
# Πολυτεχνείο Κρήτης

## Τμήμα Μηχανικών Παραγωγής και Διοίκησης


**ΣΥΝΘΕΤΙΚΗ ΜΕΤΑΠΤΥΧΙΑΚΗ ΕΡΓΑΣΙΑ ΜΕ ΘΕΜΑ**

# Κατηγοριοποίηση Πλαισίων Ηλεκτρονικής Διακυβέρνησης


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**Χανιά 2009**

*In Loving Memory of my Grandfather*

**AKNOWLEDGEMENTS**

I feel the need to express my most sincere appreciation to many people who generously supported, guided and helped me during my postgraduate studies at the Management and Production Engineering Department of the Technical University of Crete. Without their contribution and encouragement this study would have never reached its current status.

First of all, I need to kindly thank my supervisor, Professor Nikolaos Matsatsinis, for his continuous and undivided attention. He generously devoted his precious time to me and has been always available to guide me. Moreover, I need to thank Lecturer Yiannis Marinakis as well as, Assistant Professor Anatsasios Doulamis, for their precious comments and remarks, during my thesis defence presentation.

Dr. Fotis Kitsios deserves special thanks for his mentoring and coaching the last ten years. Dr. Thanos Papadopoulos has spent many nights proofreading my English written documents as well as providing invaluable information and for these I need to thank him.

For their support and help, I need to thank my friends Antonis Lentzakis and Anthea Makouli for the feedback they provided on my work and for being there anytime I needed them. Furthermore I could not neglect the support I received from Angelica Kostaki whose devotion has been determinant for the completion of this study in time.

Last, but not least I would like to respectfully thank my beloved parents, Panayiotis and Valia, as well as my brother Marios for their support and love during all these years I have been chasing a goal which many times seemed unreachable.

## CONTENTS

# CHAPTER 1

# INTRODUCTION

## 1.1 OVERVIEW

The current 21st century is perhaps one of the most interesting times in history to be alive. Its dawn has come up with new models of Economics, where global barriers are falling, economies are merging, communication is getting better and cheaper (Salvi & Sahai, 2002) and "*knowledge in the world*" becomes more important (Dix et al., 2004). E-business is becoming a vital factor in governmental institutions as well as in the private sector. Utilization of Information and Communication Technologies (ICT) in order to change the structures and processes of government organizations in an attempt to allow the exchange of information with citizens, businesses and other arms of government, results to improved efficiency, convenience as well as better accessibility of public services.

There is no doubt that Electronic Government (e-government) is a phenomenon of our age. It suggests the use of ICTs to enable and improve the efficiency with which government services are provided to citizens, employees, businesses and agencies; it increases the convenience and accessibility of government services and information to citizens (Carter & Belanger, 2005). The three segments of e-government services are Government-to-Citizen (G2C), Government-to-Business (G2B) and Government-to-Government (G2G) in a correspondence to the business model segments. In fact, governments have been practising e-Government for more than fifty years. Moreover, e-Government strategies are about harnessing the information revolution to improve the lives of citizens and businesses, and to improve the efficiency of government (Borras, 2004).

Despite the emergence of e-government as buzzword in public administration (Yildiz, 2007), it nevertheless remains a concept that implies many different things to different groups of people (Grant & Chau, 2005). Researchers have not been able to come up with a universally accepted definition to describe the concept of e-government until now (Halchin, 2004). Additionally, the benefits of e-government may be numerous, such as greater public access to information and a more efficient, cost-effective government, but, however, the success and acceptance of e-government initiatives, such as online voting and licence renewal, are contingent upon citizens' willingness to adopt e-government (Carter & Belanger, 2005). Hence, although the ministration of public sector services on the Internet is growing, there is still lack of research related to the organisational issues involved in its adoption.

It is common knowledge that ICTs contribute substantially to the acceleration of financial development as well as the elimination of poverty. Ample and ubiquitous access to new technologies is essential for uniform and consistent diffusion of innovation. Ubiquity postulates the omnipresence of networking; an unbounded and universal network (Angelopoulos et al., 2008). This, however, can only be implemented through the sharing of ICT resources across governments and their citizens.

In countries such as the United Kingdom, the United States of America, Canada, Sweden, Singapore, Finland, Sweden as well as South Africa there is an increasing interest in using e-government services to re-engage citizens with the political process. The use of Internet capabilities by governments all around the world has increased significantly over the last years. Among all the constituencies that are affected by the development of e-government, businesses represent one constituency that may experience significant benefits (Thompson et al., 2005).

E-government projects have a breadth of impact that extends far beyond the agency concerned and where benefits often expand beyond the agency owning the aforementioned project. E-government utilizes technology to accomplish reform by fostering transparency, eliminating distance and other divides, and empowering people to participate in the political processes that affect their lives (CDT, 2002). The usability, the lower cost of communication channels, the function of electronic services (e-services) as well as the increased participation of citizens will create a

socio-economic environment, which could satisfy both the administration and the citizen (Tahinakis et al., 2006).

The rapidly changing business environment of the last years has created uncertainty in the market place and high risk for decisions in the years to come. In order to survive in this demanding market place, service organizations have only one choice, to successfully develop new services (Kitsios & Zopounidis, 2007). However the failure rate for new services projects is high, because the knowledge about how new services should be developed is limited. The success rate of new service projects is an average 58% (Griffin, 1997). In other words, four out of ten new service projects fail in the market place.

Within this changing business environment there has been a resurgence of interest among researchers regarding the role of innovation in gaining competitive advantage. However services innovation literature has grown significantly over the last decade, reflecting the increased contribution of service industries to the national economy. Although internationally there is a noticeable shift of governmental services provision from traditional channels to web-based ones, restraints due to poor quality of service are apparent. (Papadomichelaki et al., 2006). New service development has not been widely researched (Martin & Horne, 1993) so there exists a need for further research in this field (Johne & Storey, 1998). During the previous years very few academic studies have concentrated on this area, which means that the knowledge of new service development has not advanced very far. Although the majority of new service development research has concentrated on the financial service sector, so far there has been no important research on new service development in the public sector.

Management is what makes e-Government successful by coordinating the use of corporate resources, managing relationships and empowering strategic alliances. However, current e-Government methodologies and models used are only tailored to specific requirements. This restrains the ability to compare cases and draw valuable conclusions as to how to improve e-Government and its performance measurements. Today, management of the integration of e-Government Information Technology (IT) processes faces a number of issues. Firstly, different delivery models of e-Government services are in use. An e-services system -for example- can only be deployed by looking at the penetration of IT in the everyday life of citizens of a

country. As an instance, Sweden and Greece have a high and a low IT penetration in their societies respectively (Bhatnagar, 2004). So it is important to measure or obtain data of the IT penetration levels of a society prior to embarking on an e-Government project. In addition, it is important to help increase the digital literacy of young individuals within schools so as to encourage the use of e-Government services offered to the public. The overriding driver for students in choosing subjects to study is the enjoyment of their topic and it would seem that repetition of subjects and unenthusiastic teaching in some schools may well be impacting on the desire of young citizens to pursue further study and careers in the area of ICT (Gilbert, 2004). Another management issue regarding e-Government is performance management. This is a type of management that focuses on "*public value*" (Heeks, 2005). Lastly, e-Procurement, which has faced a lot of negative media attention, has not been able to convince the public of its benefits to e-Government services (Wyld, 2002).

Therefore, this study attempts to address the issues faced by surveying the models consisting of effective practices in e-Government IT integration management and IT support. This study does not try to stand out either as a review or as a synthetic summary of the literature concerning the frameworks of e-government, rather, its main objective is an in depth overview of the current status of e-government phenomenon. The research will commence with a thorough examination and investigation of how current e-Government IT processes operate, so as to understand what the issues that need to be tackled are. It is considered that the analysis of e-Government IT integration and service management will be done from a socio-technical, cultural and economics viewpoint and will provide answers to complex issues, thus, highlighting the significance of the research project to the public sector. The conclusions drawn at the end of the research would be of great interest to Government officials and bodies promoting e-Government services, considering the increasing urge to push e-Government technologies to the wider public. The research will also provide more information to similar research that has been carried out in the past (Griffin, 2005).

The overall aim of the research project is to conduct a critical analysis of well-established e-Government models and frameworks. Understanding e-Government integration project management will ultimately help in the development of an

effective practice model, which will improve e-Government implementation. The author emphasizes the dilemma whether e-government is really a tool for decentralization and democratization or the result of a socio-technical process towards a new model of public administration. While focusing on the changes in business processes that are needed inside governmental institutions in order e-government to be successfully implemented, the need for a holistic model arise which can embrace the back-office, the front-office as well as the real citizens' needs.

## 1.2 THESIS STRUCTURE

This study is structured as follows: after a brief introduction to the notions of e-government and implementation barriers, gaps in the extant literature are identified. The paper ends with suggestions on ways and identifies appropriate methodologies for addressing these gaps.

# CHAPTER 2

# E-GOVERNMENT

## 2.1 INTRODUCTION

Technology was seen as a means to manage the limitations of bounded-rationality and provide the infrastructure for better decision-making (Simon, 1976). In other words, until the introduction of the Internet and widespread use of personal computers, the main objectives of technology use in government were enhancing the managerial effectiveness of public administrators while increasing government productivity (Yildiz, 2007). Until then, the main use of technology in government organizations was the automation of mass transactions such as financial transactions using mainframe computers (Schelin, 2003).

This was an era in which most government agencies are creating and operating their computer systems independent from each other, in "*stovepipe*" fashion (Aldrich, 2002). Technology was buffered from the core in order to manage the uncertainty. This was necessary, since technology and environments were perceived to be the two basic sources of uncertainty that challenge rationality in organizational decision making (Thomson, 1967). In addition, since information technology was used for the automation of the backroom operations and improvement of the efficiency of clerical activities (Zuboff, 1988), government IT professionals were isolated from functional and executive oversights (Holden, 2003). Perrow's (1967) opinion differed, as he argued that technology is an important determinant of the structure and the strategy of the organizations that use it.

The diffusion of personal computers in the 1980s provided each public administrator with a personal information technology system, and thus opened a new period of IT use in government. At this point, technology management began to be decentralized in government agencies. Along with decentralization came the realization that IT issues should be integrated to the core functions in government (Yildiz, 2007). ICTs were recognized to have tremendous administrative "*potential*" (Spremic & Brzica, 2008). For example it could help create a networked structure for interconnectivity (McClure, 2000), service delivery (Bekkers & Zouridis, 1999), efficiency and effectiveness (Heeks, 2001), interactivity (DiCaterino & Pardo, 1996), decentralization, transparency (La Porte et al., 1999), and accountability (Ghere & Young, 1998).

## 2.2 DEFINING E-GOVERNMENT

The goal of e-government is to achieve in making government services more accessible, more citizen-focused, more relevant to citizens as well as more responsive to their needs and expectations. E-government comprises the use of ICT in order to deliver public services to citizens and businesses. It entails the transformation of public services available to citizens using new organizational processes as well as new technological trends (Gunter, 2006). Furthermore, it is regarded as a player with a significant role in enabling greater citizen involvement in civic and democratic matters in the sense of direct democracy as the one practiced in the city-states of ancient Greece.

E-government is also designed to facilitate a more integrated mode of governance. It encapsulates the relationships between governments, their citizens as well as their suppliers by the use of electronic means (Means & Schneider, 2000). The United Nations and the American Society for Public Administration (2002) defines e-government as the utilization of the World Wide Web for the delivery of government information as well as services to citizens. Jaeger (2003), believes that it may also include the use of other ICT in addition to the Internet and the Web, such as database, networking, discussion support, multimedia, automation, tracking and tracing, and personal identification technologies.

However, Doty and Erdelez (2002) proposed that e-government should enable an open government with transparency as well as responsiveness. In this perspective, e-government is the use of technology, especially web-based Internet applications in order to enhance access to and efficiently deliver government information and services (Brown & Brudney, 2001). Heeks (2003) asserts that the use of information and communication technologies as a means to improve the activities of public sector organizations is the definition of e-government. According to the World Bank (2004), e-government refers to the use of information technologies by government agencies that have the ability to transform relations with citizens, businesses, and other arms of government. Last but not least, according to the Center for Democracy and Technology (2002), "*e-government is the use of information and communications technologies in order to transform government by making it more accessible, effective and accountable*". However, e-government is not about the use of technology or technological innovation for its own sake. Certain technologies do not fundamentally define what e-government is and what it will be (Yildiz, 2007).

Therefore, this study adopts the claim by Hackney et al. (2005), who suggest that e-government "*constitutes a burgeoning phenomenon with huge investments being made to modernize public sector institutions at all levels. Such dramatic change is problematic in any organization, and the political, managerial and cultural environments set within government present an additional challenge. This complexity is historically founded and consistently embedded through a structure of co-operation between executive officers, elected legislative members and citizens, who form the foundations of the democratic process.*"

## 2.3 STAGES OF E-GOVERNMENT

A literature survey of the area demonstrates that the experience of e-government initiatives has been chaotic and unmanageable. The problems present a number of challenges for public administrators (Gupta & Jana, 2003). To help public administrators take an organizational view of transforming a traditional administrative organization to e-government, Layne and Lee (2001) describe different stages of the development of e-government with particular reference to the United States of

America. The four stages of development outline the structural transformations of governments as they progress toward electronically-enabled government and how the Internet-based government models become amalgamated with traditional public administration implying fundamental changes in the form of government.

Based on the technical, organizational, and managerial feasibilities of several examples, e-government is found to be an evolutionary phenomenon, and therefore e-government initiatives should be accordingly derived and implemented. In this regard, the four stages of a growth model for e-government are described as:

- Cataloguing
- Transaction
- Vertical integration
- Horizontal integration

These four stages are explained below in terms of the complexity and different levels of integration involved:

1. ***Cataloguing:*** In this stage, governments create a "*state website*". At this stage, governments do not have much Internet expertise, and they prefer to minimize the risk by doing a small project. Parts of the government's nontransactional information are put on the site. Usually at first the index site is organized on the basis of functions or departments as opposed to service access points. Consequently, if the citizen is unsure of which department he or she is searching, a search for the necessary agency will be required before being able to obtain the information about the process.

2. ***Transaction:*** This stage empowers citizens to deal with their governments on-line anytime, saving hours of paperwork, the inconvenience of traveling to a government office and time spent waiting in line. Registering vehicles or filing state taxes on-line is only the beginning of such transaction-based services. Consequently, instead of simply having the availability of downloading a form, but then having to take that form to a state facility, the form can be completed interactively on-line.

3. ***Vertical Integration:*** Information is made through citizen's local portal. The citizen-user should still be able to access the service at the state or center level from the same entry in the local portal, because the local systems are connected to upper level systems, directly or indirectly.

4. ***Horizontal Integration:*** The horizontal integration of government services across different functions of government will be driven by visions of efficiency and effectiveness in using information technology, but pulled by citizens' demands on an "*inside-out*" transformation of government functions to more service oriented ones. Here e-government offers the best hope for improved efficiencies through administrative reform because of both its vertical and horizontal integration. Such integration will facilitate "*one stop shopping*" for the citizen. Each organization may have to give up some power to move to this stage.

## 2.4 TYPES OF E-GOVERNMENT APPLICATIONS

The primary e-Government service delivery models are G2C, G2B and G2G. Other carriers that might be interested in e-Government services can be Civil Society Organisations (CSO), Non-Governmental Organisations (NGO) as well as the mainstream and social media.

All levels of government now provide a variety of online services to citizens as well as to businesses. Both G2B and G2C services involve opening up new distribution channels for traditional services, and the creation of new information-related, services. Although various initiatives investigate the application of quality management principles to the delivery of electronic public services, manifold problems related to quality of public e-services still exist (eGovernment Unit, 2004). Substantial direct benefits from G2C services may simply not be as tangible and identifiable for individual customers. In addition, the demand for G2C services will likely remain elastic as long as governments maintain other channels for citizens to conduct service transactions, for example, keeping open at least a few motor vehicle offices (Johnson, 2007).

*Table 1: Stages of e-Government growth and type of government relationship (Reddick, 2004)*

| Type of government relationship | Stages of e-Government growth | |
|---|---|---|
| | **Stage I: Cataloguing** | **Stage II: Transactions** |
| **G2C** | Online presence of information about government and its activities for citizens. | Services and forms online and databases to support online transactions for citizens. |
| **G2G** | Online presence of information for other levels of government and its employees. | Services and forms online and databases to support online transaction for other levels and government and employees. |
| **G2B** | Online presence of information for businesses about government. | Services and forms online and databases to support businesses transactions with government. |

## 2.5 BARRIERS IN E-GOVERNMENT ADDOPTION

Fundamental changes have occurred in the structure of most countries' economies, with services becoming the major sector of economic activity (OECD, 2000). Meeting the challenges of an unstable and unsettled environment is not easy. Governments all around the world have been involved in a massive project with the objective of getting as many public services electronically enabled as possible during the first decade of the twenty-first century (Gunter, 2006). E-government requires strong political leadership in order to succeed (CDT, 2002). Obviously, there are several economical and political reasons underpinning this move. It is generally believed that greater efficiencies could be achieved in public service delivery through the use of new ICTs to whichever increasing proportions of the population now have access. Moreover, online technologies are envisaged as playing a significant part in the re-engagement of politically alienated electorates in civic processes (Gunter, 2006). The utilization of ICTs in the government section and administration does not constitute a panacea, however, their use has been a means to manage the limitations of bounded-rationality and provide the infrastructure for better decision making (Simon, 1976).

Research in the past has investigated issues in respect to the implementation of e-government using diffusion models, or by providing a wide array of theories. In particular, by using Roger's (1995) Diffusion Theory, studies have focused on the adoption of IT in the public sector (Brudney & Selden, 1995; Bugler & Bretschneider, 1993; Brudney & Selden, 1995; Norris & Demeter, 1999; Norris & Campillo, 2000; Moon, 2002; Norris & Moon, 2005; Elliman et al., 2005), suggesting that the size of

administration and professionalism are the primary determinants of the adoption of computer technology. Rogers (1995) presents five categories of determining variables for the rate of adoption: perceived attributes of the innovation, type of innovation decision, communication channels, nature of the social system and extent of the change agent's promotion efforts. Berry and Berry (1999) suggest two categories of innovation and diffusion models, namely diffusion models and internal determinants models. In their study they present four diffusion models, that is, the national interaction model (learning model), the regional diffusion model, leader-laggard models and vertical influence models. In internal determinants models, they aim to incorporate internal factors. Understanding the complexity of innovation adoption decisions and multiple determining factors, they argue that no single diffusion model best explains all cases (Moon & Norris, 2005). In another study, Choudrie and Lee (2004) found that the use of broadband within government departments and agencies improved the quality of public services, and encouraged previously bureaucratic organizations to re-engineer the way services are delivered to citizens.

The Information System (IS) Success Model (DeLone & McLean, 1992) and the technology acceptance model (TAM) (Davis, 1989) suggests another means to study the implementation and adoption of e-government, which measures perceived usefulness and perceived ease of use influence one's attitude towards system usage, which influences one's behavioural intention to use a system, which, in turn, determines actual system usage. The success factors presented in Davis' model have to do mainly with the acceptance of organisational software, but have been tested for various users and types of systems (Venkatesh & Davis, 2000; Venkatesh & Morris, 2000), as well as for the user adoption of e-commerce (Gefen & Straub, 2000; Moon & Kim, 2001; Gefen et al., 2003; Pavlou, 2003). However, TAM constructs represent the subjective user assessments of a system and may not be representative of its objective acceptance (Carter & Belanger, 2005).

However, despite the emergence of frameworks, which aim to predict and study the success of IS and, in our case, e-government, there exist barriers. These may concern, for instance, the high cost or the low security of the needed infrastructure can impede its implementation and adoption. The integration of various IT applications and components inside and outside the organizational boundary remains costly and time-

consuming due to the heterogeneity of the computing environments involved in public-sector organizations (Themistocleous & Irani, 2002). Bonham et al. (2001), Bourn (2002), Dillon and Pelgrin (2002), McClure (2000) and the National Research Council (2002) agree that governments face a shortage of technical infrastructure. The above-said shortage presents a significant barrier in the development of the capabilities of government organizations to provide online services and transactions. They also agree that unreliable IT infrastructure in public sector organizations will certainly degrade the e-government performance.

A frequently cited barrier in literature seems to be the need for security and privacy in an e-government strategy (Daniels, 2002; James, 2000; Joshi & Ghafoor, 2001; Lambrinoudakis & Gritzalis, 2003; Layne & Lee, 2001; Bonham et al., 2001; Gefen & Pavlou, 2002). The shortage of IT skills is also a barrier, which contends many challenges regarding the efficiency of a public administration to provide innovative e-government services (Chen & Gant, 2001; Heeks, 2001; Ho, 2002; Moon, 2002). Finally, a major barrier to the adoption and implementation of e-government is funding (Bonham et al., 2001; Heeks, 2001; Ho, 2002), which also relates to the business procedure of government, management strategy, and organizational culture (Lenk & Traunmuller, 2000; McClure, 2000).

Organisational barriers relate to structural issues such as fragmentation, poor relations and communication between the functional departments, and an acceptance of the strategic benefits of new initiatives by the senior management (e.g. Aichholzer & Schmutzer, 2000; Fletcher & Wright, 1995; Northrop et al., 1994; Nedovic-Budic & Godschalk, 1996). Moon (2002) concludes that, to enhance the effectiveness of e-government practices, public-sector organizations would need to progress toward a higher level of e-government development, which will require a greater number of highly trained technical staff.

Finally, in their study of extant literature on e-government policy formulation, implementation and execution, Altameem et al. (2006) suggest a plethora of factors leading to success and failure of e-government and to elaborate on the underlying enabling and inhibiting conditions. In particular, they present a multi-factor model that aims to take under consideration governing factors, that is, the factors which influence people's decisions to adopt e-government initiatives and furthermore can

assist or limit the public sector's effort to diffuse e-government initiatives; technical (the infrastructure, tools and applications required to enable government agencies to participate in the adoption of e-government); and organisational, such as policy and legal issues, quality of service, training, organisational structure and culture.

However, despite the huge amounts of literature regarding implementation of e-government, there is still research to be conducted. In particular, literature has not shed enough light yet on the development of new services in e-government. Various initiatives investigate the application of quality management principles to the delivery of electronic public services (Halaris et al., 2007), however, manifold problems related to quality of public e-services still exist (eGovernment Unit, 2004). The noticeable shift in the provision of governmental services from traditional channels to web-based ones as been obscured by limitations due to the poor quality of services is apparent (Papadomichelaki et al., 2006). In the past few years, very few academic studies have concentrated on this area, which implies that the knowledge of NSD in e-government has not advanced very far. The major portion of research on the development of new services has concentrated on the financial-service sector and some prime gambits have examined the hospitality industry, but so far, there has been no significant research on NSD in the public sector.

The failure rate of new service projects is high due to the fact that knowledge about the manner in which new services should be developed is limited. The success rate of new service projects is an average 58% (Griffin, 1997). In other words, four out of ten new service projects fail in the market. Heeks (2003) empowers this belief with a recent survey regarding the success and failure rates of e-Government initiatives in developing and transitional countries, where he identified that 35% of projects are total failures (e.g. the failure of decision support systems in East Africa); further, half can be considered to be partial failures (e.g. the partial failure of management IS in Eastern Europe); and roughly 15% of e-government services can be characterized as successful. During the same year, the World Bank (2003) reported that its sectoral-based projects with ICT components faced an "*alarmingly high failure rate*" with 50% suffering disputes and 80% requiring contract amendments.

## 2.6 BENEFITS OF E-GOVERNMENT

Benefits anticipated from e-Government are many, howerver some of the most important are improved efficiency, convenience as well as better accessibility of public services. In countries such as the United Kingdom, USA, Canada, Sweden, Singapore, Finland, Sweden and South Africa there is an increasing interest in using electronic government services to re-engage citizens with the political process. Currently, there is too much emphasis on the implementation of front-end systems amongst authorities and not enough emphasis on re-engineering local government in terms of the entire range of processes and systems which is a point of security concern (Audit Commission, 2002). Similar government services can be offered in an online manner through integration of IT processes which enables organisations to use off-the-shelf hardware and software packages to meet their computing needs. Systems integrators do exactly this by combining components from various vendors and making them interoperable on computer terminals for government agency employees.

# CHAPTER 3

# FRAMEWORKS

## 3.1 OVERVIEW

There is no doubt that frameworks are of main importance in several scientific contexts. Researchers around the world devote their precious time on building, testing, comparing as well as revising frameworks. Moreover, a great ammount of journal space is dedicated to the introduction, application as well as interpretion of these invaluable assets. Frameworks are the principal instrument of modern research. However, despite the fact that they have generated considerable interest, there remain significant chasm in scientist's understanding of what a frameworks is and of how it eventually works. It is not yet clear what specific set of questions a theory of representation has to come to terms with, but whatever list of questions one might put on the agenda of a theory of scientific representation, there are two problems that will occupy center stage in the discussion (Frigg, 2006).

1. The first problem is to explain in virtue of what a model is a representation of something else

2. The second problem is concerned with representational styles.

A framework is a physical, mathematical, or logical representation of a system of entities, phenomena, or processes. It is a basic conceptual structure used to solve or address complex issues. This very broad definition has allowed the term to come as a buzzword, especially in a software context. Basically it is a simplified abstract view of the complex reality. It may focus on particular views, enforcing the "*divide and conquer*" principle for a compound problem (Gooch, 2000). Formally a framework is

an interpretation which deals with empirical entities, phenomena, and physical processes in a mathematical, or logical way. For the scientist, it is also a way in which the human thought processes can be amplified (Churchman, 1968). One of the main aims of scientific modeling, according to Silvert (2001), is to apply quantitative reasoning to observations about the world, in the hope of seeing aspects that may have escaped the notice of others. There are many specific techniques that researchers use, which enables them to discover aspects of reality that may not be obvious to everyone. One of the essentials is the understanding of the role that assumptions play in the development of the model.

The usual approach to model development is to characterize the system, make some assumptions about how it works and translate these into equations and a simulation program. After simulation one of the final steps is the validation; such as determining whether the results produced by the framework can be trusted (Silvert, 2001). Conceptual frameworks are a type of intermediate theory that have the potential to connect to all aspects of inquiry. They act like maps which give coherence to empirical inquiry. Due to the fact that conceptual frameworks are potentially so close to empirical inquiry, they take different forms depending upon the research question or problem. Shields and Tajalli (2006) have identified several types of conceptual frameworks such as:

- Working hypotheses
- Descriptive categories
- Practical ideal type
- Models of operations research
- Formal hypotheses

for the field of public administration that could find their way in the e-Government concept. The frameworks are linked to particular research purposes:

- Exploration
- Description
- Gauging
- Decision making

- Explanation / prediction

When purpose and framework are aligned other aspects of empirical research such as choice of methodology:

- Survey
- Interviews
- Analysis of existing data
- Direct observation
- Focus groups

and type of statistical technique become obvious.

Framework development is a comparatively new area of activity involving the marriage of ideas from various disciplines (Neelamkavil, 1987) and is an essential and inseparable part of all scientific activity. According to Silvert (2001), researchers that are capable of developing frameworks, bring special skills and techniques to bear in order to produce results that are insightful, reliable, and useful. Modeling techniques include statistical methods, computer simulation, system identification, and sensitivity analysis. None of these, however, is as important as the ability to understand the underlying dynamics of a complex system. These insights are needed to assess whether the assumptions of a model are correct and complete. Scientists must be able to recognize whether a model reflects reality, and to identify and deal with divergences between theory and data (Silvert, 2001). Modeling is an essential and inseparable part of all scientific activity, and many scientific disciplines have their own ideas about specific types of modeling. Science offers a growing collection of methods, techniques and theory about all kinds of specialized scientific modeling. Scientific modeling is the process of generating abstract, conceptual, graphical and mathematical models. There is little general theory about scientific modeling, offered by the philosophy of science, systems theory, and new fields like knowledge visualization.

A model is evaluated first and foremost by its consistency to empirical data. Any model inconsistent with reproducible observations must be modified or rejected. However, a fit to empirical data alone is not sufficient for a model to be accepted as

valid. Models are typically used when it is either impossible or impractical to create experimental conditions in which scientists can directly measure outcomes. Direct measurement of outcomes under controlled conditions will always be more accurate than modeled estimates of outcomes. When predicting outcomes, models use assumptions, while measurements do not. As the number of assumptions in a model increases, the accuracy and relevance of the model diminishes. Modeling is the process of constructing a model as a conceptual representation of a phenomenon. Typically a model will refer only to some aspects of the phenomenon in question, where '*phenomenon*' is used as an umbrella term covering all relatively stable and general features of the world that are interesting from a scientific point of view and two models of the same phenomenon may be essentially different, that is in which the difference is more than just a simple renaming. Empiricists like van Fraassen (1980) only allow for observables to qualify as such, while realists like Bogen and Woodward (1988) do not impose any such restrictions. This may be due to differing requirements of the model's end users or to conceptual or aesthetic differences by the modelers and decisions made during the modeling process. Aesthetic considerations that may influence the structure of a model might be the modeler's preference for a reduced ontology, preferences regarding probabilistic models vis-a-vis deterministic ones, discrete vs continuous time etc. For this reason users of a model need to understand the model's original purpose and the assumptions of its validity (WikiPedia, 2009).

# CHAPTER 4

# E-GOVERNMENT FRAMEWORKS

## 4.1 OVERVIEW

E-government projects have a breadth of impact that extends far beyond the agency concerned and where benefits often expand beyond the agency owning the aforementioned project. Management is what makes e-Government successful by coordinating the use of corporate resources, managing relationships and empowering strategic alliances. However, current e-Government methodologies and models used are only tailored to specific requirements. This restrains the ability to compare cases and draw valuable conclusions as to how to improve e-Government and its performance measurements.

Today, management of e-Government IT processes integration faces a number of issues. Firstly, different delivery models of e-Government services are in use. For example, an e-Services system can only be deployed by looking at the penetration of IT in everyday life of citizens. Another management issue regarding e-Government is efficiency management. This is a type of management that focuses on "*public value*" (Heeks, 2005). Lastly, e-Procurement, which has faced a lot of negative media attention, has not been able to convince the public of its benefits to e-Government services (Wyld, 2002).

Frameworks are useful because they allow researchers to organize and integrate the various elements of a problem in a simple and consistent way, assuring the achievement of the pursued outcomes. In addition, they allow holding a common work discipline. The benefits of counting on this kind of frameworks exceed the

objectives reached. The framework development process and the associated discussion among participants provide fundamental contributions for e-government initiatives.

Therefore, this study attempts to address the issues faced by surveying the models consisting of effective practices in e-Government IT integration management, as well as IT support. The research will also provide more information to similar research that has been carried out in the past. The overall aim of the research project is to conduct a critical analysis of well-established e-Government models and frameworks. Understanding e-Government integration project management will ultimately help in the development of an effective practice model, which will improve e-Government implementation.

## 4.2 E-GOVERNMENT FRAMEWORKS LITERATURE

Existing e-government research limit iteself by exploring the outcomes of the already implemented projects. Thus, understanding the political process behind e-government development is vital for overcoming both definitional and analytical limitations (Yildiz, 2007). In recent years, many different research teams around the globe attempted to describe e-government architecture frameworks, in many aspects of the digital side of public services, such as the strategic, semantic, security, evaluation as well as interoperability. The most significant frameworks in the are of e-government, categorized according the aforementioned architectures, can be seen in the following table.

*Table 4.1: E-government Frameworks literature*

| Framework | Author | Year | Research |
|---|---|---|---|
| **Strategic** | UK Central IT Unit | 2000 | e-Government, a strategic framework for public services in the information age. |
| | Ebrahim & Irani | 2004 | A Strategic Framework for E-government Adoption in Public Sector Organisations. |
| | Lambert et al. | 2004 | A Framework for Experience Management in e-Government: The Pellucid Project. |
| | Mittal et al. | 2004 | A framework for e-Governance solutions. |
| | Scholl | 2005 | The mobility paradigm in electronic government theory and practice: A strategic framework. |

| | | | |
|---|---|---|---|
| | Affisco & Soliman | 2006 | E-government: a strategic operations management framework for service delivery. |
| | Mahapatra & Perumal | 2006 | e-governance in India : a strategic framework. |
| | Flak et al. | 2007 | An Exploratory Approach for Benefits Management in e-Government: Insights from 48 Norwegian Government Funded Projects. |
| **Interoperability** | eGU | 2005 | e-GIF |
| | ADAE | 2003 | CCI |
| | KDSt | 2003 | SAGA |
| | ITST | 2005 | DIF |
| | IDABC | 2004 | IDABC AG |
| | CIOC | 2002 | EAG |
| | COI | 2008 | Greek e-GIF |
| | MEAC | 2006 | EIF |
| **Semantic** | Caituiro-Monge & Rodríguez-Martinez | 2004 | Net Traveler: A Framework for Autonomic Web Services Collaboration, Orchestration and Choreography in E-Government Information Systems |
| | Comte & Leclere | 2005 | A Semantical Reasoning Framework for eGovernment of French National Retirement System |
| | Herborn & Wimmer | 2006 | Process Ontologies Facilitating Interoperability in eGovernment A Methodological Framework |
| | Alasem | 2009 | An Overview of e-Government Metadata Standards and Initiatives based on Dublin Core |
| | Fang et al. | 2007 | An User-Driven Slight Ontology Framework Based on Meta-Ontology for Change Management |
| | Fernandes et al. | 2001 | ServiceNet: An Agent-Based Framework for One-Stop E-Government Services |
| | Mugellini et al. | 2005 | E-Government Service Marketplace: Architecture and Implementation |
| | Goudos et al. | 2007 | Public Administration Domain Ontology for a Semantic Web Services EGovernment Framework |
| **Security** | Makedon et al. | 2003 | A Safe Information Sharing Framework for E-Government Communication |
| | Abie et al. | 2002 | The Need for a Digital Rights Management Framework for the Next Generation of E-Government Services |
| | Gritzalis & Lambrinoudakis | 2002 | Security Requirements of e-Government Services: An Organisational Framework |
| **Evaluation** | Gupta & Jana | 2003 | E-government evaluation: a framework and case study |
| | Montagna | 2005 | A framework for the assessment and analysis of electronic government proposals |
| | Oyomno | 1998 | Towards a Framework for Assessing the Maturity of Government Capabilities for E-Government |
| | Esteves & Joseph | 2008 | A Comprehensive Framework for the Assessment of eGovernment Projects |

## 4.3 STRATEGIC FRAMEWORKS

Management is what makes e-Government successful by coordinating the use of corporate resources, managing relationships and empowering strategic alliances. However, current e-Government methodologies and models used are only tailored to specific requirements. This greatly restrains the ability to compare cases and draw valuable conclusions as to how to improve e-Government and its performance measurements. Therefore, the authors are attempting to address the issues faced by proposing a model consisting of effective practices in e-Government IT integration management and IT support. Moreover an attempt is being made for a description of current status of strategic frameworks for electronic government literature.

The research for strategic frameworks for electronic government implementation begins in 2000 with the Central IT Unit study at United Kingdom. Four years later, in 2004, three new strategic frameworks published by Ebrahim & Irani, Lambert et al as well as Mittal et al. The following year, 2005, Scholl publishes one more study. A year later, Affisco & Soliman as well as Mahapatra & Perumal publish their work on strategic frameworks and the literature continues until Flak et al investigate the insights from 48 Norwegian Government Funded Projects in 2007.

*Table 4.2: Strategic E-government Frameworks literature*

| Author | Year | Research |
|---|---|---|
| UK Central IT Unit | 2000 | e-Government, a strategic framework for public services in the information age. |
| Ebrahim & Irani | 2004 | A Strategic Framework for E-government Adoption in Public Sector Organisations. |
| Lambert et al | 2004 | A Framework for Experience Management in e-Government: The Pellucid Project. |
| Mittal et al | 2004 | A framework for e-Governance solutions. |
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| Flak et al | 2007 | An Exploratory Approach for Benefits Management in e-Government: Insights from 48 Norwegian Government Funded Projects. |

e-Government initiatives within this domain deal particularly with improving the internal workings of the public sector by cutting process costs, managing process performance, making strategic connections in government as well as transferring power, authority and resources for processes from their existing locus to new locations (Heeks, 2008).

The UK Central IT Unit (2000) framework tries to achieve a segmentation of the public e-services market, which assists in focusing efforts on citizens, or alternatively aiming products at subtly different demand characteristics. According to their study, major issues obstructing the development of e-government at present include:

- How to address security and privacy concerns
- Determining which services to integrate
- Deciding whether to outsource the service delivery either entirely or through public-private partnerships

It is received wisdom that e-government services are targeted at one of four broad constituencies:

- Businesses
- Citizens
- Other governments
- Employees.

It is more than obvious that e-services in the public sector generally apply to all four constituencies, but at least citizen and subject services. The most common examples of e-government services are:

- Exchange of information and payment to obtain some permission
- To register for a service
- To claim a benefit giving and receiving of money or information
- Regulation and procurement.

Last but not least, these four constituents must be able to access the service. If the infrastructure for the delivery of these services is not available, constituents will not be able to access the services.

Although different researchers propose different solutions for strategic frameworks and e-government implementation, most of them share three fundamental statements (Ebrahim & Irani 2005; Tambouris & Wimmer 2004; Traunmuller & Wimmer 2004):

- Involvement of citizens in the development process
- Proposal of a holistic approach
- A focus on work-processes

As a first step in the holistic approach it is recommended that governments should group the citizens according to their life situation (Tambouris & Wimmer 2004; Traunmuller & Wimmer 2004). The transformation phase encompasses redefining the delivery of government services by providing a single point of contact to citizens' that makes the government completely transparent to citizens and businesses (Affisco & Soliman, 2006). Also, significant social, organisational and technical challenges will need to be understood well and overcome in those efforts that strive to achieve governmental transformation (Affisco & Soliman, 2006).

Organizational mobility is increasingly commonplace in public organizations, and presents both opportunities and challenges: opportunities for improving working practices through the introduction of new perspectives, and challenges arising from the constant loss of experience and the steep learning curve experienced by the newly arrived staff. Experience management is a special kind of knowledge management, focusing on the dissemination of specific knowledge situated in a particular problem-solving context (Bergmann, 2002). The experience management model of Lambert et al (2004) exploits these experience-sharing concepts. The main benefit expected from the Pellucid project (Lambert et al., 2004) is the improvement of efficiency and effectiveness due to the reduction of time spent, and leveraging of experience due to the movement of staff among different roles. The main purpose of this project was to enhance employees' performance by giving them access to the required knowledge by the activity they are performing at the time they are actually performing this specific activity.

The cost of e-government implementation has always been a significant barrier and that is the reason why solutions which promise to lower the cost of developing; deploying and managing e-government projects really deserve researchers' focus. Mittal et al. (2004) study a framework that simplifies the procedures of developing, deploying, as well as managing complex, integrated, and standards-compliant e-government solutions. Their framework enables development, configuration, integration, and management of solutions at a higher semantic level. Furthermore, it provides commonly used services. Some of these services are:

- Access to citizen and property records
- Access control and authentication services
- Public key infrastructure
- Support for digital signatures.

In this framework, the solution components as well as data models, are described at a higher semantic level and they are constructed with customisation points that can be programmed through a policy administration interface, that is fairly intuitive and intended for solution managers who may not be well versed in application development. The ability to manage solutions at a higher semantic level enables participants who are not familiar with programming to customise solutions in order to address specific needs of the different national, state, and local governments. This also embraces the ability to build custom user interfaces for multiple local languages used in governmental transactions as well as to customise workflows in order to comply with the organisational structure and policies to manage access to and retention of government records.

A phase model and a framework of strategic choice that constitutes an addition to the academic knowledge in the field of organizational development and transformation induced by mobile technology diffusion is being discussed by Scholl (2005). With his work, Scholl contributes to the understanding of mobile technology diffusion in government by identifying and assessing the influential forces and the direction in this process. Scholl's study presents a parsimonious phase model of the diffusion process, identifies the various classes of fully mobile wirelessly connected applications and uses, discusses specific challenges in the implementation process, presents a

framework of alternative strategic approaches to fully mobile wirelessly connected diffusion, and maps the fully mobile wirelessly connected application classes to the strategic approaches as well as to the diffusion stages. By doing so, it develops an understanding of phase-related strategic choices and presents testable propositions regarding the assumed distribution of approaches over the phases. Finally, it proposes a business-information and user-need-oriented principle to guide the various strategic approaches under consideration, which may also be of utility to practitioners in the field.

While in some cases the implementations are praiseworthy, they are effort-centered rather than being result-centric. Mahapatra and Perumal (2004) provide a strategic framework for the implementation of e-governance projects in Indian context, to achieve a result-centric implementation. By presenting and analyzing the components of good e-government:

- Stakeholder Analysis
- Organizational Structure
- Project Management
- Process Streamlining
- Technological Feasibility and Up-gradation

Mahapatra and Perumal present a workable strategic framework to provide a roadmap for the projects to be sustainable in long-term. Their study concentrates on stake-holders, environment, technology enablers, internal processes as well as delivery mechanisms along with the factors that should be taken care of for scaling-up of the e-government projects and making it self sustainable.

Since, there is no e-government textbook and no e-government theory, knowledge derives from practice and excellence follows best practices (CDT, 2002). E-services in the public sector address the digital divide for citizens and businesses through multiple access channels and have been successful in creating a government without walls, doors and civil servant work shifts. With these in mind, Flak et al. (2007) described and summarized a Norwegian approach to benefits management particularly targeting e-Government efforts. Forty-eight government-funded projects have implemented the approach and insights from these projects are used to provide

empirical insights on the usefulness of the process. With their work, Flak et al. (2007) present rich insights from a large number of projects employing a benefits management approach and thus responds to the lack of empirical studies on benefits management in the e-Government domain. The results provide extensive insights in terms of hindrances for benefits realization, examples of qualitative benefits as well as some indications of quantitative benefits.

## 4.4 INTEROPERABILITY FRAMEWORKS

Most governments around the globe released their e-government strategies during the last decade. Their own framework policies, covering security, and confidentiality as well as delivery channels supported these e-government strategies. The European Union has set up different initiatives in the area of e-government within the limits of its powers in the domain of Public Administration (Alabau, 2004). One of such policies was the interoperability policy (CEC, 2002; OECD, 2003).

Interoperability is "*the ability to exchange information and mutually to use the information which has been exchanged*" (CEC, 1991). An interoperability framework aims at referencing the basic technical specifications that all agencies relevant to the e-government strategy implementation should adopt. This interoperability framework should enable, at least, the interoperability between IS from different agencies in order to provide services to citizens and businesses in an integrated way.

A Government Interoperability Framework (GIF) is one way to achieve e-Government interoperability. A GIF is a set of standards and guidelines that a government uses to specify the preferred way that its agencies, citizens and partners interact with each other. As noted by Guijarro (2007), a GIF includes: *"the basic technical specifications that all agencies relevant to the e-Government strategy implementation should adopt.*" A GIF normally includes:

- Context
- Implementation and compliance regimes
- Technical content

- Process documentation.

Principles indicate the priorities of government in terms of ICT development. These principles guide the development of the GIF and become the criteria for choosing standards. Many of the GIFs recognized seven similar key principles as described below:

- Interoperability
- Market support
- Security
- Scalability
- Reusability
- Openness
- Privacy

According to Guijarro (2009) interoperability frameworks in Europe have shown up "*as a key tool for interoperability in the deployment of e-Government services*", both at national as well as European level. They are initially focused on technical interoperability, but recently inclusion of semantic in the interoperability frameworks started.

The main issue of an interoperability framework is the integration of a wide variety of legacy software applications. This has always created a costly and time-consuming IT challenge and has led the Business Integration to focus on the concepts of Service Oriented Architecture (SOA) (Channabasavaiah et al., 2004) as wells as Event Driven Architecture (Sadtler et al., 2004). These two models enable process level integration allowing the automatic communication among sub-components of heterogeneous systems, rather than a simple data transfer between different systems.

Governments are adopting solutions based on SOAs to solve their business integration problems according to e-government plans, new technologies and market developments. Governments Agencies that want to operate in real time and realize the zero-latency must adopt event-driven architecture, message-oriented middleware and publish-subscribe communication (Baldoni et al., 2003). Embracing Event-driven

architecture is in fact essential to synchronize data without batch processing and redundant manual entry.

Event-driven and Service-oriented architectures are compatible but distinct concepts, each with its own advantages and limitations. One of the critical issues arising now is finding more efficient and effective ways of designing, developing and deploying Web services (WSAT, 2001) based systems; more importantly, moving beyond the basic point-to-point Web services communications to broader application of these technologies to enterprise-level processes. The challenge is to extend the Web services and SOA vision with the emerging Enterprise Service Bus model that provides a standards-based integration layer using the Even-driven architecture. messages are made available and delivered to all the subscribers in a timely manner.

Nowadays, building an e-Government Interoperability Framework must oppose the tendency to "*reinvent the wheel*" and requires examination and extended review of related research and standardization efforts (Guijarro, 2007) in the UK, Germany, Greece and other EU countries.

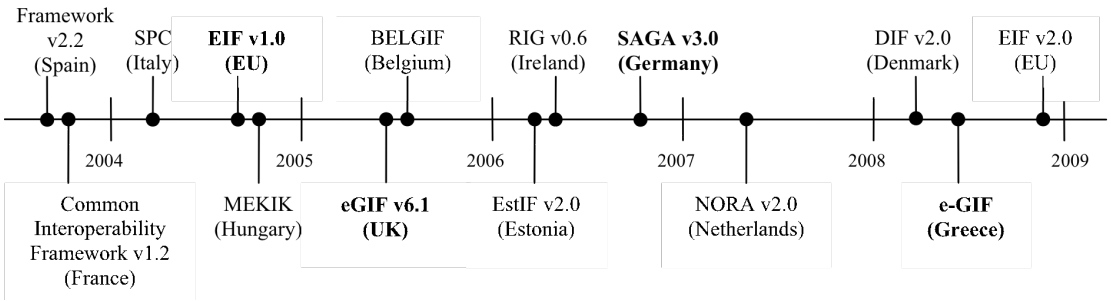


*Figure 1: e-GIFs in European Union (Gatautis, 2009)*

*Table 4.3: Interoperability Frameworks adapted from Guijarro (2007)*

| Framework | Agency | Country | Year |
|---|---|---|---|
| e-GIF | eGU | UK | 2005 |
| CCI | ADAE | France | 2003 |
| SAGA | KDSt | Germany | 2003 |
| DIF | ITST | Denmark | 2005 |
| IDABC AG | IDABC | EU | 2004 |
| EAG | CIOC | USA | 2002 |
| Greek e-GIF | COI | Greece | 2008 |
| EIF | MEAC | Esthonia | 2006 |

This section enumerates and discusses eight major initiatives being carried out by e-government agencies in the interoperability arena, which have produced the corresponding interoperability frameworks. The frameworks that are discussed in the following sections are: the British e-Government Interoperability Framework, The French ADAE, the German Standards and Architectures for e-government Applications, the Danish e-Government Interoperability Framework, the Federal Enterprise Architecture Framework, the Esthonian Interoperability Framework and last but not least, the Greek e-Government Interoperability Framework. The study has been based on the analysis of the publicly available documents. An important difference of these various frameworks relate to enforcement. The e-GIF reflects a higher level of enforcement than CCI, SAGA, and DIF. e-GIF is mandatory, whereas CCI, SAGA and DIF are recommendations and guidelines (Guijarro, 2007).

### 4.4.1 e-GIF: The British Interoperability Framework

The heart of British strategy for ensuring IT supports the business transformation of government is the e-GIF (e-Government Interoperability Framework). This transformation is about delivering better and more efficient public services. The e-Government Unit (eGU) contributes to this through the e-GIF and also by supporting joined-up service delivery, sharing best practice and putting the citizen at the centre of government's work.

The e-GIF was first published in 2001 and has gone from strength to strength. There are now facilities to help public and private sector organizations ensure that their systems are e-GIF compliant, and that people have the necessary knowledge and skills to enable systems to work together. The British e-GIF specification has been led by:

- Interoperability
- Scalability
- Openness
- Market support
- International standards

The value of interoperable systems, and the benefits of the standards-based approach exemplified in the e-GIF, is becoming widely recognized by the private sector. This has led to calls to adopt the policy, or a similar tool, to further increase efficiency and enable new and exciting services to be developed across different sectors.

The eGU in the United Kingdom has based its technical guidance on the e-GIF, which was issued in 2000. E-GIF mandates specifications and policies for any cross-agency collaboration and for e-government service delivery. It covers four areas (eGU, 2005):

- Interconnectivity
- Content management
- Data integration
- E-services access

In the eGIF, the Technical Standards Catalogue was initially regarded as a part of High Level Architecture, together with other high-level models. Both the catalogue and the models served as a reference in the requirements, design and implementation of e-government services. The role was played with the help of reusable elements such as patterns, components and resources (eEnvoy, 2001). The set of high-level models that comprised the High Level Architecture can be regarded as part of an e-government enterprise architecture. Within the eGIF, two initiatives are relevant for content management metadata:

- eGov Metadata Standards (eGMS), which lays down the elements, refinements and encoding schemes to be used by government officers when creating metadata for their information resources or when designing search systems for ISs (eGU, 2005).
- Integrated Public Sector Vocabulary (IPSV) structured thesaurus of administrative activities both at central and local governments. IPSV was setup initially for use within the eGMS and it enhances the Government Category List (GCL) (FEAPMO, 2005).

IPSV is a truly semantic initiative, whereas eGMS deals mainly with syntactic issues. The e-GIF contains a Technical Standard Catalogue, which is revised and updated every six months.

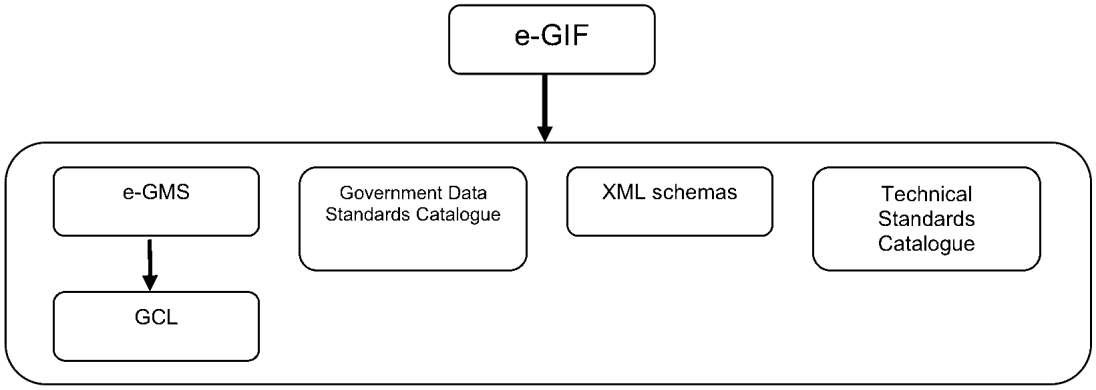


*Figure 2: e-GIF architecture*

The e-GIF is parted by:

- The Framework itself that covers policy statements of high-level, technical policies and management as well as implementation and compliance regimes
- The Registry that covers the e-GMS and GCL, the Government Data Standards Catalogue, Extensible Markup Language (XML) schemas and the Technical Standards Catalogue.

### 4.4.2 The French ADAE

E-government is now seen as the only way of building a government working to serve citizens, businesses and associations. The services prepared in this context must bring together the State, regional authorities and public bodies in the health and welfare sector to enable users of government services, or the intermediaries assisting them to claim their rights more quickly and more simply and receive personalized information from the administration through the medium of their choice, and must improve administrative problem-solving in conditions of proven security.

Although France is well known for the high quality of its public websites, its e-government services are quite average in comparison with those of its European and international neighbours. Recent technological advances, the appropriation by the civil service and political decision-makers of ICT tools, the expectations by users of government services of a real simplification of administrative formalities, and the budget restrictions hampering government departments add up to an outstanding opportunity to engage in a massive job of building up e-government. The major aim

of the national e-government programme is to decide on the gradual setting up of the provision of the services citizens, the professions and civil servants are entitled to expect, supported by an e-government developed coherently and with coordination. The French Government has therefore decided to implement a 4-year e-government strategic plan (PSAE) covering the period from 2004 to 2007. This strategic plan is the framework within which the work of the different administrative departments must be done with regard to e-government. It defines the quality and quantity objectives to be met, as well as the resources allocated for this purpose. Finally, the year 2007 was used to prepare for the 2008-2012 five-year period.

The French attempt has been under the "*Agence pour le Développement de l'Administration Électronique*" (ADAE), which published "*Le Cadre Commun d'Intéroperabilité*" (CCI) in 2002. It comprises the recommendations for strengthening public electronic systems coherence and for enabling multi-agency electronic service delivery (ADAE, 2003). ADAE has been very active in the development of reusable information resources. This term designates any reference schema, core component, category, or semantic asset. ADAE has set up the Antalia project, which aims to provide services to central and local governments as well as businesses and citizens in order to search for and find reusable reference resources. The user would be able to find on Antalia nomenclatures, guides, data models, and XML schemas.

Outstanding developments have certainly taken place in some sectors, but online services are far from being the norm in France that they are or soon will be in neighbouring countries, and the fact that these initiatives have not been coordinated means that existing administrative complexity is simply replicated, with the multiplication of unnecessary expenditure. Several structures have been set up at ministerial or inter-ministerial level to handle matters relating to e-government, but there has been no overall coordination.

The government therefore intends to enable citizens and professionals to have tools and services, which will enable them to exercise their rights more simply and completely.

- Decentralised storage of data

- Identification in interdepartmental relations
- Online user identification
- The personal space: control by the user of the transmission of his or her data in administrative online procedures
- Better exercise of the right of access by public and professionals to the data gathered by the administration.

The Government has decided to continue discussions in order to draw up the outlines of this new form of user/administration relationship, and in particular:

1. To define the legal environment which will make it possible to set up a "*pact of trust*" in e-government while respecting our basic principles of public freedoms and monitoring the transparency and rationalisation of exchanges

2. To stipulate the legal guarantees linked with the use of trusted third parties, in particular when setting up personal spaces

3. To confirm the relevance of the identity federation solutions under consideration.

The strategic plan and the accompanying action plan reflect great ambitions. The protagonists of e-government, strongly attached to the durability of public service French-style, have done their utmost to achieve all these ambitions. However, they must ensure the appropriation of users and technological developments, which are sometimes unforeseeable and must therefore be able to overhaul the initial projects they had decided on. One important aspect is to give visibility to all those involved, in the short, medium and long term. This is how France makes its voice heard more clearly in Europe.

### 4.4.3 German Standards and Architectures for e-government Applications

There are other European and German projects in the field of e-government. The "*Document Management and Electronic Archiving in Electronic Courses of Business*" (DOMEA) concept (KBsT, 2005a) is the basis of the German Government for meeting the objective of a paperless office. Particularly, DOMEA introduces the

concepts and criteria that should lead to paperless offices in the administrations. The three-pieced modular structure of DOMEA consists of documents, records and files. In contrast to our solution the issues of hierarchical process execution and security in the distributed process execution is not addressed. Germany's Federal Government Co-ordination and Advisory Agency for IT in the Federal Administration (KBSt), published the SAGA framework (Standards and Architectures for e-Government Applications) in 2003. SAGA is guideline that serves as an orientation aid for decision-makers in the e-government teams in German administrations (KBSt, 2003).

Within the SAGA defined by the German Federal Ministry of the Interior, regulations on standards, procedures, methods and also products for the modern IT-evolution are provided (KBsT, 2005b). Standards are divided into different categories (mandatory, recommended, under observation and rejected). SAGA also proposes applications like the "*Government Site Builder*". This application is a Content Management System (CMS) whose Document Management component offers versioning on change; write-locks and the possibility to use meta-data for documents. However, the "*Government Site Builder*" was not designed for the work with cross-authority process execution.

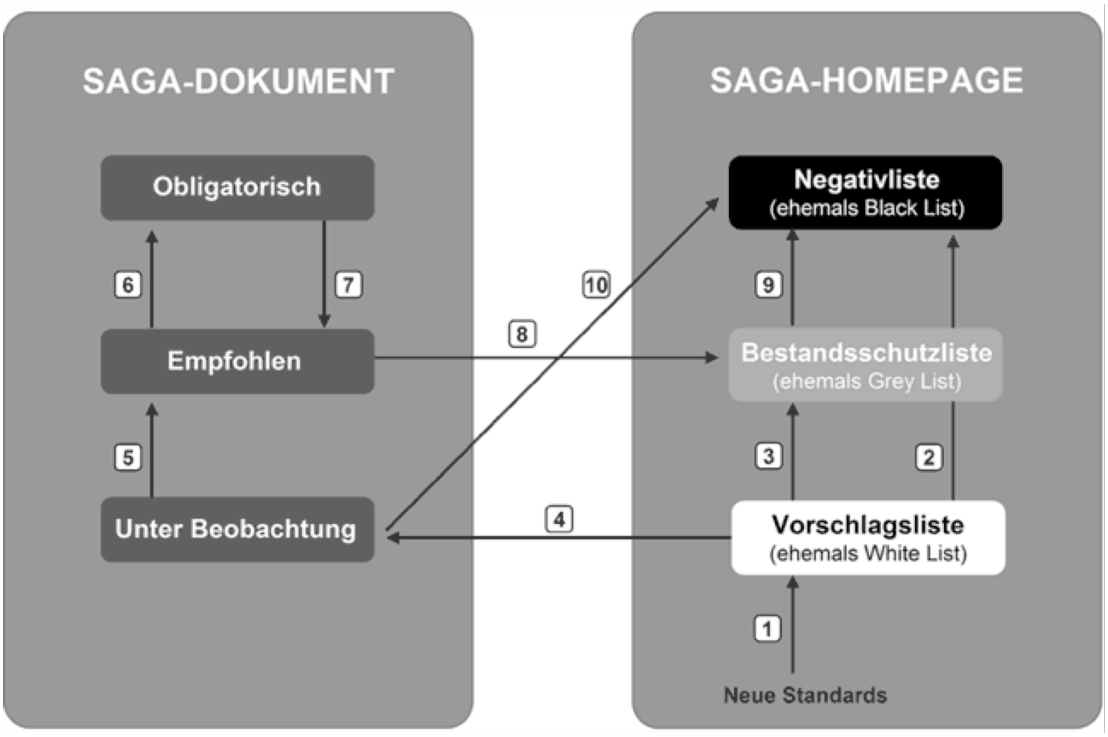


*Figure 3: SAGA architecture*

In SAGA, moving from task-oriented to process-oriented administration appears today as the key challenge to overcome. Regarding the current version of the SAGA, the Reference Model of Open Distributed Processing (RM-ODP) is not well used since standards are not appropriately associated to viewpoints and there are many aspects not yet established. Finally, SAGA partially has too much "*German / Bund Flavor*" and there is not sufficient internationalization at European Union level (Charalabidis et al., 2007). Further lessons learnt from the experience with SAGA suggest that:

- Standards and technologies to be followed should be proposed in an eGIF, yet a determination on certain technologies is not necessary for achieving interoperability and should not be integrated in eGIFs since variety guarantees continuous innovation and competition and prevents market foreclosure
- A bottom-up approach needs to be adopted covering equally all the viewpoints of the RM-ODP: technology, information, and enterprise, computational and engineering. Creating patterns of standard processes and data models for similar services must be pursued
- The continuous revisions of the eGIF must be balanced between adding the latest developments and experiences and its being characterized as too complex and overregulated.

### 4.4.4 Danish e-Government Interoperability Framework

In order to achieve the goals for e-Government, such as efficiency, improving levels of services and cost-cutting, Public Servants must use IT in an optimal way. This is not achieved through local initiatives spread across the public sector and a national set of guidelines as well as strategic initiatives are needed. The Interoperability Framework is one initiative toward harmonizing the use of technologies throughout the Danish administration. The Danish e-Government Interoperability Framework was initially intended to become a guideline for public agencies in their attempt to develop IT plans as well as projects.

Danish Government compiled the Danish e-Government Interoperability Framework (DIF) in 2004 collaborating with a committee whose aim is the facilitation as well as coordination of IT related initiatives (DIF, 2004). The actual work on this interoperability framework has been governed by the IT Architecture Committee.

DIF has been compiled in accordance with the European Interoperability Framework (EIF) and offers a set of guidelines, technical standards as well as policies, which outlines the government's policy on how to achieve interoperability. The framework is targeted at any authority that request to interoperate with other national authorities or abroad with the EU and its member countries. The rationale behind the focus on interoperability is that a contribution towards better interoperability can reach a number of objectives:

- Efficiency
- Usefulness
- Transparency
- Provide assistance in local decisions relating to IT
- Make it easier to ensure coherency and optimization locally

These objectives can be reached by making use of the possibilities provided by e-Government initiatives. An optimal progress can only be achieved by using common standards throughout the public sector. It is the objective of the DIF to contribute to this task of standardization. In the e-Government project and thus in the framework, the term "*standard*" is used in a broader sense meaning a set of recommendations which might originate from a "*de jure*" standard, a "*de facto*" standard or from a standard especially designed for a given purpose.

Across the Danish Government a collaboration to achieve consensus on standards, specifications and technologies has been established. The aim is to agree upon which standards to use throughout the public sector. As mentioned earlier, the committee representing government, regions and local governments of Denmark is a central player in this collaboration. The IT Architecture Committee and the XML Committee acknowledge their views on standards, specifications and technologies in the DIF. Those standards are core elements relevant across the government and domain

elements relevant within a specific domain only. The following assumptions outline the recommendations by the interoperability framework:

- Use open standards
- Incorporate existing standards in a broader context
- Stimulate the re-use of already established standards
- Re-design administrative processes in order to make the best use of offered technology.
- Coordinate and manage the initiative.

The scope of an interoperability framework is usually the jurisdiction for which it was introduced. But as citizens and businesses increasingly demands to procure services from beyond their jurisdiction's borders, administrations must be ready to cater for those demands. The national interoperability frameworks then need to address issues that do not necessarily play a role at the national level. This means that if the scope of a national interoperability framework is beyond the country's borders, attention must be paid to surmount the transnational obstacles.

The DIF addresses various aspects of standards, specifications and technologies to support the task of implementing e-Government and for this purpose the document has been divided into these categories:

- User Interfaces
- Document and Data Interchange
- Web-based Services
- Content Management and Metadata Definition
- Data Integration
- Identity Management
- Interconnectivity
- Operations
- Business area specific standards

The framework provides an overview of the IT standards set by the national public administration. Three top-level categories are used:

- Technical standards
- Data standards
- Process standards.

The technical standards have so far been the mainstay of the framework. The process standards describe common approaches and guidelines for processes, and are a relatively new area in the work on e-government standardisation.

As a step in the consolidation and dissemination of the framework, it has been decided to clearly state how the content of the website can be used. The Danish interoperability framework is known as a "*best practice*" for such frameworks and is subject to increasing attention from countries, which have no such framework. The IT Architecture Committee has therefore decided to make the framework available through a Creative Commons license, hereby making the content available and open for all to reuse while also pointing out that the IT Architecture Committee holds the intellectual property rights to the framework.

### 4.4.5 European Interoperability Framework

The EU equivalent of a national framework for interoperability is the European Interoperability Framework (EIF). Within the European Commission, the Directorate-General Enterprise & Industry published the IDABC Programme (Interoperable Delivery of European e-Government Services to public Administrations, Business and Citizens) in 1999 (IDABC, 2004). It takes advantage of the opportunities offered by ICTs to:

- Support and encourage the delivery of cross-border public sector services to citizens and enterprises in Europe
- Improve efficiency as well as collaboration between European public administrations
- Contribute in making EU an attractive place to live, work and invest.

IDABC is a Community Programme managed by the European Commission's Directorate General for Informatics. IDABC supports the implementation of EU legislation, from internal market regulations to consumer and health policies, by

facilitating the exchange of information between public administrations across Europe through the use of information technology. In 1994, a Council Resolution underlined the need for enhanced synergies between European and national ISs. In response, the IDA Programme was established with a Community Decision in 1995. The Programme's primary objective was to set up IT empowered networks for information exchanges in the different community policy areas. In this way, the IDA Programme pioneered the use of IT in public administrations and facilitated the transition from paper-based to electronic exchanges across Europe.

Moreover, IDABC provides financial support to projects addressing European policy requirements, thus improving cooperation between administrations across Europe. National public sector policy-makers are represented in the IDABC programme's management committee and in many expert groups. This makes of the programme a unique forum for the coordination of national e-Government policies.

By using state-of-the-art ICTs, developing common solutions and services and by finally, providing a platform for the exchange of good practice between public administrations, IDABC contributes to the i2010 initiative of modernising the European public sector. IDABC is a Community programme managed by the European Commission's Directorate-General for Informatics.

This provided concepts and reference for optimum interoperability between European Institutions, European Agencies, and governments in Member States. The IDABC provides a common framework for discussions about interoperability, pinpointing which interoperability issues should be addressed when implementing pan-European e-government services. It, however, avoids prescribing any concrete architecture or standard catalogue. The EU's EIF and the supporting IDABC Architecture Guidelines (2004) are intended to address the interoperability of pan-European e-Government services (PEGS). Its scope includes A2A, A2C, and A2B (where "*A*" stands for "*Administration*", "*C*" for "*Citizens*" and "*B*" for "*Business*"). The EIF identifies three types of PEGS interactions:

- Direct interaction between citizens or enterprises of one Member State with administrations of other Member States and/or institutions

- The exchange of data between administrations of different Member States in order to resolve cases that citizens or enterprises may raise with the administration of their own country

- The exchange of data between various EU institutions or agencies, or between an EU institution or agency and one or more administrations of Member States.

The EIF's recommendations are quite high level, whereas the related IDABC Architecture Guidelines (2004) are very low level, thereby leaving a large gap between these two sets of specifications. The impact of the EIF so far appears to have been rather modest, in part, because PEGS have not yet appeared in significant numbers. Nevertheless, the EIF is referenced frequently in national interoperability frameworks, most of which at least claim the intention of complying with it (Charalabidis et al., 2007; Malotaux, et al., 2007; Rothenberg et al., 2008).

Companies under contract carry many of IDABC's activities out. In order not to give unfair advantage to individual companies wishing to bid for the Programme's call for tenders, IDABC pursues a policy of transparency and non-discrimination. This means that IDABC does not engage in bilateral meetings with individual industry players. Instead, IT companies wishing to raise specific issues with IDABC are recommended to form interest groups with other industry actors or to invite IDABC to open events organised by them. IDABC also welcomes any written documentation that may guide its implementation activities.

IDABC currently funds 75 projects and actions from Member States, Candidate, and EFTA Countries. The average budget is around €25 million per year. IDABC provides financing for all phases leading up to the implementation of a project. However, the Programme does not cover operational costs. The IDABC unit prepares a yearly work programme on the basis of the proposals prepared by the different European Commission services wishing to participate in the Programme. The Work Programme is then submitted to the TAC Committee and subsequently adopted by the Commission. Direct participation to the IDABC programme is limited to the public administrations. IDABC is in fact a Commission-driven programme not comparable to programmes such as eTEN, eContent or IST. While the latter are cost-share

programmes allowing consortia to send in proposals for evaluation and possible funding, the Commission via public tendering exclusively does the realisation of the different projects and actions in IDABC.

### 4.4.6 Federal Enterprise Architecture Framework

E-Government initiatives require a flexible, comprehensive framework that supports designing, development of planning requirements, as well as building major systems. This is essential if the Federal Government is to:

1. Leverage IT investments and avoid duplication of infrastructure
2. link business processes through shared, yet sufficiently protected ISs
3. leverage disparate business processes, services and activities that are located outside Agency boundaries.

In the United States of America, the Federal Chief Information Officers Council (CIOC) issued the Federal Enterprise Architecture Framework (FEAF) in 1999 (CIOC, 1999). To leverage FEAF guidance in e-government implementation, the Federal CIOC endorsed the E-government Enterprise Architecture Guidance (CIOC EAG) in 2002, for guiding the e-government projects across the federal government (CIOC, 2002).

Development of the FEA commenced on 2002. The purpose of this effort is to identify opportunities to simplify processes and unify work across the Agencies and within the lines of business of the Federal Government. The outcome of this effort will be a more citizen-centered, customer-focused government that maximizes technology investments to better achieve mission outcomes. The FEA is a business-based framework for cross-Agency, Federal Government-wide improvement. It provides OMB and the Federal Agencies with a new way of describing, analyzing, and improving the Federal Government and its ability to serve the citizen. The purpose of this document is to augment FEAPMO guidance to e-government Initiative Teams and other web-based development efforts involving or affecting the Federal Government. It is a result and reflection of the ongoing interaction and cooperation between the Federal CIO Council and the FEAPMO.

This guidance provides a consistent, industry-aligned architecture for definition of and communication about the components commonly needed to deliver e-government solutions. This architecture will help avoid pitfalls such as:

- Duplicative efforts
- Failure to consider infrastructure requirements
- Implementing technologies that are not sufficiently flexible or scaleable to meet Federal e-government requirements.

This approach also increases the potential for meaningful collaboration by clearly identifying opportunities where shared elements of e-government solutions might occur. The common reference models contained herein are intended to extend from and support the high-level business architecture as defined by the FEA. Each view is intended to feature and describe the logical relationships of e-government capabilities, processing/access flows, technologies, and components. The intent is not to overly constrict the solutions, nor to proffer a solution that may be defined and implemented in only one manner. In fact, this document attempts to keep the potential solution sets broad and robust, capable of applying new and better technologies as they are conceived and delivered. That is why the explanations for these models stress that one or more components or parts may be logically combined or configured somewhat differently in actual solutions.

The Federal Enterprise Architecture (FEA) is a function-driven framework for describing the business operations of the Federal Government independent of the Agencies that perform them. The Federal Enterprise Application Framework (FEAF), provides various approaches, models, and definitions for communicating the overall organization and relationships of architecture components required for developing and maintaining the FEA.

This Guidance was developed in accordance with the basic principles and structure defined in the FEA and FEAF. It identifies a core set of e-government architectural concepts and pragmatic examples for e-government Initiatives across the Federal Government. The FEAF defined, and the Federal CIO Council adopted, principles that govern and represent the criteria against which all potential investment and

architectural decisions are weighed. The FEAF principles are summarized here in order to emphasize their applicability and importance to this e-government guidance:

- Standards
- Investments
- Data Collection
- Security
- Functionality
- Information Access
- Proven Technologies
- Privacy

The FEAF defined, and the Federal CIO Council adopted, a four layer, segmented structure for defining the Federal Enterprise Architecture. The following Figure (Fig. 4), shows the four layers of the FEAF and the corresponding models addressed in this guidance. The models in this guidance associated with the Business, Performance, Data, and Application Architectures are primarily conceptual descriptions to establish a baseline of effective e-government architectural concepts and a common vocabulary. The models and standards associated with the Technology Architecture present more pragmatic guidance and examples for e-government Initiatives.

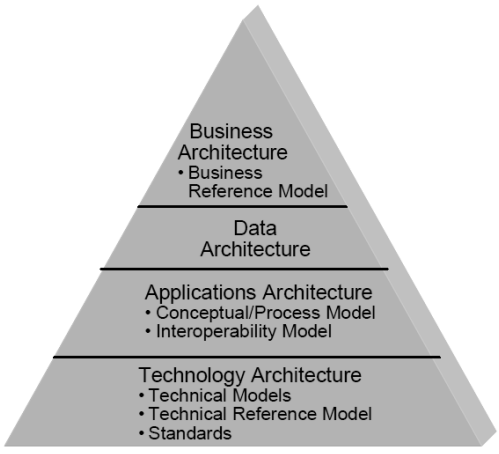


*Figure 4: Architectures and Models in guidance*

1. Business Architecture presents the evolving Federal Enterprise Architecture Business Reference Model that systematically identifies the business functions

of the Federal Government. This model is provided for context and the guidance does not attempt to define business architectures or e-government processes for specific functions or organizations.

2. Data Architecture development was not practical in the timeframe available for this initial guidance. Instead, the Data Architecture section provides initial guidance on areas such as the use of XML, which are key to e-government solutions.

3. Application Architecture defines the major application components common to e-government solutions, and includes two models:

   - The Conceptual Model provides the bridge between the business view of the Business Reference Model and the systems view of the remaining models
   - The Interoperability Model describes the common technical components of an e-government solution and how they interoperate within and across e-government solutions

4. Technology Architecture provides more pragmatic implementation guidance for e-government Initiatives in the form of:

   - Example Technical Models for major components of an e-government solution
   - E-government Technical Reference Model
   - Starter set of voluntary industry standards that should be understood and considered by e-government Initiatives.

The folllowing figure (Fig. 5) presents the way that FEA couples E-Gov architectures with the FEAF and government-wide reference models as the foundation for defining and implementing e-government cross-Agency solutions. The FEA includes a Performance Reference Model (PRM) that provides common outcome and output measures throughout the Federal Government.

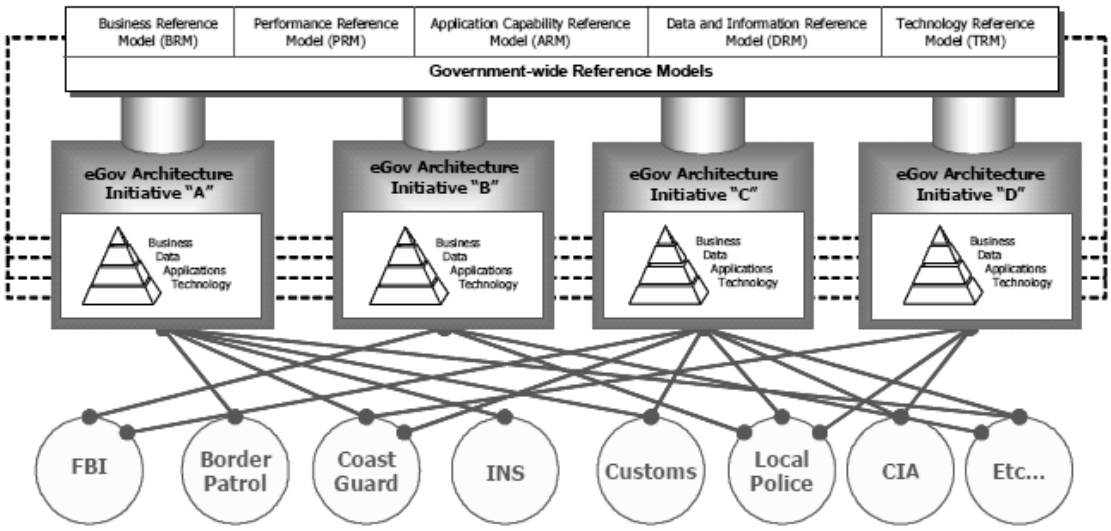


*Figure 5: Federal Enterprize Architecture*

The Interoperability Model describes the primary application components supporting the Conceptual/Process Model and how they interoperate within and across e-government solutions. This includes interoperability at the user, data, and application levels. The Interoperability Model reflects commonly found industry representations, embracing industry standards and best practices.

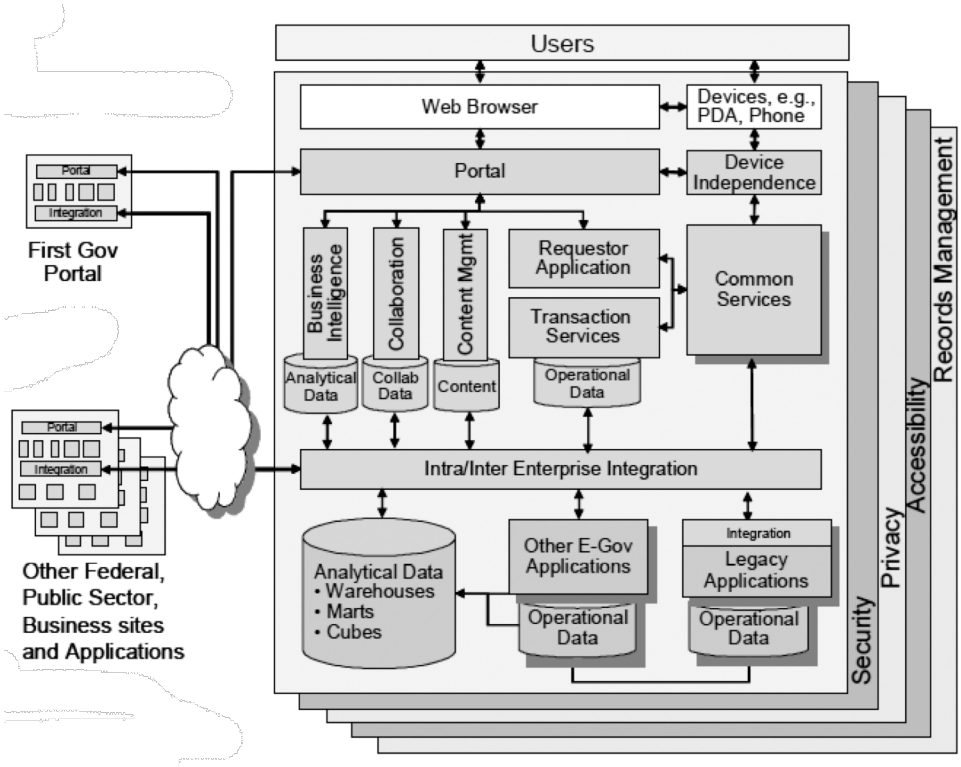


*Figure 6: Interoperability Model*

Many components of the e-government Interoperability Model will be required for all e-government Initiatives. However, the business requirements of each e-government Initiative will determine which components are most critical or central to that initiative. e-government Initiatives should identify the critical components for their business requirements and ensure that those components are robustly supported in their architecture. Figure 6 shows the e-government Interoperability Model.

### 4.4.7 eG-Cooperative Framework

Castellano et al. (2005) present an e-Government Framework that allows the cooperation among applications of different Government Agencies in order to supply new added value services tailored to citizens and business needs. Moreover it promotes an internal process reengineering realized by integrating legacy governmental applications. The framework is based on the Enterprise Service Bus (ESB) model and on the Web Services technology. Finally, their study describes the architecture of the prototypal framework and a case study of a single desk for businesses. They describe an open standard framework following the Italian National Center for Information Technology in the Public Administration (CNIPA) standards and complies with the relevant developments around EU as well as the rest of the world. The framework improves G2C interactions by supplying a single access point, built around the life events of citizens.

As main result the framework is able to supply to citizens and businesses, services built around the events of their life as a process composed by activities executed by more eG-Domains. To achieve this goal the framework is based on two ESB. The first is the backbone for inter-GAs cooperation while the second realizes intra-GAs service integration. Moreover, by adopting open and widespread standards, the proposed Framework serves as a basis for reducing the costs and risks associated with carrying out major IT projects and aligns government with the rest of industry.

The eG-Domain represents all the computing resources, networks, applications and data that belong to a specific Government Agency. The communication in this network is managed by the eG-Bus. Each eG-Domain is connected to the eG-Bus through the eG-Gate. The eG-Bus provides a common, standard-based infrastructure

for application connectivity and process orchestration (Von Huizen, 2003) among different eG-Nodes. It is the middleware that:

- Transforms message formats between consumer and provider
- Routes requests to correct service provider
- Converts transport protocol between consumer and provider
- Ensure a secure communication

The eG-Domain main interactions are requiring/providing a service and communicating/processing an event in order to supply "*events of life*" services as a process composed by activities executed by one or more intra and extra Domain services.

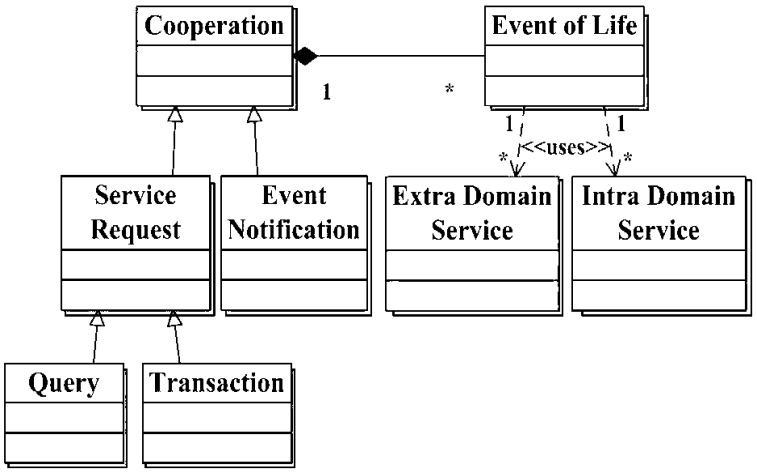


*Figure 7: eG-Domain main interactions*

To realize the integration among GAs different resources the eG-Domain architecture is based on the ESB model. As shown in Figure 8, the main components in this architecture are:

- ***eG-DomainBus:*** it is the middleware able to establish the communication among the different services present in the GA.
- ***eG-Gate:*** it realizes the connection between the eG-Domain and the eG-Bus.
- ***eG-Services:*** they are services present in the GA provided by databases, legacy applications, portals and workflow engines. Each eG-Service is mapped into a Web Service.

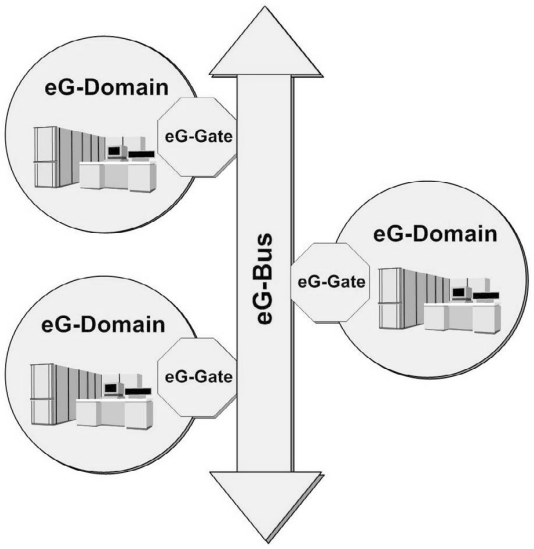


*Figure 8: eG-Cooperative Framework*

### 4.4.8 Hellenic e-Government Interoperability Framework

The Hellenic gambit on an e-Government Interoperability Framework (Greek e-GIF, 2008) places among the overall design of the Public Administration for the provision of e-Government services to public bodies, businesses and citizens. It has been the cornerstone of national Digital Strategy for the transition and adjustment of the requirements of modern times and is directly related to the objectives and direction of European policy. The Greek e-GIF aims to support effectively at Central, Regional as well as Local level and contribute to the achievement of interoperability at the level of IS, procedures as well as data. The Framework is consisted by the following:

- The Certification Framework for Public Administration web sites
- The Interoperability Framework between IS and e-Government transaction services of public administration
- The Digital Authentication Framework
- The Documentation Model.

Four Project Units part the e-GIF:

- Developing of Framework for e-Government Services
- Design Data Standards and XML Schema
- Development of Educational Materials and organization of Seminars

- Coordination of bodies and Specialized Services.

This project has been designed in order to study the Service Framework and the development of interoperability standards. The e-government agencies policies in interoperability have been scrutinized in order to identify common treats in the creation and maintenance of their interoperability frameworks. Interoperability frameworks have shown up as a key tool for interoperability in the deployment of e-government services. Although they initially focused on technical interoperability, inclusion of semantics in the interoperability frameworks started recently. The inclusion is still at early stages: the interoperability frameworks are mainly dealing with syntax issues, but increasingly tackling specific issues in semantics, namely ontologies.

The new Hellenic e-Government Service Provision and Interoperability Framework introduces a new system that will interact with e-Government portals and back-office applications, guiding their evolution and ensuring interoperability by design, rework or change. The implementation addresses a number of key issues, such as (Chalabidis et al., 2007):

- Development of unified governmental data models
- Specification of truly interoperable, one-stop governmental services
- Definition of standards and rules
- Adoption of protection, security and authentication mechanisms and arrangement of the corresponding legal issues
- Change management procedures and customization techniques for applying the findings to the specific public administration needs and demands.

The initial application of the Greek eGIF, as well as the evolutions of the German and UK eGIF's are indicating that new perspectives should be taken into consideration from now on, analysed as following (Vitkauskaite & Gatautis, 2008):

- Importance and adequate effort should be put in defining standard electronic services for businesses and citizens, thus providing clear examples to administrations and service portal developers

- The paper-based specification should give way to system-based presentation of the framework, incorporating service descriptions, data definitions, certification schemes and application metrics in a common repository
- Organisational interoperability issues should be supported by a more concrete methodology of how to transform traditional services to electronic flows
- The collaboration among European e-Government Interoperability Frameworks is particularly beneficial for the ongoing frameworks, since it ensures that lessons from the pioneers' experience are learnt and that the same mistakes will not be repeated.

In the near future the Hellenic gambit will conduct research on the distinct frameworks complementing its first release, publication of XML Schemas based on Core Components methodology, initial training of key staff within administrations and extension of the system in order to encourage stakeholders to engage themselves and build synergies across the public sector in a truly interdisciplinary way (Sourouni et al., 2008).

### 4.4.9 The Estonian IT interoperability framework

One of the main objectives of the Estonian ICT policy is to make state IS citizen-oriented as well as service-based. IS need to be integrated into a single logical whole serving the population and different organisations. To this end, it is necessary to set clear rules and agreements, and to use common middleware.

The Estonian IT interoperability framework (EIF, 2006) is a set of standards and guidelines aimed at ensuring the integration of IS in a single logical whole, so as to provide services for public administration institutions, enterprises and citizens both in the national and the European context. It gives a systematic overview of the positive trends in the development of the Estonian state IS. The cornerstones of the state IT architecture are the following:

- Technical interoperability

- Security
- Openness
- Flexibility
- Scalability

Although the functioning of state IS is targeted at achieving the same rationality as the private sector, sharp differences between the state and the private sector remain. It is not the state's aim to provide services under a certain cost, but to ensure their expediency. It is presumed that in the nearest future, IS will enable to perform several operations from one and the same place. The efficiency of public sector ISs cannot be measured by same indicators as that of the private sector. In terms of integrated service provision, public sector ISs have to serve as pathfinders for private sector ISs. Participation through public procurement in the development of state ISs and satisfying the needs of the state as a whole poses a considerable challenge for the Estonian IT sector.

The Estonian IT interoperability framework serves as:

- A guidance for those elaborating concepts for country-wide ISs
- A guidance for IT project managers in the public administration for elaborating concepts for the ISs of their institutions
- An aid in the organisation of public procurements.

The aim of the IT interoperability framework is to increase public sector efficiency in Estonia by improving the quality of services provided to citizens and enterprises both at the Estonian and the EU level. The specific objectives of the framework are the following:

- To facilitate and, consequently, implement the transformation of institution-based public administration into a service-centred one, where all citizens can communicate with the state without knowing anything about its hierarchical structure and division of roles
- To reduce public sector IT expenses through a wide use of centrally developed solutions

- To improve the interoperability of new IT projects through a co-ordinated use of centrally developed infrastructure, middleware and open standards
- To improve the co-ordination and management of state ISs and to accelerate the development of IT solutions
- To contribute to the co-development of the state IS
- To allow autonomous development for all systems within the principles of organisational, semantic and technical interoperability
- To ensure free competition in the area of public procurement.

The logical components of the state IS are the following:

- ISs
- The administration system for the state ISs together with its services catalogue
- The state-administered citizen IT environment
- Support systems and rules.

The framework has been elaborated by IT experts representing the central and the local government agencies as well as organisations from the third and the private sector. The work of the expert group was led by the Department of State IS of the Ministry of Economic Affairs and Communications (MEAC) together with private sector specialists.

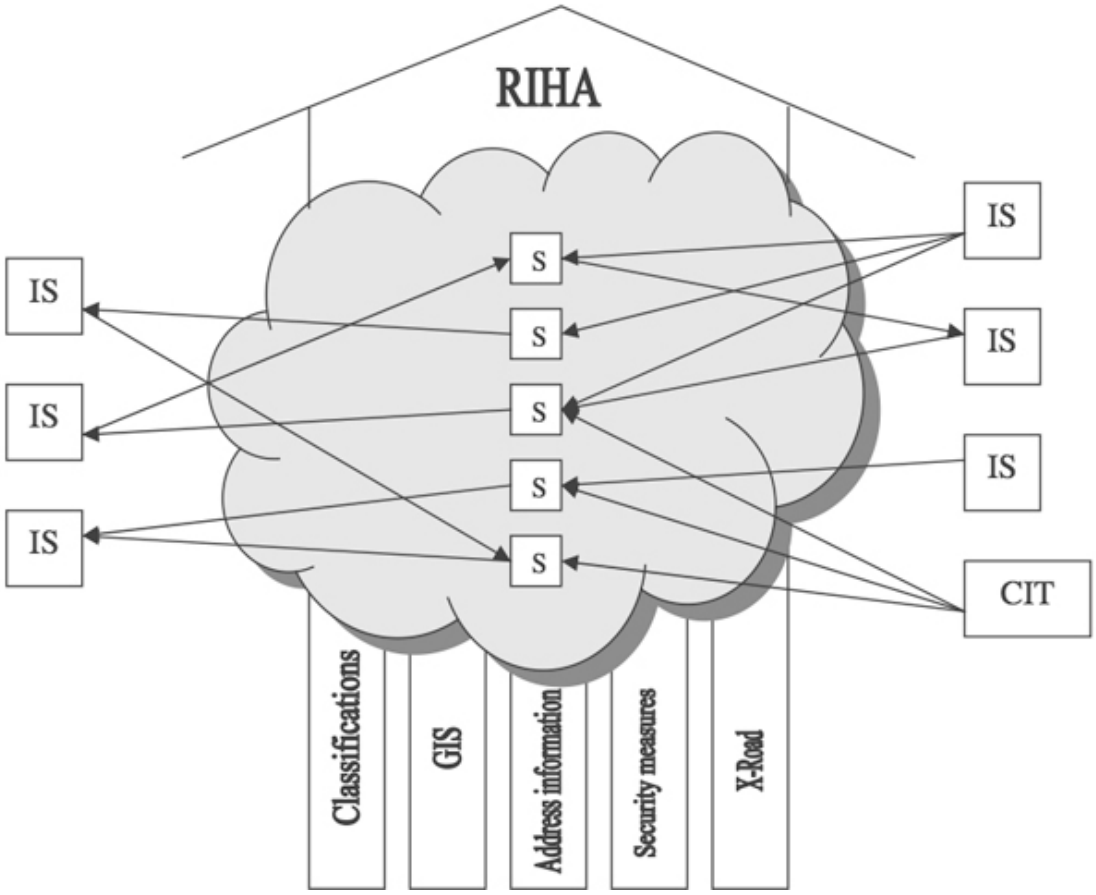


*Figure 9: Esthonian Interoperability Framework*

### 4.5 SEMANTIC FRAMEWORKS

E-Government systems are subject to a continual change. However, the most important challenge for E-Government services is to adapt themselves to the complexity of their own environment, as well as the internal structures and processes.

Semantic frameworks can be used to support successful e-Government initiatives by connecting system design to a shared understanding of interactions and processes, since metadata standards and repositories can be used to establish and maintain such an understanding, as well as in the automatic generation and instantiation of components and services.

A semantic framework consists of components at three levels (Crichton et al., 2007): terminology services, providing interpretations for basic terms; metadata registries,

holding collections of observations; and model repositories, descriptions of components or data sets, or characterizations of domain information.

*Table 4.4: Semantic Frameworks Literature*

| Author | Year | Research |
|---|---|---|
| Caituiro-Monge & Rodríguez- Martinez | 2004 | Net Traveler: A Framework for Autonomic Web Services Collaboration, Orchestration and Choreography in E-Government Information Systems |
| Comte & Leclere | 2005 | A Semantical Reasoning Framework for eGovernment of French National Retirement System |
| Herborn & Wimmer | 2006 | Process Ontologies Facilitating Interoperability in eGovernment A Methodological Framework |
| Alasem | 2009 | An Overview of e-Government Metadata Standards and Initiatives based on Dublin Core |
| Fang et al. | 2007 | An User-Driven Slight Ontology Framework Based on Meta-Ontology for Change Management |
| Fernandes et al. | 2001 | ServiceNet: An Agent-Based Framework for One-Stop E-Government Services |
| Mugellini et al. | 2005 | E-Government Service Marketplace: Architecture and Implementation |
| Goudos et al. | 2007 | Public Administration Domain Ontology for a Semantic Web Services EGovernment Framework |

### 4.5.1 Next-generation Government Information Systems

E-services is a critical actor in the integration of distributed systems over wide-area networks. The emergence of the Internet has provided citizens with access to vast amounts of rich data sets that are located on data sources distributed over it's peers. The research in the area of Distributed Database Systems (DDS) has concentrated on the barriers of heterogeneous data integration (Chawathe, et al., 1994; Rodriguez-Martinez & Roussopoulos, 2000; Roth & Schwarz, 1997; Tomasic et al., 1996), distributed query processing, as well as distributed transaction processing.

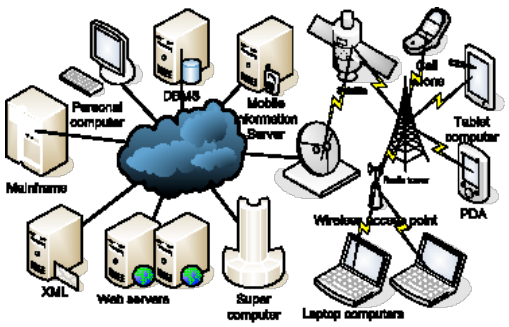


*Figure 10: Wide-Area Environments*

Governments around the Globe pose a vast number of challenges to computer science researchers who work on building transparent, scalable, and reliable IS in order to allow citizens to execute queries that need access to heterogeneous and geographically distributed databases. Citizens usually request information that includes several entities. IS are independently designed and implemented, so it is so difficult to get them together to work. In this context, it is necessary to gather the information from several IS among different entities. Thus, the orchestration and choreography of the IS will allow an efficient and effective result. Moreover, IS need to be accesses through a standard and universal middleware. Web services fulfill such requirements, since they are broadly used in the Internet.

Caituiro-Monge and Rodríguez-Martinez (2004) in their study regarding the Next-generation Government IS believe that the Next-generation IS (NIS) will integrate large amounts of heterogeneous data sources located on distributed networks like the Internet and present a new middleware architecture under the name of "*Net Traveler*". It is a framework for e-services co-opperation, in peer-to-peer autonomic systems, which works by unchaining the execution of control software from the coordinating sites. Net Traveler is a framework for Web services collaboration in E-Government and is based on a model for composition of ad-hoc peer-to-peer web services in which one site completes a given task and sends the results along with some extra control information, to another site, which can continue with the process. This framework includes control data in an XML document, which is attached to service requests and partial results. These control data indicate the next Web service to be invoked the destination of partial data and the way that partial data should be processed.

The main goals that designers pursued in the design of "*Net Traveler*" were transparency, scalability, reliability and performance. Their goal was to provide a set of well-defined services that can be combined to create a larger service.

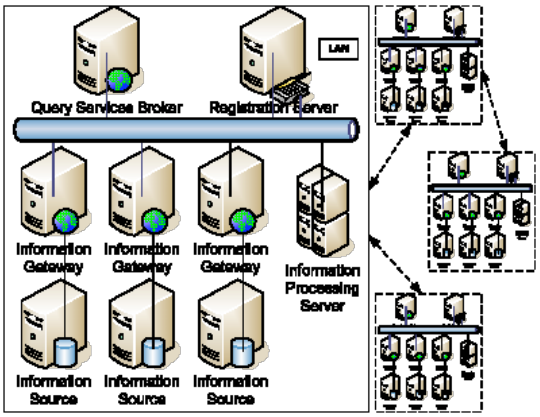


*Figure 11: Architecture*

The main feature of Caituiro-Monge and Rodríguez-Martinez's approach is the decentralized coordination through lightweight web services that can be run from a client or information source site. In their approach, they include control data in an XML document that is attached with a request for a service, or with partial results. This XML document indicates the next service to be requested, the possible target site and how should it process any partial results. This feature is necessary to avoid imposing a connection-oriented type of system, were a site has to be in continuous contact with the sites providing services it needs. Their study proves "*Net Traveler*" to be flexible, scalable and efficient for the web services collaboration in electronic government applications.

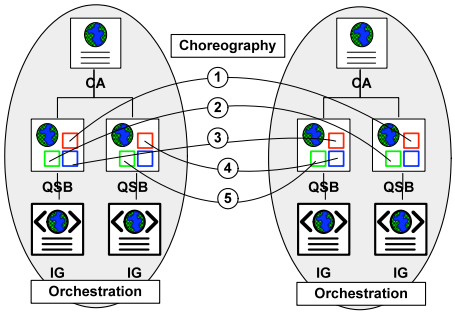


*Figure 12: Orchestration and Choreography*

### 4.5.2 Semantical Reasoning Framework

The French social retirement system and its e-Government potentials constitute the main area of focus in Comte and Leclere (2005) study. As a brief background of this study, national institutes manage organisation of the French social retirement system.

They are in charge of subscriptions from active people. These subscriptions are used to provide settlements for retired people. Nowadays there exists around 200 institutes in charge of 27 millions of working people and 13 millions of retired persons.

The poor document management (Klischewski, 2003), the lack of interoperability (Wimmer & Traunmuller, 2002) as well as the absence of inferentials mechanisms, have been the initiatives for constructing a Semantical Reasoning Framework.

Their framework is designed around resource, metadata, as well as ontology paradigm. Each resource of the framework is accessible by a unique identifier and can be characterised by its metadata. Metadata vocabulary came from the domain ontology. This ontology is a kind of heavy height ontology allowing complex representation like type definition or hypothesis/conclusion couple used as rules or constraints. Their architecture is consisted of a Semantical web portal, a business plugin, a set of protocols and processes as well as a Logic Kernel.

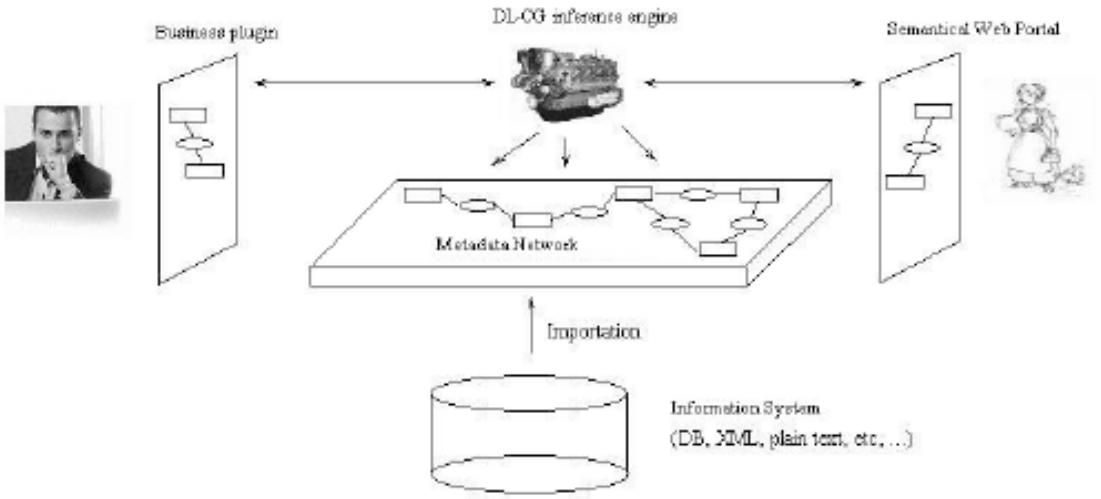


*Figure 13: Semantical Reasoning Framework*

### 4.5.3 Process Ontologies Facilitating Interoperability

Governments are more and more using ICT to facilitate their tasks and responsibilities as well as to promote the collaboration among public organizations more efficiently. It is a common ground that e-Government is characterized by the usage of multiple applications as well as heterogeneous data environments and a vivid example of such a diversity are the business registers of the member states of the European Union. In

order to guarantee the free movement of European citizens and companies, the European Community perceives the imperative necessity to establish an appropriate and interoperable ICT basis (Commission of the European Communities, 2003).

Herborn and Wimmer (2006), with the project Business Register Interoperability Throughout Europe (BRITE), focus on the use and development of ontologies in respect to the intended interoperability of e-Government applications and public administration systems especially in the context of European Business Registers (EBR) and aim to build interoperability between the business registers in order to facilitate EU-wide transactional services for companies. Herborn and Wimmer's study introduces the approach to develop a common BRITE domain ontology which links up national domain ontologies and BR processes. The BRITE platform thereby serves as an intermediary to link up the diverging ontologies of national business registers and interoperability is reached among various national business registers and their respective services.

The application of ontology-driven semantics can enable the achievement of these goals. In this context, already implemented domain ontologies based on different geographical, organizational and historical roots have to be faced and harmonized respectively linked up with each other. Instead of "*reinventing the wheel*", the re-usability of existing ontologies has to be checked and aggregation of existing data, document and process schemata should be aspired on an overarching level. Moreover, an ontology has to fulfill criteria such as openness, dynamics and flexibility in order to allow for future changes and integration of laws to come. The aim of BRITE was to combine Domain Ontologies and Process Ontologies in a way to achieve maximum productivity. This combination was necessary in order to:

1. Harmonize the vocabulary toward a common upper level conceptual standard
2. Get an understanding of the individual, national processes
3. Integrate the corresponding processes correctly.

In order to achieve the goals mentioned above, Herborn and Wimmer introduced a methodological framework to secure real interoperability between different institutions, even with language barriers and massive process diversities. The

approach has the advantage of maintaining already existing systems and link them with the use of ontologies. These domain process ontologies are abstracted to general process ontology. The help of this high-level process ontology can address legacy systems addressed over the borders of domains. The outcome of this approach is interoperability between different legacy systems on technical, organizational and semantical levels.

The first step Herborn and Wimmer undertook was to resolve the differences within the vocabulary in order to get a common understanding of Business Register's topics. Then, semantics were added to the vocabulary in order to build a knowledge map and enable inferences. Finally, processes were modeled on a high level and were opened to other inputs and created consequently the basis for interoperability. Final step will be to integrate these processes into the legacy systems, varying in depth and depending on legal, organizational and technical constraints.

### 4.5.4 e-Government Metadata Development

The broad definition of metadata is "*data about data*" or "*data that describe data or information*". In more specific terms, "*metadata is data about other data or objects, used to describe digitized and non-digitized resources located in a distributed system in a network environment*" (Haynes, 2004). In e-Government applications it may be used, amongst other for the discovery and retrieval of government information, as well as to assist in the management of government electronic resources. In other words, metadata is the key to interoperability.

Metadata is a valuable tool in e-Government applications to make seamless flow of information and services across government and support citizens finding government information and services more easily. Over the last ten years many studies have been written focusing on the importance of metadata in general in terms of information finding and managing. However, there have been relatively few studies on metadata in e-Government applications as a tool that can be used in order to improve multiple functions (Alasem, 2009). Several of those studies discussed metadata as principles of Information Architecture. In addition, several projects have been published that can be characterized as the best practices authored by a group of consulting firms, government bodies and organizations.

The benefits of using metadata in e-Government domain can be seen in several aspects. In terms of government information and services discovery "*metadata can facilitate the discovery of e-Government resources, by identifying resources, bringing similar resources together, distinguishing similar resources, and giving location information*" (Tambouris et al., 2007), which enable users to search and locate electronic and non-electronic government information without needing details of government structure. Additionally, metadata is a tool for the administration of information resources, whether they are electronic and available on the web or in physical format, they enable the administration of the life-cycle wherein the resources are being created, edited or used. Furthermore, metadata helps to determine the authenticity of data and, last but not least, metadata is the key to interoperability. (Haynes, 2004).

In an attempt to compare the work which has been carried out in the UK, Australia, New Zealand, Canada and Ireland with the most widely metadata standard used in e-Government application, Alasem (2009) aimed to highlight the use of metadata in e-Government projects and finally to propose a framework for metadata development. His proposal for an e-Government metadata development framework is parted by four phases:

1. Establishing a Metadata Working Group
2. Identifying the Requirements of Providers of Government Resources, Users' Needs & Government Resources to be described by Metadata
3. Studying existing government websites
4. Determine appropriate metadata elements.

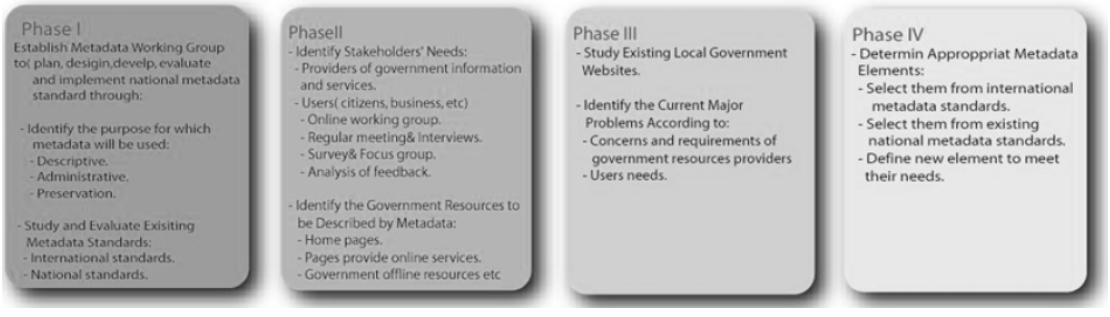


*Figure 14: e-Government Metadata Development*

### 4.5.5 A Slight Ontology Framework Based on Meta-modeling

In their study Fang et al. (2007) present an approach for ontology-based change management. Their approach goes beyond a standard change management process since it is a continual improvement process. The novelty of the approach lies in the using of formal methods for achieving consistency when a problem is discovered and the formal verification of the service description.

The Slight Ontology Framework (SOF) is a model for change management. The system based on SOF has been developed which is much more than a standard framework for creating, modifying, querying and storing ontology-based description of semantic web services. It supports the change evaluation management, which includes modeling services, discovering services, compositing services as well as reconfiguring services. The SOF platform is parted by three layers:

1. Services Application
2. Middleware API
3. Data Storage

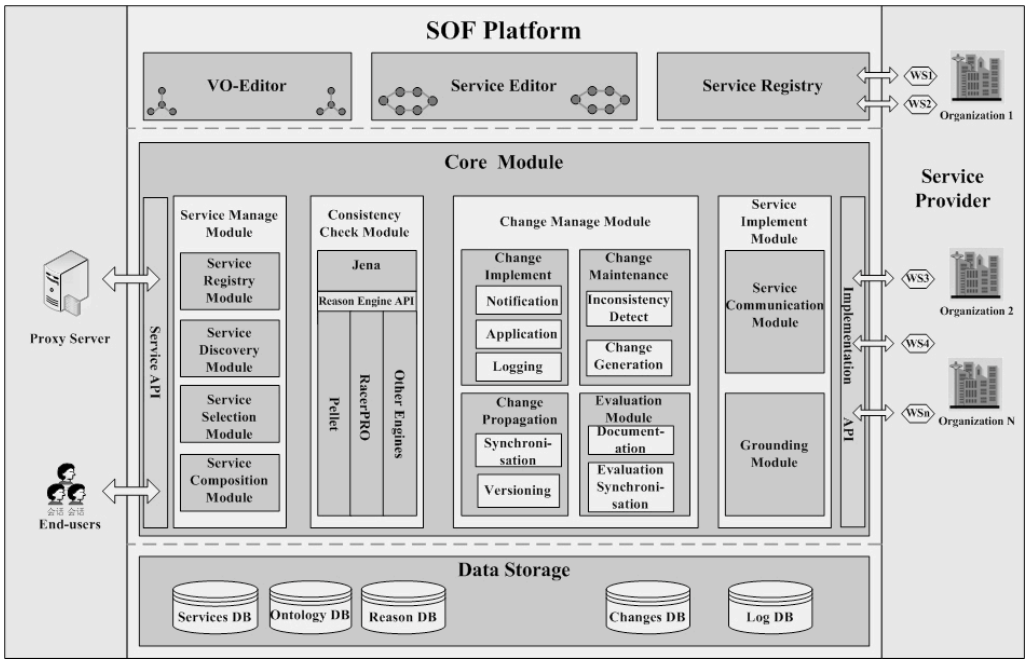


*Figure 15: The architecture of change management system*

### 4.5.6 Agent-based framework for one-stop e-government services

Often service delivery requires several steps cutting across multiple departments or agencies, each with separate eligibility and other rules, data requirements, and processes. One-stop provision of e-services is a fundamental vision of e-government. E-government and its one-stop government objective is the first really promising approach for reducing bureaucracy and increasing the access to and quality of services (Newcombe, 2000; Robb, 2000).

For this complex setting, Fernandes et al. (2001) proposed a three-tiered intelligent-agent-based framework (Woodridge & Jenning, 1995), called ServiceNet, to provide one-stop services. These three layers include client problem diagnosis, service planning, and service provision. The central contribution of ServiceNet is corresponding client problem diagnostic, client advocate, and service facilitator agents. A service plan is defined to be the steps that a citizen client can take to meet a need. Each service has:

1. A rule base of entry requirements, including predecessor and successors steps, that must be satisfied before a client can register for the service
2. One or more processes
3. Associated database record sets
4. A facilitator agent, which provides information on meeting eligibility rules, finding service capacity, scheduling, etc.

The client advocate communicates with service facilitator agents to build, execute, monitor, and report on service plans. ServiceNet is an overarching framework and ultimate target of the one-stop, e-government movement. Moreover, it integrates government, non-profit, and even private-sector services, with coordination by a community of interacting electronic agents that address the special bureaucratic and red tape features of government.

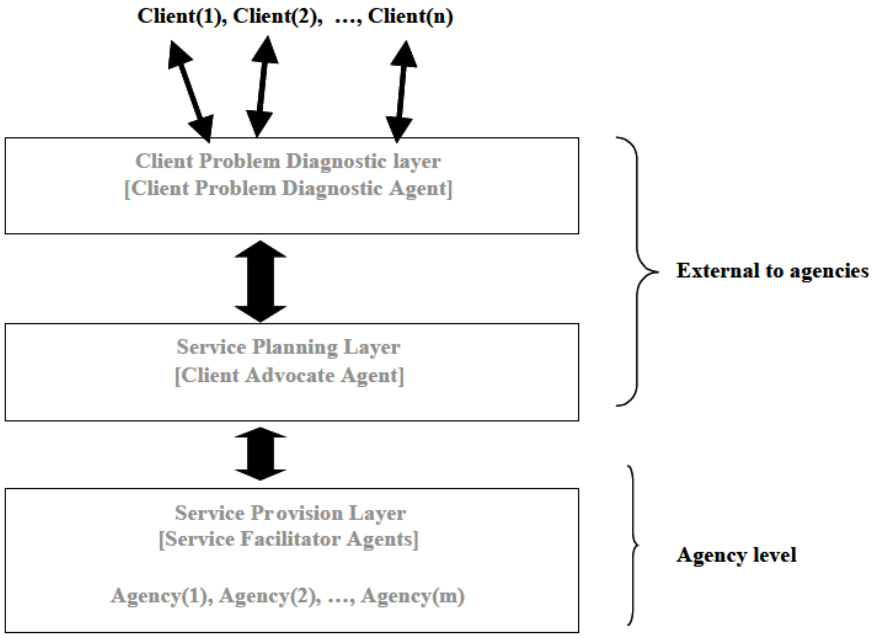


*Figure 16: The ServiceNet Framework*

### 4.5.7 eGovSM Metadata Model

In order to enable a real collaboration among different public administrations while respecting their technical and political capabilities, their autonomies as well as to provide a flexible and evolutionary solution capable of adapting to changing and evolving needs of administrations, Mugellini et al. (2005) proposed a new concept of e-Government Service Marketplace (eGovSM) which aims at providing quality services by facilitating citizen and public administration interaction.

The metaphor of the marketplace proposes the vision of a virtual place where citizens can have access to the available services without caring about information sources, responsibilities or composition. Moreover, administrations can take part to this market according to their technical and political capabilities. The eGovSM is based on a set of document models allowing the development of a flexible, interoperable and scalable environment: Life Event Manager (LEM) supervises interactions with citizen, Document Manager (DM) concerns the document management processes, Service Manager (SM) manages interactions with administrations, and finally UNIversal CITizen IDentifier Manager (UNICITIDM) represents the manager of unique citizen identifier.

eGovSM concept is formalized using a Document Engineering approach. This modeling approach aims to be generic and extensible allowing the design of a flexible and scalable e-government solution. It allows the description of system behavior and functionalities in platform-independent way, making the model portable across different development environments. The global eGovSM framework is consisted of three main parts:

1. A Configurator
2. A Generator
3. Web Applications

The eGovSM offers services to citizen via a single access point even if services are provided by different administrations. Citizens can access to public services in terms of life events without needing a specific knowledge of public administration functional fragmentation and complexity.

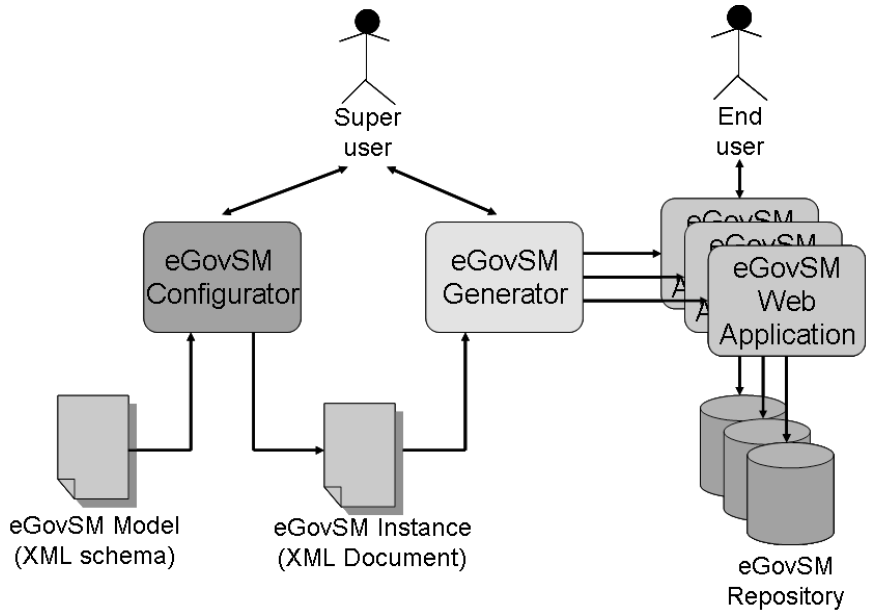


*Figure 17: eGovSM Framework*

### 4.5.8 Public Administration Domain Ontology

The Public Administration domain features are of interest to the Semantic Web research since it can provide an ideal test bed and Semantic Web technologies can be

an ideal platform to achieve the vision of a knowledge-based, citizen-centric, and citizen-empowering, distributed and integrated e-Government. The first step towards this vision is to develop formal Public Administration service models as well as Public Administration information models to be used as underlying formalisms in Semantic Web and Semantic Web services environments.

Goudos et al. (2007) have shown how a generic Public Administration service model can be expressed by a fully-fledged logic programming language for describing Semantic Web Services. In their study they present a generic Public Administration domain ontology and define a formal model for a Public Administration service on the basis of the Web Service Modeling Ontology. They describe the ontology using the Web Service Modeling Language. This domain ontology will be used in semantic web services architecture for e-government. This Public Administration domain reference ontology can certainly have an important role in a semantic web services environment for e-government. Two main reasons have lead to the expression of this ontology in Web Service Modeling Language:

1. The Web Service Modeling Ontology framework provides a steady execution environment (Haller et al., 2005)

2. The Web Service Modeling Ontology supports both a client and a service perspective.

The described Public Administration service model using Web Service Modeling Ontology is the underlying specification for Public Administration service provisioning built on Web Service Execution Environment. In particular, Web Service Execution Environment can serve as an execution environment for Public Administration service provisioning in national and pan-European e-government contexts.

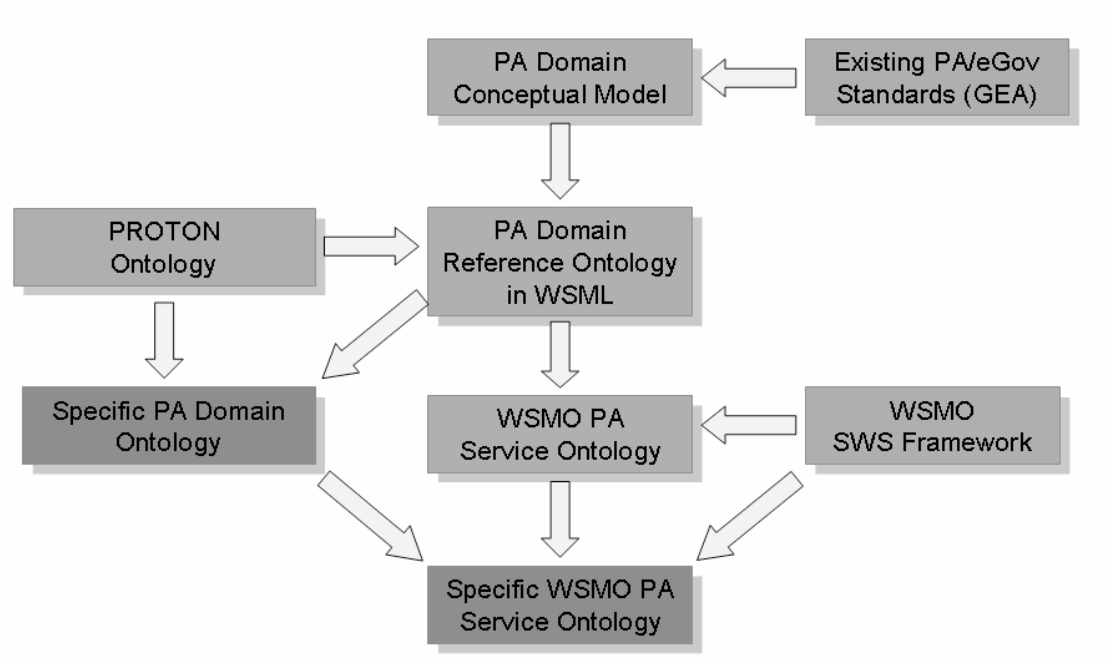


*Figure 18: Ontology Logical Structure*

## 4.6 SECURITY FRAMEWORKS

Worldwide, local and national government agencies are facing the challenging era of e-government. More than $600 billion of government fees and taxes have been processed through the web by 2006 (James, 2000). United States Federal Government spending alone has reached $2.33 billion (Gartner Group, 2000). This is more than the expected spending by consumers from retail businesses ($2.24 billion). A survey of government finance officers reveals that e-government is one of their top concerns (Bornstein, 2000). New problems arise by these numbers and make us understand that the security of e-government services should not be neglected in any way. Current European Commission efforts to absorb different government systems fit these aims and depend on a common data-sharing standard. Currently, too little information is shared among European government agencies, especially in the security arena.

Negotiation-based sharing is a key aspect of any e-government system that ensures democratic principles. Challenges in creating computational infrastructures for such sharing are both technical and non-technical, the latter being the harder to solve and needing novel incentive schemes. Assessing the quality of e-government information

is dependent on building trust on the safety and goodness of a negotiation-based sharing system. Encoding European laws is a challenge with all the different nations involved. A negotiation system that includes the usage requirements of the data being shared is essential. Several web-based negotiation support systems are in use. WebNS (Ding, 2000) is a prototype web-based system designed to facilitate remote negotiations on the Internet. SmartSettle (ICAN, 2003) attempts to find quantitative and qualitative preferences for all parties, and uses a central server to arrive at agreements without exposing confidential data. INSPIRE (Kersten & Noronha, 1997) and INSS (Kersten & Noronha 1998) are web-based systems containing facilities for specification and assessment of preferences, a messaging system, a scoring function to aid in the construction of offers, graphical displays of the negotiation progress, and a facility for constructing compromises. Most existing negotiation systems do not focus on security and privacy concerns, which make them inappropriate in a security-sensitive environment. Since they are designed primarily for use in online markets, they also lack efficient support for representing the exchange of complex information.

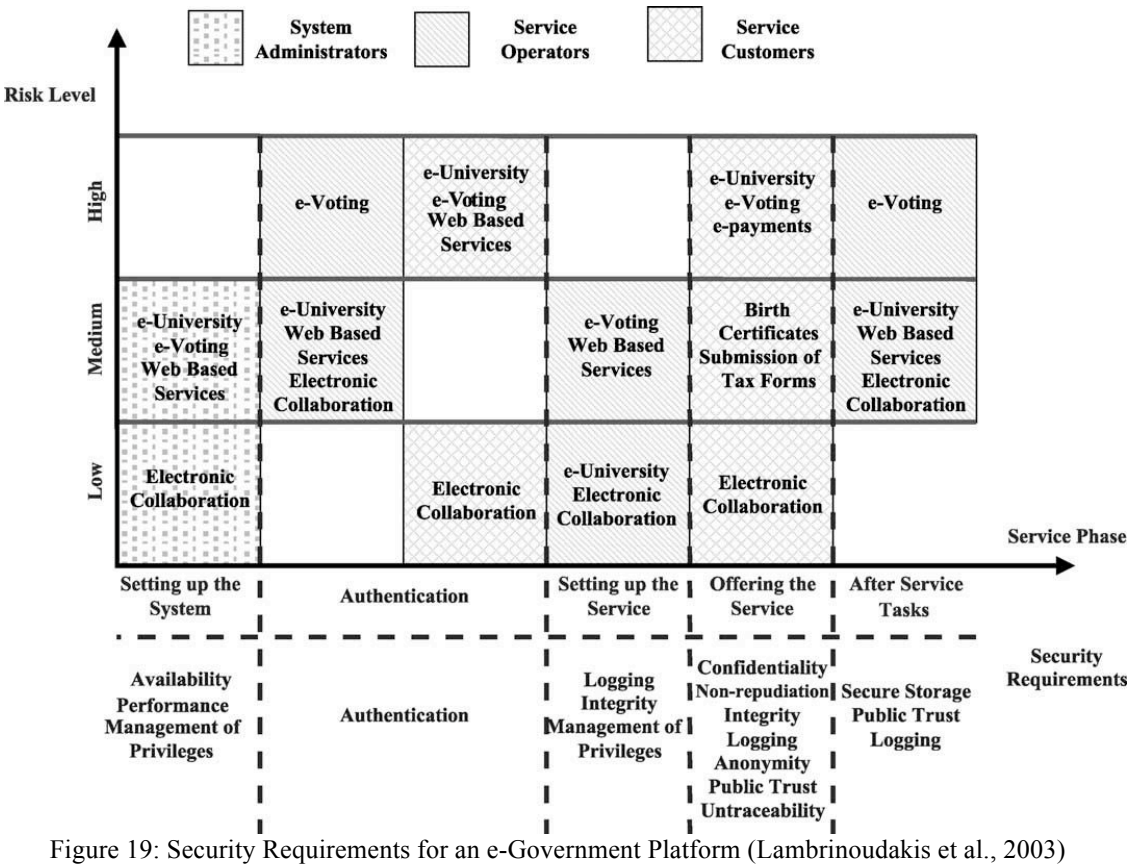

Figure 19: Security Requirements for an e-Government Platform (Lambrinoudakis et al., 2003)

Due to the Internet's ubiquitous nature, citizens reasonably expect to interact with government online. They prefer to interact with a personal computer and broadband connection rather than spending time talking face-to-face with a public servant. This move from in-person transactions to the electronic arena benefits governmen. The automation of routine government services allows the deployment of limited government resources to areas that require human intervention. Automation also makes service delivery more efficient and diminishes the cost per transaction, while at the same time increasing customer satisfaction. Information becomes available in a timely, correct, and current form. With automation, the number of transactions can grow significantly without requiring the salaries, training and support of government employees. Rather, the government or its technology suppliers and contractors could simply bring new technical resources online as needed. But such seamless, technology-transparent interactions carry a price. The promise of e-government will only become reality after a significant investment in addressing privacy concerns. The challenge is that the public and the government rightfully expect that all such online transactions should be as secure and private as traditional, face-to-face transactions. This simple and reasonable expectation implies specific, complex requirements:

- Authentication
- Nonrepudiation
- Transaction integrity
- Authorization

*Table 4.5: Security Frameworks Literature*

| Author | Year | Research |
|---|---|---|
| Makedon et al. | 2003 | A Safe Information Sharing Framework for E-Government Communication |
| Abie et al. | 2002 | The Need for a Digital Rights Management Framework for the Next Generation of E-Government Services |
| Gritzalis & Lambrinoudakis | 2002 | Security Requirements of e-Government Services: An Organisational Framework |

### 4.6.1 The SCENS framework

An e-government negotiation system is inherently international due to its digital

nature. It helps establish the conditions of sharing original as meta-information among different divisions or even countries. Makedon et al. (2003) are developing such a negotiation system called Secure Content Exchange Negotiation System (SCENS). SCENS has a flexible 3-layer service structure that provides different levels of negotiation services for different type of users:

1. ***Layer 1:*** Behaves as a traditional web-based negotiation support system for human beings.

2. ***Layer 2:*** Supports complete negotiation strategy customization by users.

3. ***Layer 3:*** Provides an open and automated negotiation environment.

SCENS ensures safe sharing as it:

- Authenticates the user and protects the privacy of data, users and transactions with encryption technology,
- Negotiates the sharing based on a metadata description of the information; using metadata to describe the original information is a form of security that also keeps the information provider in control of his data;
- Allows the actual exchange of the real data to occur only after prior agreement on the conditions has been reached,
- Tracks usage of shared information and collects feedback that becomes part of the security infrastructure of the system,
- Makes non-interoperable data interoperable with a uniformly secure metadata extraction system,
- Provides high-level government security by facilitating government sectors to cooperate and prepare for incidents or events that threaten security due to lack of communication.

Components of the system include authentication and authorization security components for access control, an intelligent data collection component that semi-automates the extraction of metadata and provides a workflow management interface for improved government worker productivity, components for searching and querying informational assets via metadata, a negotiation mechanism for recording

and tracking the exchange of raw data, an incident reporting component for monitoring risks and security violations, an automated data broker component, a consultation and training component, user-interaction components that include a discussion forum and a user-interface visualization system.

### 4.6.2 Digital Rights Management Framework

e-Goverrnment utilises ICT in order to transform already existing procedures and make them more accessible, effective, accountable and citizen friendly. The goal is to:

- Improve the orchestration of information dissemination among different agencies and co-operating organisations and individuals
- Make government more accountable by making its operations transparent, and allow policy-based secure handling of information, thereby reducing the phenomenon of mismanagement and corruption
- Provide greater access to government information and promote citizen interaction with governmental services.

The overall goal is to develop a framework for policy, privacy, security, trust and risk management for Digital Rights with the ultimate goal of establishing a virtual competence centre that will successfully provide a flexible context of technologies and concepts that can be integrated to ease the management of eGovernment. This should be done in a cross-disciplinary, inter-domain, and open approach at international level. The purpose of the framework is to:

- Integrate the traditionally separated Digital Rights Management (DRM) research communities in the fields of technology, business, law, ethics and social science and to structure the way DRM research is carried out in the research community and amongst practitioners by networking together teams of experts in these fields

- Stimulate joint scientific research projects to gain insights into the fundamental issues and challenges associated with future DRM systems, harmonisation of DRM technologies and solutions, and learning programs at the European level

- Create a self-sustainable set of knowledge-spreading activities through liaison with end-user communities, industries, standard bodies and governmental organisations, and a solid bi-directional technology transfer between industries, standard bodies, and governments.

Abie et al. (2002) have proposed an integrated approach to address the vision of trust and confidence in e-Goverrnment services and satellite electronic activities and wit communication, business, entertainment, learning, health, and generic-services. Furthermore, Abie et al. have highlighted the benefit that DRM provide to e-Government. An integrated research framework will help governments understand and uptake the knowledge-based digital economy in the context of e-Government. In their study they describe a DRM research framework, which aims at:

- Integrating the traditionally separated DRM research communities across Europe in the fields of technology, business, law, ethics and social science, all of which are vital to understanding the issues related to DRM in the future and its use

- Stimulating joint scientific research projects to gain insights into the fundamental issues and challenges associated with future DRM systems

- Creating a self-sustainable set of knowledge-spreading activities through liaison with end-user communities, industries, standard bodies and governmental organisations.

The primary feature, which assures a coherent integration, is the well-defined collective goal, which can be simply stated as DRM. DRM is an extremely motivating goal for researchers, and the research effort to be invested is, by its nature, highly complicated and diverse. The necessity of a well co-ordinated large and diverse research group to achieve this goal greatly discouraged researchers for a long time. Therefore there is a need to network experts in the different disciplines necessary for a holistic view and understanding of DRM and its implication in eGovernment scenarios. For each discipline a task force should be responsible for on-going and future high quality research into those aspects of the discipline concerned, which are relevant to DRM. The task forces will co-operate with each other on joint research using common concepts, methodologies and tools that will be developed and

synthesised from components taken from jurisprudence, the social sciences, business theory and economics, and science and technology. This integration of interdisciplinary approaches and ensuing technologies will provide the network with a common background and basis for combined research, and facilitate the exploitation of the synergy of the various projects, areas of expertise and stakeholders. Intellectual property (IP) asset creation, IP asset capture, IP asset management, and IP asset usage (Iannella, 2001) control and tracking will be handled effectively as common domain platform services. Standards will be further developed to allow interoperability so as not to force DRM users to encode their works in proprietary formats or systems. This is of paramount interest in the eGovernment domain where changes in procedures and information representation are slow.

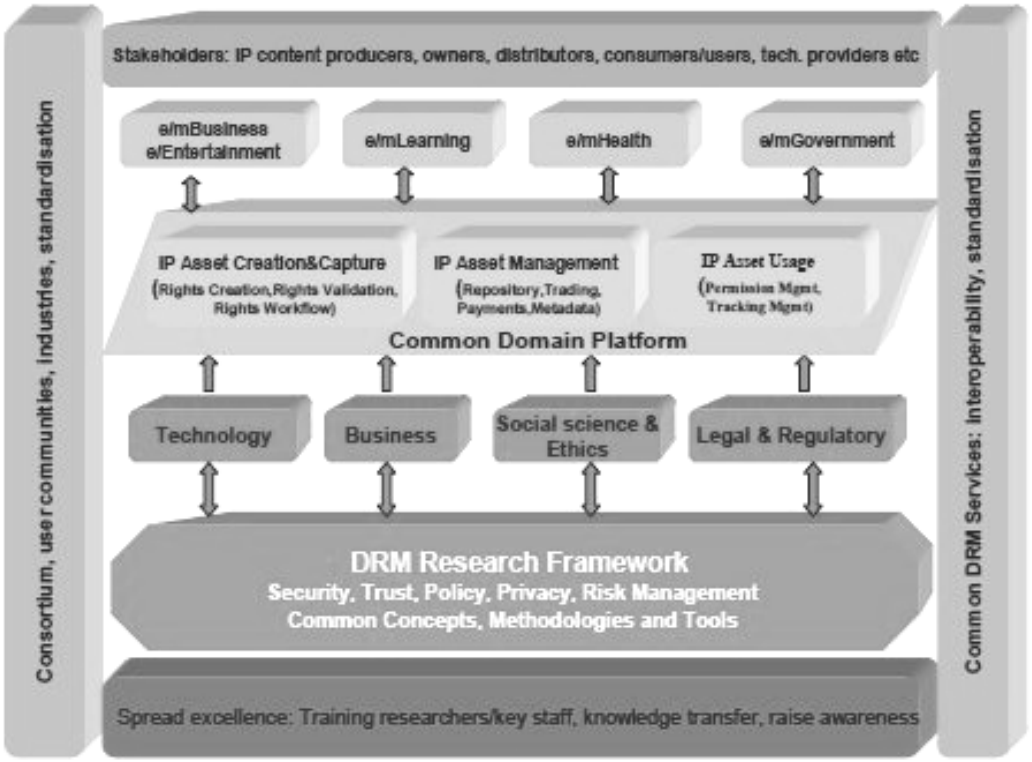


*Figure 20: DRM Framework*

The focus is mainly on technology as this is the common denominator in tackling eGovernment issues at a global level. In this context, it is important to note that the object is not merely to develop and implement DRM technology, but also to ensure that it is widely used regardless of the business processes or the country specific requirements involved. This will require a reliable and secure infrastructure depended

on trust of users and confidence in the technology, which allows them to control privacy, security, accessibility and usability issues. The following figure (Fig. 21) depicts the proposed DRM research framework with some of its major components.

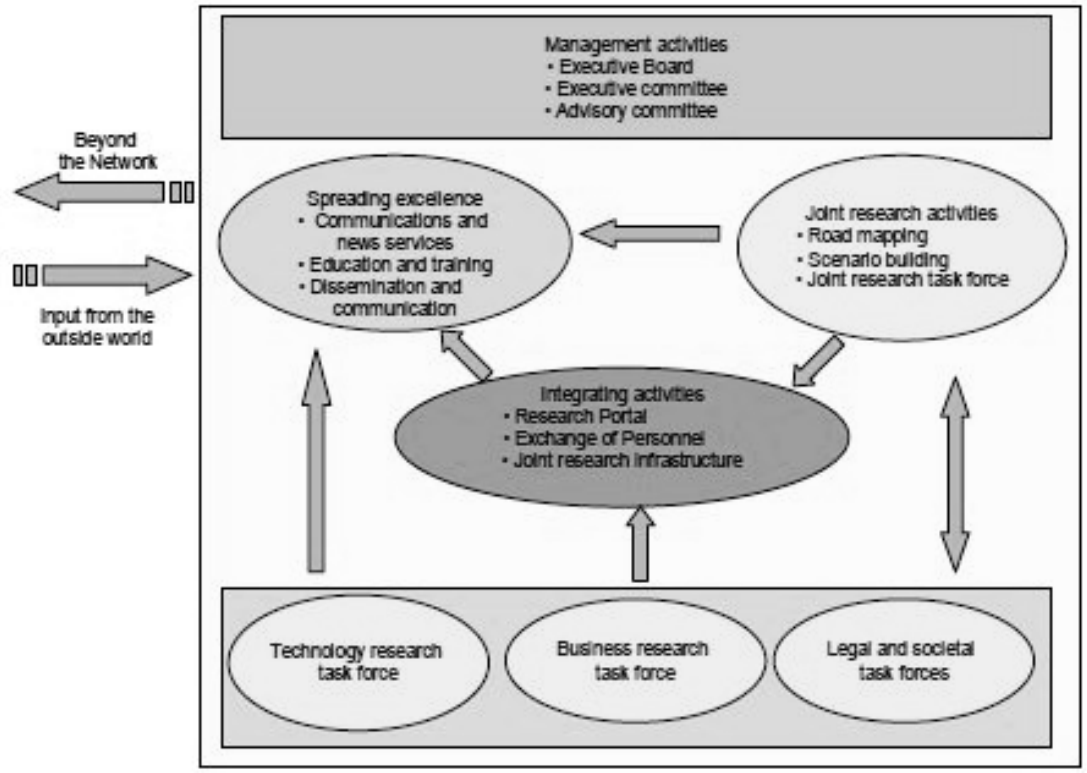


*Figure 21: Integration Process*

### 4.6.3 An Organisational Framework for the Security Requirements of e-government

The End-User can utilise the managed e-government services through a global entrance point: the governmental portal. The governmental portal can be either accessed through the local network or remotely through the World Wide Web or even through other type of wireless devices like mobile phones. Normally, the e-government services are supported through several collaborating client – server ISs. This conventional client – server architecture assumes to know where computing and storage power is located. However, the continuously increasing user requirements, in conjunction with the huge number of potential users, impose the need for evolved computational models that can transparently access distributed computational and storage resources.

Such architectures can be supported, an example being the Grid technology which

forms the next logical step in computing infrastructure following a path from standalone systems to tightly linked clusters, enterprise-wide clusters and geographically dispersed computing environments. The Open Grid Services Architecture (TESTFIT, 1995) is supporting the creation, maintenance and application of services through a common representation for computational and storage resources, networks, programs, databases and the like. The advantage of such a service-oriented view is that most of the interoperability issues are limited to:

- The definition of service interfaces
- The specification of the protocols that can invoke a specific interface (Foster et al., 2002).

Although state-of-the-art technology eases the development of on-line "*one-stop government*" platforms, it is, at the same time, the major cause of some of the problems associated with the implementation and design of a secure environment (Denning & Denning, 1998), especially when combined with the continuously increasing citizen mobility. By allowing users to access services from virtually anywhere, the number of non-eligible citizens that may try to harm the system can expand up to a serious extend. Moreover, existing methodologies for determining risk factors and identifying security requirements for the assets of an IS with well-defined boundaries are not necessarily applicable or/and cost effective for new architectures like GRID. GRID security requirements, including authentication, communication protection and authorisation, should provide for interoperation among different domains, adoption of different security rules and policies and take into consideration the definition of globally unique identities for each involved entity, the provision to each entity of a mean to prove that it possesses a specific identity and the adoption of rights delegation mechanisms to other entities.

Existing Risk Assesment (RA) methodologies can only be applied to IS with well-defined boundaries and are thus not appropriate for studying an e-government environment as a single entity. Instead, each IS must be studied independently, in accordance with the guidelines of the chosen RA methodology, identifying the security requirements associated with it. Gritzalis and Lambrinoudakis (2002) proposed a Framework for the Security Requirements of e-services under the name "*e-GOV-OFSR*". It aims to alleviate the inefficiencies of conventional RA

methodologies by increasing the granularity of the analysis and by interrelating, in multiple ways, the risk assessment results. Specifically, a distinct risk level value is calculated for each supported system service, or even service process, and this is done independently for each actor type. Depending on the RA methodology, it may be necessary to repeat the RA study several times or simply to extract and process, in an appropriate way, intermediate results. In their study, they highlight that the design and implementation of the security mechanisms for an integrated online e-government platform is not a straightforward task. The adoption of such a framework for identifying security requirements facilitates:

- The classification of e-government services according to the similarity of the security requirements that they exhibit.
- The protection of all services of the same class in a uniform way, through the appropriate security measures.
- The identification of security requirements associated with each type of user.
- The development of a common, but also flexible and extensible, e-government security policy.

The succeeding sections list the security requirements that have been derived through several independent RA studies for the following e-government services:

- Provision of on-line courses for distance learning
- Supporting the participation of citizens to various election processes through internet
- Electronic collaboration of various governmental departments through email, videoconference, use of shared documents, etc.
- Supporting transactions between citizens and governmental departments

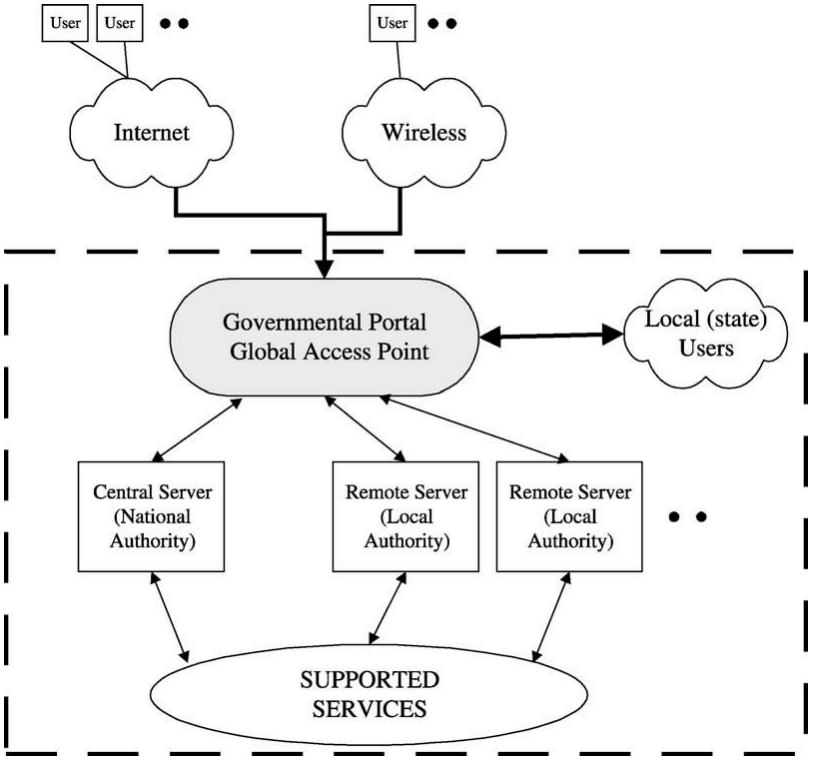


*Figure 22: Architecture of e-Government Platform*

The use of the e-GOV-OFSR leads to the compilation of a list with security requirements, for each service phase or actor which is applicable to the entire platform. By selecting the security measures that can effectively satisfy the identified security requirements it is feasible to develop a uniform e-government security policy. The requirements imposing the need for additional security measures are either related to the infrastructure of the e-government platform or to highly specialised-security critical applications.

## 4.7 EVALUATION FRAMEWORKS

E-government has been a major beneficiary of web-enabled inter-organizational systems and many governments around the world have initiated strategies to renew the public sector in order to promote the rapid step of technological change. The environment is a critical catalyst for a framework to succeed. The importance of measuring the performance of e-government cannot be overemphasized. Evaluation of e-government projects may yield meaningful results.

Several initiatives for measuring eGovernment exist; however, "*We have been measuring the progress of eGovernment in the most rudimentary fashion, where most cited studies are variations of the same methodology-benchmark governments against each other based on the online availability of a pre-determined 'basket' of services and information. The nation states with the largest 'baskets' are declared eGovernment leaders*" (Proudfoot, 2003). Different approaches exist to measure eGovernment success; however, a comprehensive framework for eGovernment assessment is needed.

Any framework for assessing e-government progress across countries or regions is flawed unless it takes into account several basic elements, including (Di Maio, Kreizman, 2001):

- Availability and actual use of the IT and communication infrastructure
- The way in which the country is organized
- The regulatory and political framework
- The actual needs of constituents
- The role of intermediaries
- The overall efficiency of government process and how oriented they are to constituents

*Table 4.6: Evaluation Frameworks Literature*

| Author | Year | Research |
|---|---|---|
| Gupta & Jana | 2003 | E-government evaluation: a framework and case study |
| Montagna | 2005 | A framework for the assessment and analysis of electronic government proposals |
| Oyomno | 1998 | Towards a Framework for Assessing the Maturity of Government Capabilities for E-Government |
| Esteves & Joseph | 2008 | A Comprehensive Framework for the Assessment of eGovernment Projects |

### 4.7.1 Return on e-government

In their study, Gupta and Jana (2003) presented a flexible framework for the selection of an appropriate strategy in order to measure the tangible and intangible benefits of

e-government. An Indian case study of New Delhi Municipal Corporation (NDMC) has been taken up for analysis and placement into the framework. Although the proposed framework is by no means optimal, the case study of NDMC provides an illustrative reference for future evaluation. The results obtained suggest that to have a proper evaluation of tangible and intangible benefits of e-government, the projects should be in a mature stage with proper IS in place. All of the e-government projects in India are still in a nascent stage; hence, proper information flow for calculating "*Return on e-government*" considering tangible and intangible benefits cannot be fully ascertained.

As there are no concrete available resources for evaluating these types of projects, their framework provides a direction about for consideration of the evaluation of e-government projects in the future. This model would be beneficial for evaluating any other municipality in the country and also comparing its performance with municipalities of other countries. But the selection of various soft and hard measures will depend on the system profile, the type of services being offered, and the profile of the citizen being served. The qualitative analysis of benefits is highly subjective and will differ from person to person, but an overall evaluation could be ascertained in the broader framework discussed. Based on other ideas and research, the framework can be changed for which the grading and, subsequently, various qualitative aspects of measurements could change. Although care has been taken to include all possible aspects of evaluation of e-government projects in the context of India, there might be an omission of some points and corresponding methodologies for its evaluation.

The framework "*Return on e-government*" refers to developing a functional view of the government organization, identifying specific functions at various levels of administration to analyze how IT is able to improve those functions and develop a Measurement of Performance for them. After measuring the tangible and intangible benefits pertinent to e-government, an evaluation framework may be evolved to fit the evaluation criteria in a more generic approach in determining the value of an IS with regards to e-government. This can be fit into hierarchy measures as "*Return on e-government*" attributable to IT applications for governance, both tangible and intangible.

- ***Level 1:*** Return on investment
- ***Level 2:*** Total costs and revenues
- ***Level 3:*** Improvement in quality of planning and control
- ***Level 4:*** Quality of decisions
- ***Level 5:*** Value of information
- ***Level 6:*** System characteristics

Using this framework, an e-government function must be examined according to the level of measure that is applicable in a specific context. The first preference is obviously for the measure of net return in dollar terms. The next best option is to explore identifying specific costs that are increased due to the installation of the new system. This may provide a conservative evaluation of the subdivision of benefits. If we fail to measure changes in costs and revenues, an attempt should be made to measure the improvements in the performance of administrative and managerial functions, that is, improvement in the quality of planning and control. Subsequent to that, one may consider measuring the quality of decisions that contribute to planning and control if the above schemes fail. Development of measurement of performance becomes difficult as it deals with the most complex functions, particularly at the strategic level where much information is qualitative and probabilistic.

Eventually, what comes to the fore is not how to quantify the contribution of e-government, but to consider how useful the information and services are in the context of its use. Information and services, which are useful, have value. Usefulness can be defined in terms of the performance of its attributes such as validity, accuracy, clarity, reliability, timeliness, relevancy, sufficiency, message content, freedom from bias, comparability, scope of multiple users, database and cost. These contribute to the value of information and services. A conglomeration of these attributes can be represented by a composite quality index, identified as the "*e-government performance index*".

### 4.7.2 A framework to assess e-government initiatives

Montagna (2005) presented a framework for evaluating e-government initiatives. His framework can be placed in the context of general electronic government projects,

which is a road that has proved to be the right one to achieve success. In this way, it is assumed that a series of decisions on the strategic level have been previously made. In the same way, it is assumed that after using the proposed framework, a series of operative tools should be applied for the execution of those initiatives that have been successfully evaluated. The objective of the model is to provide both a simple and solid scheme that allows the policy-maker to evaluate the validity of the initiatives presented in the framework of an electronic government policy. It is supposed that many proposals should be considered and before delving into the specific details of their execution, benefits and advantages generated by each proposal must be analyzed. Montagna (2005) ended with five dimensions that characterize these proposals:

- Product
- Distance
- Interaction
- Time
- Procedures.

One can recognize that four of the dimensions posed by Riggins (1999) are being used in this framework: product, time, distance and interaction, and a fifth dimension is added: procedures. These criteria are included in the definition proposed by Tambouris et al. (2001): e-government is the application ICT to transform the efficiency, effectiveness, transparency, as well as the accountability of informational and transactional exchanges within government, between government and government agencies at federal, municipal and local levels, citizens and businesses, and to empower citizens through access and use of information. Each of them can be evaluated by using four different criteria:

- ***Efficiency:*** Better use of resources Redesign of the process with higher performance Avoidance of inconsistencies and anomalies Processes streamlining

- ***Effectiveness:*** Better decision making based on reliable information Reduced workflow fragmentation

- ***Strategic benefits:*** Indirect strengthening of aspects such as governance,

image, etc. Increased use of e-services

- ***Transparency and institutional value:*** Breakdown of barriers to participation Better control and tracking

Furthermore, each dimension–criterion relationship must be considered not only from the government perspective, but also from the point of view of partners in the government action: citizen, business, government itself. Using these elements, it is possible to consider each project characteristics to evaluate its viability and the real contribution it makes to government development.

### 4.7.3 A framework for assessing the Maturity of Government Capabilities

Oyomno (1998) has developed a comprehensive framework for assessing the maturity of government capabilities for e-government. Oyomno suggests a maturity assessment framework based on:

- Six capability factors
- Six levels of maturity
- One mapping function.

The electronic capability maturity assessment framework proposed here provides for both quantitative and qualitative assessment of government institutional capabilities for e-government. By locating the maturity of relevant capabilities, quantitative assessments provide pointers to areas of the institutional environment that need further qualitative analysis to provide better understanding and knowledge. The framework also provides a more refined set of institutional capability factors relevant to an electronic government environment than is found in the current set of e-readiness assessment tools. The statistical tools to be used to translate data obtained into a contiguous set of maturity levels have standard algorithms that can be used to automate the analysis. The next step is to implement the new framework in a real world setting, a challenge that the author is taking up in the next stage of a longer research project.

Oyomno's research defines a capability maturity function as a composite function that

takes the data collected on the variables associated with each capability factor and returns values corresponding to the maturity of the organisation in that capability factor. It is considered a composite function on two counts. First, the variables corresponding to each capability factor may in themselves be functions of other lower-level independent variables. Secondly, the value obtained by direct manipulation of the variables corresponding to each capability factor must first be subject to transformation that aligns the variables to a standard learning or logistic curve. Finally, the value obtained from the learning curve is converted to a contiguous value corresponding to the maturity level of the organisation for the capability factor.

The use of a learning curve is necessary to depict the actual situation in organisations. Being a growth process, capability maturity is subject to characteristics similar to growth. The capabilities of an organisation experience slower growth at the beginning due to inertia arising from resistance to change and other cultural factors. As time goes by, the organisation gradually builds more knowledge, competence and confidence in the changes introduced, and its capabilities experience a period of accelerating growth, peaking somewhere in the middle. Beyond this point, the growth rate decelerates due to increasing saturation. The diagram depicts the resulting trajectory and maturity levels. The adoption of equal intervals for maturity levels means that these can be expressed as capability maturity indices.

On the basis of these considerations, the following six factors were identified as constituting the most appropriate capability factors for e-government, and they are used in this study.

- Development and business agenda
- ICT application portfolio
- ICT infrastructure development
- Human and intellectual assets
- Governance and institutional infrastructure
- Leadership and management

### 4.7.4 e-Government assessment framework

Evaluating e-Government projects is an important issue (Lenk & Traunmüller, 2002). The lack of formal methods for monitoring and assessing e-Government initiatives has led to a significant slowdown of country-level e-Government development (Kunstelj & Vintar, 2004). The current approaches to monitoring, evaluating, and benchmarking e-Government development do not support comprehensive e-Government assessment and need to be further improved in order to give policymakers better evaluation criteria for their decisions (Kunstelj & Vintar, 2004). Esteves and Joseph (2008) emphasize understanding and analysis of e-Government initiatives via an assessment framework. The proposed e-Government assessment framework (EAM) consists of three components:

- E-Government maturity level
- E-Government stakeholders
- Assessment dimensions.

One of the major criticisms of theoretical models is their over-simplification of real-world constructs (Kaplan, 1964). To overcome this problem Esteves and Joseph's framework is comprehensive in nature and includes all the major entities involved in the e-Government landscape. The theoretical basis for the three components of EAM is the socio-technical model (STM) (Bostrom & Heinen, 1977). The STM incorporates four inter-dependent social and technical elements:

- Actors
- Structure
- Technology
- Task.

The components of EAM include constructs from both a social and technical perspective. The socio-technical model examines key design elements for IS (Bostrom & Heinen, 1977; Lyytinen et al., 1998). The STM states that IS failures can be reduced by considering the two complementary system components: the social side as well as the technical side (Bostrom & Heinen, 1977). Social systems consist of people and structures while technical systems consist of technology and tasks. All

four of these constructs are inter-related. The socio-technical perspective envisions humans and technology in supporting rather than antagonistic roles. The STM is applicable in e-Government because of the interplay between people and technology.

The assessment dimensions of EAM are based on the STOPE model. The STOPE model (Bakry, 2004) identifies strategy, technology, organizations, people, and environment as the core components for the development of e-Government in the digital age. We use the constructs of the STOPE model to provide the basis for assessment of e-Government projects. The dimensions for assessment from the STOPE framework are: strategy, technology, organization, and environment. We included two additional assessment dimensions outside of the STOPE framework: operational and services. In the EAM all people, including employees and citizens, are represented as stakeholders. The assessment dimension of EAM contains six components:

- Strategic
- Technological
- Organizational
- Economic
- Operational
- Services.

The framework for assessment is illustrated in the following graph:

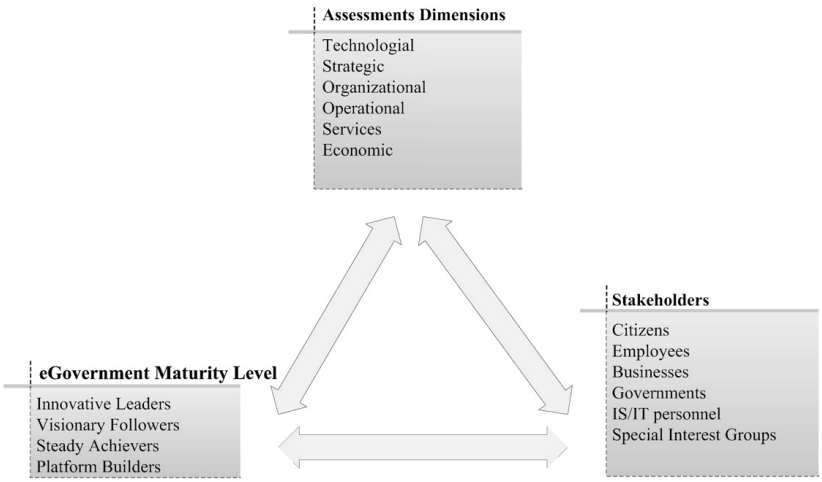


*Figure 23: e-Government Assesment Framework*

# CHAPTER 5

# CONCLUSIONS

Defining a model is a really complex as well as multi-faceted issue made even more difficult in the emergence of e-Government context. This study attempted to summarise the state-of-the-art among research on the design of a model for e-Government integration management to date and to explore the most common dimensions, which can be applied to measure the concept of e-Government in the context of its use. Understanding e-Government from a citizen's perspective implies to understand the processes of the council prior to applying metrics to assess service quality. This study does not try to stand out either as a review or as a synthetic summary of past literature concerning frameworks for e-government, rather, its main objective has been an in-depth overview of the current status of e-government phenomenon.

E-government is considered to be one of the key actors of the development of an information society. However, the application of ICTs in e-government should not be considered as an end in itself. It has already been clear that a competitive telecommunications market as well as an conducive environment, will enable e-government to become an affordable means for citizens and businesses to interact with government as long as frameworks provide the needed security to protect electronic transactions as well as data exchanges. In cases that telecommunications infrastructure is already available or affordable, as a result of competition, e-government applications are quickly embraced and its projects are more likely to lead to success. Governments all around the world have seen the rapid evolution of e-government when there is an integrated approach to planning and implementation of public sector reform.

The exploration of e-government frameworks literature revealed many interesting aspects of their nature. Among the most interesting are the extensive research of semantics in the Public sector, the plethora of interoperability frameworks as well as the noticeable lack of evaluation and security frameworks whose importance seem neglected by public servants. Strategic management seems always a pretty popular era and many researchers have tried to shed light on its most apocryphal complexions.

As an addition to the current status of e-government, future works need to give an answer to the dilemma, which derived from this study, whether e-government is really a tool for decentralization and democratization or the result of a sociotechnical process towards a new model of public administration. A scientifically documented answer will certainly boost the evolution of e-government. Finally, in an attempt to focus on the changes in business process that are needed inside governmental institutions in order e-government to be successfully implemented, a second recommendation for future work resides on the need for a holistic model which can embrace the back-office, the front-office as well as the real citizens' needs.

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