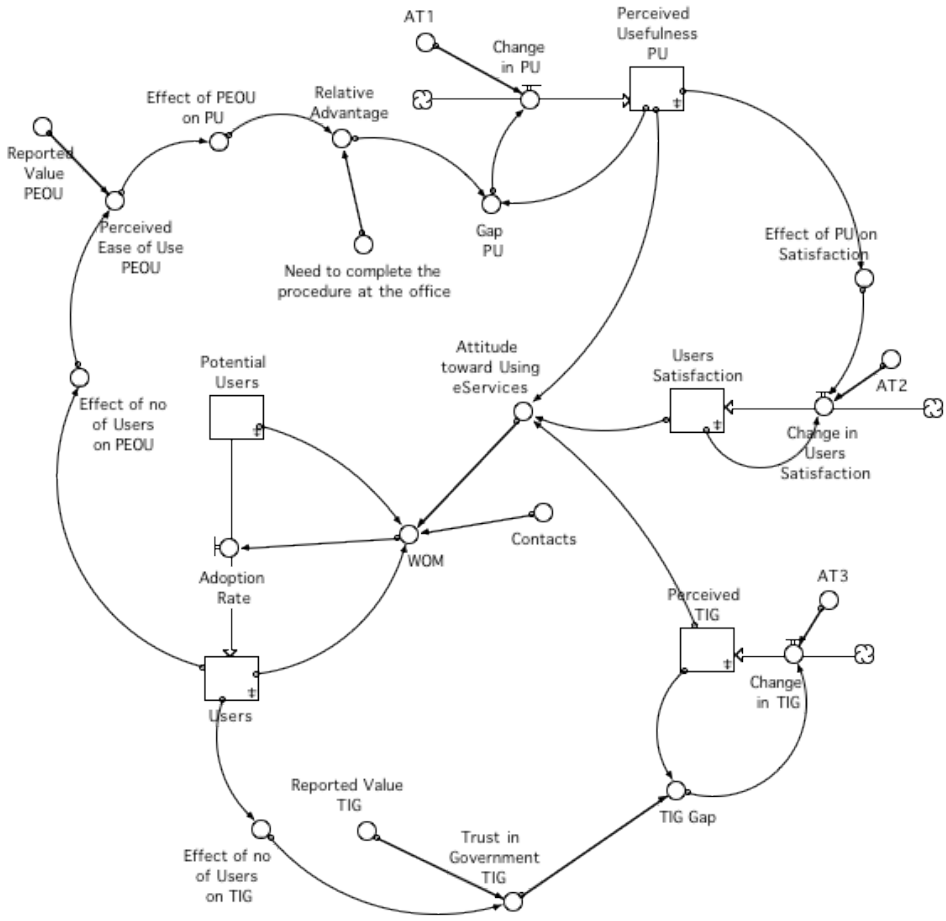

Fig. 14 SFD of e-Gov adoption in Palermo (explanatory model)

The Adoption Rate is determined by the WOM (Word of Mouth) effect. WOM is calculated as:

WOM= contacts*attitude toward use* potential users*users/ total population

where *contacts* are the number of people directly inducted to the registration by other people. The number of contacts has been set to 2 according to the average number of components of italian families (www.anci.it).

Attitude toward use is a combination of *PU*, *users' satisfaction* and *TIG*. All of these components are structured as information delays. All the variables have been weighted 1 while waiting for further analysis on their individual effect on the attitude toward use.

The *adjustment times* have been set equal to 2 years.

Running the simulation, the projection of the current condition shows a scenario where the goal of the adoption process is achieved in 2024, in ten years. Of course, System Dynamics is not magic and does not predict the future. Moreover, many radical innovations or other events could occur in the meanwhile so this graph has just the claim to suggest an indication of a *possible* scenario.

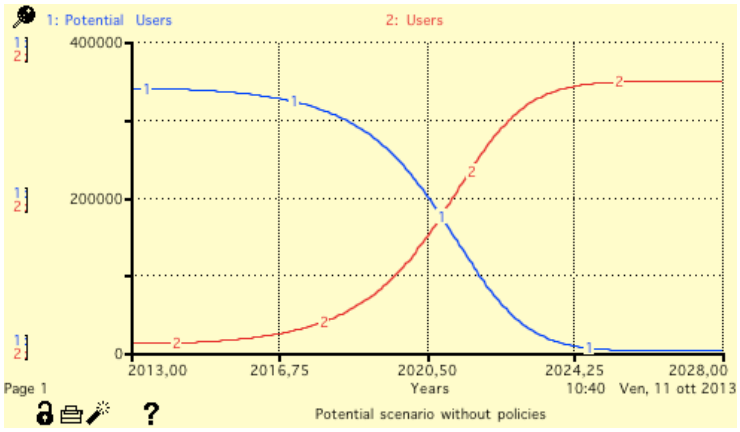

Fig. 15 Simulation of the explanatory model

After a careful analysis and with the help of the comments of the respondents to the survey, the weakness of the system has been recognized in three critical points.

The first one lies behind the *relative advantage*, which is low because of the high rate of procedures that need to be completed going to the office personally.

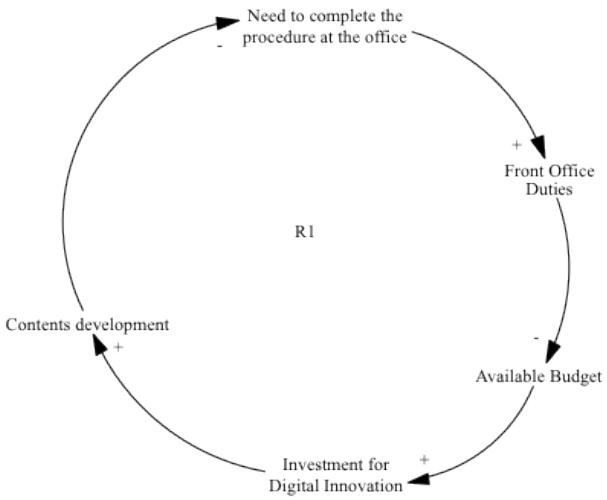

Fig. 16 A critical feedback of the model

A high *need to complete the procedure at the office* gives life to an erosive phenomenon, a reinforcing loop acting in the opposite way and quickly draining the resources dedicated to the innovation. As described in the CLD in fig. 16, the higher the *need to complete the procedure at the office*, the more *front- office duties* in terms of human resources and administrative costs. The amount of *front- office duties* is indirectly linked to the *available budget*, budget that would be dedicated to *investments for digital innovation*. The lack of a constant investment may stop the process of content development increasing the need to complete the procedure at the office.

But the solution does not lay in a simple cut of the services at the front desk. This is because also the service at front desk has an impact on trust and on satisfaction. The decision makers should be aware of this important trade-off.

The magnitude of these effects has not been measured because of their complexity so the analysis was stopped at the qualitative step.

The simulation in fig. 19 has been run considering an achieved decrease of the rate of the need to complete the procedure at the office. The second point of weakness was envisaged in the lack of an appropriate communication campaign. “Bass solved the startup problem by assuming that potential adopters become aware of the innovation

through external information sources whose magnitude and persuasiveness are roughly constant over time" (Sterman, 2000, p.332).

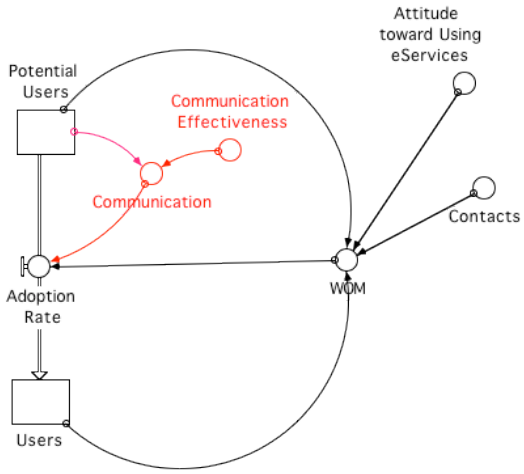

Fig. 17 Implementation of a communication policy (SFD)

The impact of a communication campaign (fig.17) is the result of the communication effectiveness of the campaign multiplied by the number of the potential users. Communication effectiveness is the fractional adoption rate from the activity of communication. It has been estimated that the achievement of a communication effectiveness of 0.10 (combined to the relative advantage policy seen above) would be enough to reduce the adoption process of 5 years (see fig. 20). This impact is then added to the Word of Mouth (WOM) effect to obtain the final adoption rate.

The third point of weakness has been introduced in paragraph 3.2 and lies on the implementation side. It is the cultural resistance of the

employees who perceived the digital channels as an increase of their workload in the short term.

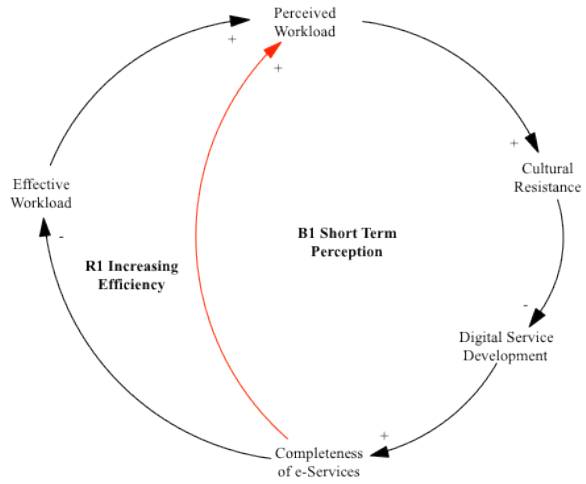

Fig. 18 Perceived Workload (CLD)

This phenomenon is represented in fig.18. The completeness of e-services increases the effectiveness of the administration in the long term reducing the effective workload. But, in the short term, the employees perceive an increase in workload due to the duplication of channels. In fact, the traditional channel cannot be canceled because many people are not ready to use digital instruments. So the traditional and the digital channels will be coexisting as long as the digital divide will not be bridged.

Fig. 19 represents the SD model that includes both policies while fig. 20 shows the big improvements the policies would lead to. The results will be discussed in the next paragraph.

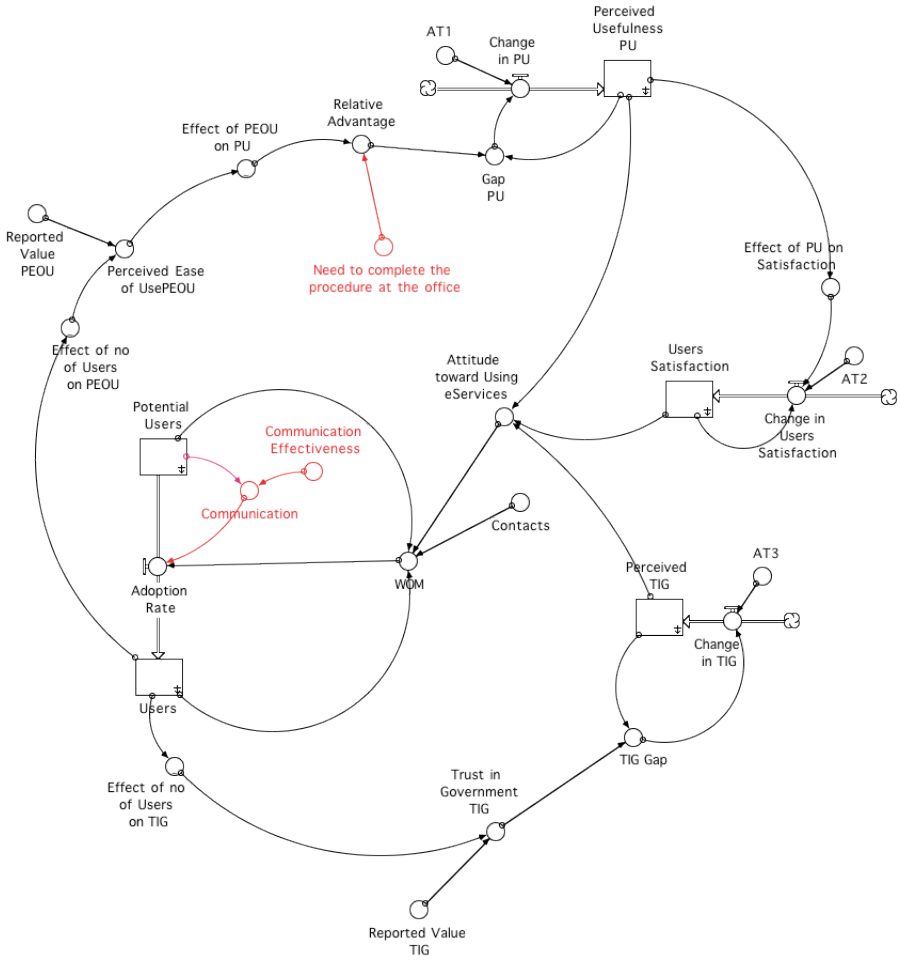

Fig. 19 SFD of e-Gov adoption in Palermo with policies

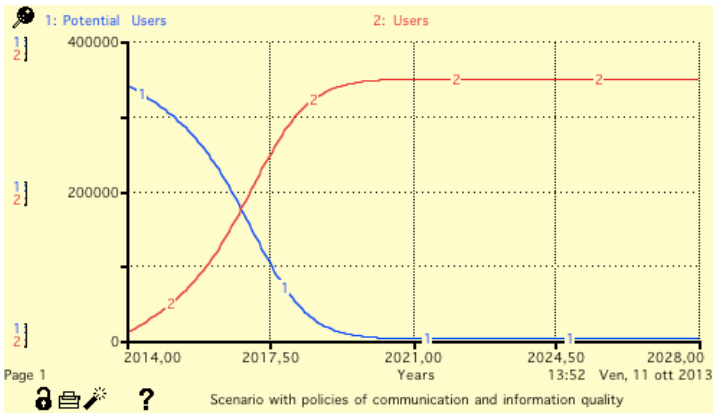

Fig. 20 Potential effect of policies implementation

3.5. Results and Discussion

The analysis of the case- study shed light on the state-of-the-art of the process of e-Government adoption in the municipality of Palermo. The evidence showed that the implementation of the e-services has been fragmented and the focus was on the availability of the services more than on the real capacity of the citizens to use them.

The survey confirmed that most of the determinants of the adoption are consistent with what the literature suggests. The adoption is fostered by high degrees of *perceived usefulness*, *perceived ease of use*, *satisfaction* and *security*.

These perceptions can be deteriorated from the occurrence of barriers that hinder the adoption of e-services.

The first barrier is a low relative advantage in the use of the portal in place of the traditional channels that is usually determined by a high rate of the need to go back to the offices to complete a procedure started online.

This barrier can be overcome with investments in the quality of the system in terms of training of human resources and arrangement of adequate facilities. The model shows that the investments cannot be performed cutting the traditional service on which the population still relies because the disappointment can influence the very same variables.

The SD model stresses the importance of the continuity of any deliberate policy. A quick action would not lead to the desired goal. The system takes a long time to register the improvements. Moreover, the ICT is constantly evolving and the administration must be able to follow in order to sustain the economic system.

Another barrier is the lack of awareness of the digital opportunities offered to the population. Promoting the portal can boost the system.

The issue of trust (both in government and in technology) will be discussed in paragraph 3.6.

3.6. Trust and the Effect of the Latest Financial Crisis

Trust in government has an impact on the adoption as well but its magnitude is less intense. It would be interesting to investigate this variable more in depth. The deviation of this value from the other variables combined with the analysis of the free comments of the respondents suggests that the recent financial crisis had a strong impact on the territory and on people trust.

The latest financial crisis hit Sicily later but harder than the rest of Italy in spite of the fact that the economic system was less financial. According to "38th Report Sicilia" edited by Di.Ste Consulting for Fondazione Curella, during the past year, Sicily lost 3% of its GDP (Italy about 1,7%). The cumulative rate (2008-2012) reports a loss of 10% of

GDP against an Italian average of 6,5%. Significant decreases were recorded also by the employment rate (-2,2%), consumption (-4,1%) and investments in industrial equipments (-12,8%).

The data about the shortfalls of consumption and investments are probably the most alarming. Household and businesses cut their expenses under the effective decline of their purchasing power. Moreover, the adoption of a strong contractionary fiscal policy worsened their perception of the reality, and their expectation for the future is still pessimistic.

The Municipality of Palermo, as most areas of southern Italy, was hardly hit by the financial crisis though its economy is not based on the financial sector but real. The crisis was indeed mainly driven by fear and loss of *trust in government* with consequent aversion of citizen and businesses towards consumption and investment. This approach generated a feedback that made harder and harder for the government to gain trust again.

Tab. 7 shows average TIT and TIG how they were perceived in the past (old) and how they are perceived now (new). As it possible to observe TIT increased over the last few years after the crisis, TIG increased as well, but it is still low. The lower values are registered for the categories 24-35 and 35-60 those that are active in the job market. In

particular, the category 24-35 seems to be discouraged for its difficulties in entering the job market.

AGE	TIT (OLD)	TIT (NEW)	TIG (OLD)	TIG (NEW)
18-24	1.51613	7.87097	2.00000	3.80645
24-35	1.52147	7.87730	2.18405	3.34356
35-60	1.63030	7.18788	2.09697	3.51515
>60	1.60000	6.83333	2.10000	4.10000

Tab. 7 TIT & TIG per age categories

On the other hand, *trust in technology* does not have an influence on the adoption, most likely because technology has been integrated in everyone every-day life independently from the will to interact with the administration.

3.7. Limitations

Most of the limitations of the study concern the selection of the respondents to the online survey.

On the one hand, an online survey allows the participation of users with several kinds of backgrounds, the number of online respondents can be larger and the selection cheaper. The respondents work in a totally natural environment. Moreover, their attention is dedicated to what they actually consider relevant (Elling et al., 2012).

On the other hand, though, online respondents base their judgment on different experience of the website (looking for information such as transportation time tables, obtaining a birth certificate or paying a fine). There is an high risk of *sampling error* (not all users have the same chance of participating in the survey) and *non response error* (not every user wants to participate in the survey (Elling et al., 2012). Answers may be of lower quality if respondents interpret the items in the survey in a wrong way since there is not a facilitator assisting them. There is actually a discrepancy between the survey percentage and the Audiweb data for southern Italy (see tab.2, p.32).

Despite these risks and discrepancies, an online survey appeared to be the more effective for the purpose of this study and it helped to collect several comments that would not have be raised in a laboratory setting.

Other limitations are related to the System Dynamics model. The studies of e-Government by their very nature include a lot of immaterial elements. The effects of all the citizens' perceptions included in the survey are represented with graph functions. Those functions were built on the basis of the experience of the experts interviewed during the project but of course maintain a subjective profile.

Conclusion

This dissertation has aimed to provide a contribution to the field of e-Government adoption in a local government. The interest in the local level is due to the evidence that a local government, in this case a municipality, is the first reference point for the citizen and, for this reason, more sensitive to the dynamics of adoption.

The case- study has examined the municipality of Palermo with its cultural and socio-economic peculiarities. Palermo is experiencing the implementation of a second- generation e-Government project started in January 2013. Therefore it is a crucial moment to investigate the potential problems that could hinder the success of the project.

The survey administered to the citizens through the official website of the municipality provided important insights that were afterwards tested with the help of a TAM analysis.

There is a strong connection between those that are the determinants favorable to the adoption and the barriers that hinder the adoption. Since *perceive usefulness* and *perceived ease of use* have been confirmed to be the most significant determinants of adoption also in Palermo's context (in line with the previous reviewed literature), the municipal government should continue developing the website and portal's contents to provide the citizens with a user-friendly navigation

and to assure them the benefit of a concrete relative advantage in terms of time saving and transparency.

As seen in par. 3.6, the results of this study differ from the reference literature for the impact of trust on adoption. Trust in government is really low and does not seem to be strongly correlated to the adoption. This should not be ascribed to the methodology but to the social and economic context.

It is worth remarking that e-Government requires efforts in terms of money and human skills. It can help in saving time and money in the long term but it will not unless the necessary investments are constantly assured to the departments in charge of the implementation.

The System Dynamics model helped in simulating the possible evolution of the current situation and in proposing the implementation of policies that, acting on the feedback structure of the system, could improve the process of e-Government adoption.

One of the strength of this methodology, that is possible to appreciate in this work, consists in providing a systemic view including all of the determinants of adoption in the same analysis, allowing the reader to perceive the combined effect of all the determinants and barriers.

System Dynamics highlights the existing trade-off between traditional and digital service since they intervene on common variable.

The development of digital services cannot disregard the maintenance of traditional service wherever they are needed. In fact, a decrease of the quality of digital services influences citizen satisfaction, variable that influences also digital services generating a prejudice in the citizens.

It is important to underline that System Dynamics has not a predictive power. Its most valuable contribution consists in the extension of the mental model of managers so to include *counterintuitive feedbacks* that were hidden and not considered during the policy design process.

Recommendations for Research

Further research should investigate in depth the reasons of the lack of interest in interacting with the government online of a relevant percentage of the population to find out if those people simply do not need to interact or have been discouraged by prior bad experiences.

The research should also be extended in order to integrate implementation and adoption issues in the very same model for a complete view of the system and the opportunity to verify the externalities arising from a targeted action.

References

Ajzen, I. (1991) "The theory of planned behavior" *Organizational Behavior and Human Decision Processes* (50:2), pp.179-211.

AlAwadhi, S. & Morris, A. (2009) "Factors Influencing the Adoption of E-government Services". *Journal of Software*, Vol. 4 (6), pp.584–590.

Alroaia, Y.V., Hemati, M. & Shahabi, A. (2011) "Modeling of technology acceptance model based on system dynamics approach" *JM International Journal of IT*, Vol.1(1).

Andersen, K.N. et al. (2011) "The forgotten promise of e-government maturity: Assessing responsiveness in the digital public sector" *Government Information Quarterly*, 28(4), pp.439–445.

Axelsson, K., Melin, U., & Lindgren, I. (2010) "Developing public e-services for several stakeholders. A multifaceted view of the needs for an e-service" in S. Newell, E. Whitley, N. Pouloudi, J.Wareham, & L.Mathiassen (Eds.), Proceeding of the 17th European Conference on Information Systems, Verona, Italy (pp. 2804–2815).

Bannister, F. (2007) The curse of the benchmark: An assessment of the validity and value of e-government comparison, *International Review of Administrative Sciences*, Vol.73 Issue 2, pp.171- 188.

Bannister, F. & Connolly, R. (2011) "Trust and transformational government: a proposed framework for research" *Government Information Quarterly*, Vol. 28, pp.137-147

Bélanger, F. & Carter, L. (2008) "Trust and risk in e-government adoption" *The Journal of Strategic Information Systems*, 17(2), pp.165–176.

Bianchi, C. (2009) *Modelli di system dynamics per il miglioramento della performance aziendale. Verso un sistema di programmazione e controllo per lo sviluppo sostenibile*, Management, IPSOA.

Carter, L., & Bélanger, F. (2005) "The utilization of e-government services: Citizen trust, innovation and acceptance factors" *Information Systems Journal*, Vol. 15(1), pp. 5–25.

Carter L., Weerakkody V. (2008) "E-government adoption: a cultural comparison" *Inf Syst Front*, n.10, pp.473-482.

Codagnone, C. and Wimmer, M. (eds., 2007) *Roadmapping eGovernment: Research Visions and Measures towards Innovative Governments in 2020,* www.egovrtd2020.org.

Cordella, A. & Bonina, C.M. (2012) "A public value perspective for ICT enabled public sector reforms: A theoretical reflection" *Government Information Quarterly*, 29(4), pp.512–520.

Corradini, F., Falcioni, D., Polini, A., Polzonetti, A., & Re, B. (2010) "Designing Quality Business Processes for e-Government Digital Services" IFIP EGOV 2010 conference, Lausanne (Switzerland), LNCS of Springer, pp 424 -435, September 2010.

D'Agostino, M.J. et al. (2011) "A Study of E-Government and E-Governance: An Empirical Examination of Municipal Websites" *Public Administration Quarterly*, Vol.35 (1), Spring.

Davis, F. (1989) "Perceived usefulness, perceived ease of use, and user acceptance of information technology" *MIS Quarterly*, (13:3), pp.319-339.

Detlor, B. et al. (2012) “Information quality and community municipal portal use” *Government Information Quarterly*, 30(1), pp.23–32.

Elling, S. et al. (2012). Measuring the quality of governmental websites in a controlled versus an online setting with the “Website Evaluation Questionnaire”. *Government Information Quarterly*, Vol. 29(3), pp.383–393.

European Commission (2003) The role of E-Government for Europe's future. http://eurlex.europa.eu/LexUriServ/LexUriServ.do?uri=COM:2003:0567:FIN:EN:PDF.

European Commission (2012) “Digital Competence in the Digital Agenda” Document of the Digital Agenda Available at: https://ec.europa.eu/digital-agenda/sites/digital-agenda/files/scoreboard_digital_skills.pdf

Fishbein, M., & Ajzen, I. (1975). *Belief, Attitude, Intention, and Behavior: An Introduction to Theory and Research.* Reading, MA: Addison-Wesley.

García-Sánchez, I.-M., Cuadrado-Ballesteros, B. & Frías-Aceituno, J.-V. (2012) “Determinants of E-Government Development: Some Methodological Issues” *Journal of Management and Strategy*, 3(3), pp.11–21.

Gil-Garcia, J.R., & Martinez-Moyano, I. J. (2007) “Understanding the evolution of e-Government: The influence of systems of rules on public sector dynamics” *Government Information Quarterly*, Vol 24, pp.266–290.

Gil-Garcia, J.R. & Pardo, T. (2006) “Multi-Method Approaches to Understanding the Complexity of e-Government” *International Journal of Computers, Systems and Signals*, Vol.7, No.2.

Ho, A.T.K. (2002) “Reinventing Local Governments and the E-Government Initiative” *Public Administration Review* 62(4) pp.434–44.

Information Systems Department, Municipality of Palermo (2004) “Rapporto Esecutivo B1” February 2004.

Jayashree, S. & Marthandan, G. (2010) “Government to e-Government to e-Society” *Journal of Applied Sciences*, 10(19), pp.2205–2210.

Kamal, M., Weerakkody, V., & Irani, Z. (2011). “Analyzing the role of stakeholders in the adoption of technology integration solutions in UK local government: An exploratory study” *Government Information Quarterly*, 28(2), pp. 200–210.

Kemp, R. and R.Weehuizen (2003) “Policy learning, what does it mean and how can we study it?” *Publin Report No. D15* Prepared as part of PUBLIN, project under the 5th EU Framework Programme, http://survey.nifu.no/step/publin/reports/d15policylearning.pdf.

Lenk, K., Traunmüller, R. and Wimmer, M. (2002) ‘The Significance of Law and Knowledge for Electronic Government’, in A. Gronlund (ed.), *Electronic Government– Design, Applications and Management*, New York: Idea Group Publishing, pp. 61–77.

Lin, H.F & Lee, G.G. (2006) “Determinants of success for online communities: an empirical study” *Behaviour & IT*,Vol. 25(6), pp. 479-488.

Luna-Reyes L. F., Gil-Garcia J.R. (2011) "Using Institutional Theory and Dynamic Simulation to Understand Complex E-Government Phenomena" *Government Information Quarterly*, Vol. 28 (3) pp.329-345.

Luna-Reyes, L.F., Gil-Garcia, J.R. & Romero, G., (2012) "Towards a multidimensional model for evaluating electronic government: Proposing a more comprehensive and integrative perspective" *Government Information Quarterly*, 29(3), pp.324–334.

Mignerat, M. & Rivard S. (2005) "Positioning the Institutional Perspective in Information Technology Research" HEC Montreal. Available at: http://neumann.hec.ca/chairegestionti/cahiers/cahier0501.pdf

Moon, M.J. & Norris, D.F. (2005) "Does managerial orientation matter? The adoption of reinventing government and e-government at the municipal level" *Information System Journal* , 15, pp.43-60.

Morgeson, F.V., Van Amburg, D. & Mithas, S. (2010) "Misplaced Trust? Exploring the Structure of the E-Government-Citizen Trust Relationship" *Journal of Public Administration Research and Theory* Vol.21 pp. 257-283.

Orlikowski, W.J., and Barley, S.R. (2001) "Technology and Institutions: What can Research on Information Technology and Research on Organizations Learn from Each Other?" *MIS Quarterly*, Vol. 25(2), 145-165.

Ormerod, P. (2012) *Positive Linking: How Networks Can Revolutionise the World* Faber & Faber, London, UK.

Petter, S., DeLone, W., & McLean, E. (2008) “Measuring information systems success: Models, dimensions, measures, and interrelationships” *European Journal of Information Systems*, Vol. 17(3), pp. 236–263.

Rabaiah, A. & Vandijck, E. (2009) “A Strategic Framework of e-Government : Generic and Best Practice” *Electronic Journal of e-Government (EJEG)*, 7(3), pp.241–258.

Reddick, C.G., (2005) “Citizen interaction with e-government : From the streets to servers?” *Government Information Quarterly*, 22, pp.38–57.

Rogers, E. M. (1995) *Diffusion of innovations* (4th ed.), New York: Free Press.

Rorissa, A., Demissie, D. & Pardo, T. (2011) “Benchmarking e-Government: A comparison of frameworks for computing e-Government index and ranking” *Government Information Quarterly*, 28(3), pp.354–362.

Sabatier, Paul. A. (1993) “Policy Change over a Decade or More” in Paul A. Sabatier and Hank Jenkins-Smith (eds.) *Policy Change and Learning. An Advocacy Coalition Approach*, Boulder: Westview Press, 13-39.

Scott, W.R. (2004) “Institutional Theory: Contributing to a Theoretical Research Program” Chapter prepared for *Great Minds in Management: The Process of Theory Development*, Ken G. Smith and Michael A. Hitt, eds. Oxford UK: Oxford University Press.

Sitkin, S.B., and Roth, N.L. “Exploring the limited effectiveness of legalistic remedies for trust/distrust.” *Organization Science*, 4, 3 (1993), pp.367–392.

Srivastava, Shirish C. & Teo, Thompson S.H. (2008) "The Relationship between E-Government and National Competitiveness: The Moderating

Influence of Environmental Factors" *Communications of the Association for Information Systems* Vol. 23, Article 5.

Srivastava, S. C., Teo, T. S. H. & Jiang, L. (2008–9) "Trust and electronic government success: An empirical study" *Journal of Management Information Systems*, 25(3), pp.99–131.

Sterman, J. D. (2000) *Business Dynamics: Systems Thinking and Modeling for a Complex World*, Irwin/McGraw-Hill, Boston (USA), p. 982.

Tolbert, C. J. & Mossberger, K. (2006) "The Effects of E -Government on Trust and Confidence in Government" *Public Administration Review* Vol. 66(3), pp. 354-369.

United Nations and American Society for Public Administration (UNASPA, 2001) *Global survey of e-government*, Asia Oceania E-business Marketplace Alliance.

Venkatesh, V. (2000) "Determinants of perceived ease of use: Integrating control, intrinsic motivation, and emotion into the technology acceptance model" *Information systems research*, pp.342–365.

Venkatesh, V. et al. (2003) "User acceptance of information technology: Toward a unified view" *MIS Quarterly*, 27, pp.425–478.

Veenstra, A.F. van & Janssen, M. (2010) "Migration Strategies for Multi-Channel Service Provisioning in Public Agencies" in Worrall (ed.) *Leading Issues in e-Government Research* (2011) Academic Publishing International.

Verdegem, P. & Verleye, G. (2009) "User-centered E-Government in practice: A comprehensive model for measuring user satisfaction" *Government Information Quarterly*, 26(3), pp.487–497.

Wangpipatwong, S. Chutimaskul, W. and Papasratorn, B (2008) "Understanding Citizen's Continuance Intention to Use e-Government Website: a Composite View of Technology Acceptance Model and Computer Self-Efficacy" *The Electronic Journal of e-Government* Vol. 6 (1), pp. 55 – 64.

West, D. M. (2004) "E -Government and the Transformation of Service Delivery and Citizen Attitudes" *PublicAdministration Review* 64(1), pp. 15-27

Wheat, D. (2010) "What Can System Dynamics Learn from the Public Policy Implementation Literature?" *Systems Research and Behavioral Science*, Vol. 27(4)s.

Wimmer, M.A. (2002) "Integrated Service Modelling for Online One-stop Government", *Electronic Markets* Volume 12 Issue 3 pp.149-156, www.electronicmarkets.org.

Worrall, L. (2011) "Introduction to Leading Issues in e-Government Research", in Worrall (ed.) *Leading Issues in e-Government Research*, Volume One, Academic Publishing International Ltd, Reading, UK.

Normative References (chronological order)

Law n.150/2000 "Disciplina delle attività d'informazione e di comunicazione delle pubbliche amministrazioni" published on Gazzetta Ufficiale no. 136/ 2000.

Presidential Decree no.445/2000 "Disposizioni legislative in materia di documentazione amministrativa." published on Gazzetta Ufficiale n. 42/2001.

Law 9 gennaio 2004, no. 4 "Disposizioni per favorire l'accesso deisoggetti disabili agli strumenti informatici" published on Gazzetta Ufficiale n.13/2004.

Belisario E. (edited by), Codice dell'Amministrazione Digitale (Decreeno. 82/2005 renewed by Decree no. 235/2010, Forum PA Edizioni.

Decree no. 150/2009, "Attuazione della legge 4 marzo 2009, n. 15, inmateria di ottimizzazione della produttività del lavoro pubblico e di efficienza etrasparenza delle pubbliche amministrazioni." published on Gazzetta Ufficiale 254/2009 - Supplemento Ordinario n.197.

Decree no. 5/2012, "Disposizioni urgenti in materia di semplificazione e di sviluppo." published on Gazzetta Ufficiale 33/2012- Supplemento Ordinario n.27.

Decree no. 83/2012 "Misure urgenti per la crescita del Paese." published on Gazzetta Ufficiale 147/2012- Supplemento Ordinario n.129.x

Web References

www.anci.it - Associazione Nazionale Comuni Italiani

www.audiweb.it - Institution “super partes” monitoring the Italian websites. Milano.

www.comune.palermo.it - Official Municipal Website.

http://www.comune.palermo.it/questionario_e-gov.php – survey on the Official Municipal Website.

https://servizionline.comune.palermo.it/portcitt/jsp/home.do?sportello=portcitt – Official Municipal e-services Portal

Appendix A. Survey

Age:

1. 18-24;
2. 24-35;
3. 35-60;
4. >60

Gender:

1. M;
2. F

Education:

1. Middle high school
2. High school
3. Bachelor or higher

Occupation:

1. Student
2. Employee in the private sector
3. Employee in the public sector
4. Entrepreneur
5. Professional
6. Unemployed
7. Others

Are you an Internet user? Y/N

What is your current level of trust in using the Internet? (1-10)

What was your level of trust five to three years ago? (1-10)

What is your current level of trust in the government? (1-10)

What was your level of trust in the government five to three years ago? (1-10)

Do you use the Internet to interact with the Public Administration?

If yes, how:

1. To gather information
2. To download forms
3. To complete procedures online
4. Other

If yes, what entities are you interacting with:

1. Central administration
2. Regional administration
3. Municipal administration
4. Others

If no, why:

1. I do not trust the instrument
2. The information I find are wrong/ the websites are not updated
3. I must go personally to the office anyway to complete the procedure
4. I do not feel the need of interacting online with the Public Administration
5. Other

Do you use the Internet to interact with the municipality trough the website www.comunedipalermo.it?

- Yes
- No

If yes, how:

1. To gather information
2. To download forms
3. To complete procedures online
4. Other

If no, why:

1. I do not trust the instrument
2. The information I find are wrong/ the websites are not updated
3. I must go personally to the office anyway to complete the procedure
4. I do not feel the need of interacting online with the Public Administration
5. Other

Give a mark from 1-10 (where 10 is absolutely true and 1 absolutely false)

I am satisfied with the service provided by the website

The homepage is visually appealing (easy on the eyes)

The website is easy to navigate

The website provides useful information

The website provides reliable information

The new website is better the than the old one

I feel protected in the use of the website

What is your level of interest in knowing and controlling the activity of the Public Administration through the Internet?

Have you ever heard about “e-Government”?

- Yes
- No

Have you ever heard about “Portale dei servizi online”?

- Yes
- No

Have you ever heard about “Linea Amica”?

- Yes
- No

Do you use the social network?

- Yes
- No

If yes, which one?

Do you think the public administration should use the social networks as a communication channel?

- Yes
- No

Have you ever heard about the Digital Agenda?

- Yes
- No

How much 1 being the minimum and 5 the maximum do you think is important to interact online with the municipality of Palermo?

Comments:

Appendix B. Equations of the System Dynamics model

Perceived__TIG(t) = Perceived__TIG(t - dt) + (Change__in_TIG) * dt

INIT Perceived__TIG = 0

INFLOWS:

Change__in_TIG = TIG_Gap/AT3

Perceived__Usefulness_PU(t) = Perceived__Usefulness_PU(t - dt) + (Change__in_PU) * dt

INIT Perceived__Usefulness_PU = 0

INFLOWS:

Change__in_PU = Gap__PU/AT1

Potential__Users(t) = Potential__Users(t - dt) + (- Adoption__Rate) * dt

INIT Potential__Users = 340000

OUTFLOWS:

Adoption__Rate = WOM

Users(t) = Users(t - dt) + (Adoption__Rate) * dt

INIT Users = 10000

INFLOWS:

Adoption__Rate = WOM

Users__Satisfaction(t) = Users__Satisfaction(t - dt) + (Change_in___Users__Satisfaction) * dt

INIT Users__Satisfaction = 0

INFLOWS:

Change_in___Users__Satisfaction = (Effect_of_PU_on__Satisfaction-Users__Satisfaction)/AT2

AT1 = 2

AT2 = 2

AT3 = 2

Attitude__toward_Using_eServices = (Users__Satisfaction+Perceived__Usefulness_PU+Perceived__TIG)/3

Contacts = 2

Gap__PU = (Relative__Advantage)-Perceived__Usefulness_PU

Need_to_complete_the__procedure_at_the_office = 0.8

Perceived__Ease_of_Use_PEOU = Reported__Value_PEOU*Effect_of_no__of_Users__on_PEOU

Relative__Advantage = 1-Need_to_complete_the__procedure_at_the_office+Effect_of_PEOU__on_PU

Reported_Value__TIG = 0.2

Reported__Value_PEOU = 0.6

TIG_Gap = Trust_in__Government_TIG-Perceived__TIG

Trust_in__Government_TIG = Reported_Value__TIG*Effect_of_no__of_Users__on_TIG

WOM = Contacts*Attitude__toward_Using_eServices*Potential__Users*Users/(Potential__Users+Users)

Effect_of_no__of_Users__on_PEOU = GRAPH(Users)

(0.00, 0.03), (35000, 0.172), (70000, 0.315), (105000, 0.457), (140000, 0.57), (175000, 0.66), (210000, 0.757), (245000, 0.877), (280000, 0.975), (315000, 1.09), (350000, 1.27)

Effect_of_no__of_Users__on_TIG = GRAPH(Users)

(0.00, 0.08), (35000, 0.11), (70000, 0.145), (105000, 0.185), (140000, 0.225), (175000, 0.29), (210000, 0.375), (245000, 0.445), (280000, 0.58), (315000, 0.665), (350000, 0.89)

Effect_of_PEOU__on_PU = GRAPH(Perceived__Ease_of_Use_PEOU)

(0.00, 0.015), (0.1, 0.21), (0.2, 0.337), (0.3, 0.48), (0.4, 0.6), (0.5, 0.698), (0.6, 0.772), (0.7, 0.847), (0.8, 0.892), (0.9, 0.938), (1, 0.982)

Effect_of_PU_on__Satisfaction = GRAPH(Perceived__Usefulness_PU)

(0.00, 0.00), (0.1, 0.26), (0.2, 0.45), (0.3, 0.61), (0.4, 0.74), (0.5, 0.85), (0.6, 0.95), (0.7, 1.04), (0.8, 1.12), (0.9, 1.18), (1, 1.26)

Appendix C. Equations of the System Dynamics model with policies

Perceived__TIG(t) = Perceived__TIG(t - dt) + (Change__in_TIG) * dt

INIT Perceived__TIG = 0

INFLOWS:

Change__in_TIG = TIG_Gap/AT3

Perceived__Usefulness_PU(t) = Perceived__Usefulness_PU(t - dt) +

(Change__in_PU) * dt

INIT Perceived__Usefulness_PU = 0

INFLOWS:

Change__in_PU = Gap__PU/AT1

Potential__Users(t) = Potential__Users(t - dt) + (- Adoption__Rate) * dt

INIT Potential__Users = 340000

OUTFLOWS:

Adoption__Rate = WOM+Communication

Users(t) = Users(t - dt) + (Adoption__Rate) * dt

INIT Users = 10000

INFLOWS:

Adoption__Rate = WOM+Communication

Users__Satisfaction(t) = Users__Satisfaction(t - dt) +

(Change_in___Users__Satisfaction) * dt

INIT Users__Satisfaction = 0

INFLOWS:

Change_in___Users__Satisfaction = (Effect_of_PU_on__Satisfaction-

Users__Satisfaction)/AT2

AT1 = 2

AT2 = 2

AT3 = 2

Attitude__toward_Using_eServices =

(Users__Satisfaction+Perceived__Usefulness_PU+Perceived__TIG)/3

Communication = Potential__Users*Communication__Effectiveness

Communication__Effectiveness = 0.1

Contacts = 2

Gap__PU = (Relative__Advantage)-Perceived__Usefulness_PU

Need_to_complete_the__procedure_at_the_office = 0.3

Perceived_Ease__of_UsePEOU =

Reported__Value_PEOU*Effect_of_no__of_Users__on_PEOU

Relative__Advantage = 1-

Need_to_complete_the__procedure_at_the_office+Effect_of_PEOU__on_PU

Reported_Value__TIG = 0.2

Reported__Value_PEOU = 0.6

TIG_Gap = Trust_in__Government_TIG-Perceived__TIG

Trust_in__Government_TIG =

Reported_Value__TIG*Effect_of_no__of_Users__on_TIG

WOM =

Contacts*Attitude__toward_Using_eServices*Potential__Users*Users/(Potenti

al__Users+Users)

Effect_of_no__of_Users__on_PEOU = GRAPH(Users)

(0.00, 0.03), (35000, 0.172), (70000, 0.315), (105000, 0.457), (140000, 0.57),

(175000, 0.66), (210000, 0.757), (245000, 0.877), (280000, 0.975), (315000,

1.09), (350000, 1.27)

Effect_of_no__of_Users__on_TIG = GRAPH(Users)

(0.00, 0.08), (35000, 0.11), (70000, 0.145), (105000, 0.185), (140000, 0.225),

(175000, 0.29), (210000, 0.375), (245000, 0.445), (280000, 0.58), (315000,

0.665), (350000, 0.89)

Effect_of_PEOU__on_PU = GRAPH(Perceived_Ease__of_UsePEOU)

(0.00, 0.015), (0.1, 0.21), (0.2, 0.337), (0.3, 0.48), (0.4, 0.6), (0.5, 0.698), (0.6,

0.772), (0.7, 0.847), (0.8, 0.892), (0.9, 0.938), (1, 0.982)

Effect_of_PU_on__Satisfaction = GRAPH(Perceived__Usefulness_PU)

(0.00, 0.00), (0.1, 0.26), (0.2, 0.45), (0.3, 0.61), (0.4, 0.74), (0.5, 0.85), (0.6,

0.95), (0.7, 1.04), (0.8, 1.12), (0.9, 1.18), (1, 1.26)