

# Enterprise Architecture in Government - Towards a Multi-Level Framework for Managing IT in Government

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**Abstract:** This paper outlines a theoretical framework for a research project in progress focusing on the management of information systems at different levels in government through the use of enterprise architecture in conjunction with the European Interoperability Framework. In response to the growing business and civilian demands for improved service and efficiency, public sectors in Europe are restructuring with e-government initiatives. Many of these e-initiatives have, however, failed to illustrate success in practice, and even though the e-government field has matured over the last few years, there is fairly little research in the ability of public institutions to evolve, develop and manage new information systems that helps realize the potential of e-government. This paper introduces enterprise architecture as an information systems architecture approach for solving various interoperability challenges at different levels of government. The paper argues that information systems architecture has been a lost realm in e-government research, and that there is a need for a broad and integrated view that takes both organization, semantic and technology in government into account.

**Keywords:** Enterprise Architecture, e-Government, European Interoperability Framework, Information system architecture, IS planning, IS management

## 1. Introduction

In response to the growing business and civilian demands and expectations for improved service and efficiency, governments and government institutions in Europe are transforming their traditional service-delivery channels and internal operations by an intensive use of IT and communication technology. Since the 1990's, the introduction of information technology has promised to optimise government service delivery, constituency participation and internal government operations through the use of new IS-based management paradigms for the public sector (see e.g. Bellamy and Taylor, 1998). The successful private sector experiences with e-commerce have raised expectations for government service delivery, and citizens and businesses now want services "anytime, anywhere" through multiple channels like they know it from the private sector (Schoeniger, 2000). However, despite a few significant success stories, many governments and individual institutions are failing to deliver the kind of benefits that were expected from the incurring huge cost and scheduling overruns<sup>1</sup>.

In practice, the challenge in government institutions is that many e-government initiatives require information exchange in networks of various governmental organizations. Most public institutions today manage technology in what is popularly described as "stove pipes" or "islands", with individual institutions implementing their own channels, web page applications and supporting infrastructure (Hamburg and Bekkers, 2002). While much of recent public sector management reform e.g. the introduction of New Public Management (NPM) has been about giving more autonomy to organizational units (see the outline of NPM below), digital government requires a tremendous amount of central co-ordination to yield system-wide adaptation and horizontal action (Allen et al., 2001). The pressure to coordinate has always been present in government, but the Internet has escheated this need, and in the future, barriers to efficient service provision arising from the way government institutions are organized will not be accepted by neither politicians nor public institutional leaders (Hazlett and Hill, 2003). e-Government is not just 'old government' plus the Internet; it is the use of new technologies to transform public institutions and to provide new ways of working – organizing government front and back offices in a way that places citizens and business at the centre of attention.

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<sup>1</sup> Meta Group reports that only 25% of projects deliver on their narrowly-defined "project only" goals and only 12% deliver any strategic business advantage (see [metagroup.com](http://metagroup.com)).

#### **4th European Conference on e-Government**

When working with the management of IT in the public sector, political scientists and other researchers in this field need to draw on the research perspectives developed in the IS discipline. As Baskerville and Myers (2002) have pointed out, IS has much to offer researchers in other disciplines and IS scholars should consider where there might be opportunities for cross-field collaboration with e.g. political scientists. However, most IS e-Government research has focused little on the interoperability challenges that governments in most countries are facing in the struggle to support the exchange of data and the sharing of information and knowledge across IT-systems and business processes. In the literature on e-government, the focus is often on the interaction between governmental institutions and citizens – the front-office (see e.g. the excellent study by West, 2004). This paper argues that there is a need to address the interdependence across institutions in government – the back-office. e-Government practice and research is very much about cooperation between government institutions in order for them to provide quality and reliable services for business and civilians. As stated by Stamoulis et al. (2001) the value of offering governmental services through a plethora of user-friendly electronic channels is not the biggest issue in e-government. The big issue in e-Government research lies in the area of strategy and planning, and more emphasis must therefore be put on business strategy and information systems architecture.

With a private sector focus, a number of IS researchers have been paying attention to the management of *IT infrastructure* and related capabilities and artefacts in information systems architecture (Broadbent and Weill 1997; McKeen and Smith 2002a; Weill, Subramani and Broadbent 2002). However, this line of research remains unfamiliar to the majority of the e-government literature. Many practitioners and scholars have tried to build frameworks for connecting the citizen interface (front-end) of the transaction services with the organization's back-office to complete the processing cycle and offer the rich spectrum of services that customers want and governments have promised. Some of these have been successful, but the majority has failed because there has not been enough emphasis on optimising existing business processes in the back-office through the use of technology (Hamburg and Bekkers, 2002). In order for e-government initiatives to be successful we need to develop a framework for managing IT at different levels of governments where back-office operations are also to be taken into account (Bekkers, 1998). There is a need for an integrated approach to the management of information systems in government institutions that incorporates organizational as well as semantic and technological issues.

In this paper, enterprise architecture (EA) is introduced as an information systems architecture approach a government can employ to manage e-Government initiatives at state, regional and local levels though a systemic alignment of the IT function within the business vision of the institution. Theory about institutions in the public sector and different IS architecture disciplines is outlined to address the need for an integrated approach to managing IT through the use of EA in government institutions. A tentative framework is proposed on the basis of the theoretical presentation, literature on the management of information systems in government settings and the hitherto limited findings in the research project.

## **2. Information systems architectures and institutional theory in e-Government research**

In this section, the theoretical assumptions underpinning the research project on the dynamics of institutional behaviour in the public sector and different information systems architectures is briefly presented. The paper mainly draws on theory from information systems management processes in the IS discipline (cf. Davis, 2000) while institutional theory from political science is brought in to understand the difference between managing IT in industry and government respectively.

### **2.1 Institutional theory in e-Government**

The organization of the public sector is about the distribution of responsibilities and competences between politicians and government institutions; how the public institutions are financed, and how this is brought to work in practice (Christiansen, 1998: p. 195). Coming from

different traditions, institutional theory in the political science discipline is concerned with the organizational structure and behaviour in public institutions (Hall and Taylor, 1996). On the one hand public institutions must be responsive to business and civilian requirements through democratic access to the public sector, and on the other hand institutions must secure efficiency and effectiveness in their everyday operations. So far however, e-Government research has mainly focused upon the first aspect, the transactions between identifiable customers (citizens, businesses and public institutions), while the latter aspect, the efficiency in the multitude of government institutions in charge of registering objects, issuing passports, collecting taxes or paying benefits, has been less investigated (Bekkers, 1998).

In practice however, one of the largest challenges in managing e-government is coordinating IT-initiatives in public institutions at the local, regional and national level. A recent U.S. government study found that the greatest concerns for e-government managers were not democratic or technical issues, but instead policy issues, including coordination and collaboration between institutional leaders and agency-centric thinking, rather than focusing on the overall goals and functions of e-government, and improving communication to better understand and foster inter-relationships between e-government projects (see [whitehouse.gov](http://whitehouse.gov)). Like other areas in the public sector, the lack of coordination between and across, the national, regional and local level can have a significant impact on the success of government efforts in general (Bogason, 2003).

The New Public Management (NPM) philosophy (see Hood, 1991) has in many western countries resulted in an arrangement of back offices of organizations whose goals do not necessarily overlap (Hamburg and Bekkers, 2002). NPM has, among other things, resulted in the breaking-down of large organizations into networks of relatively autonomous organizations, and many policy processes are therefore fragmented over several administrative organizations in “stove pipes” and “islands” because organizations in networks are often unwilling to comply with arrangements that may not be designed to suit them (Pfeffer and Salancik, 1978). The introduction of managerial processes and behavior from the private sector has had several positive effects (see e.g. Box 1999). But, as described by Allan et al. (2001), digital government requires more coordination than “traditional” policy areas in public institutions. The fact that governments are divided into competing institutions within and between the three different levels outlined above limits the policy makers’ ability to get bureaucrats to work together to promote e-government innovations (West, 2004), just as the individual institutions must work via a complex tissue of cooperation involving many different acting entities (Traunmüller and Wimmer, 2003). The results have so far been that complex bureaucratic maze has been duplicated on the web, where institutional web sites serve to perpetuate their own mission and do little to enhance responsiveness or citizens’ participation (Davis, 1999).

These interoperability challenges are further deteriorated by the complex goal structure and the strict legal norms that public institutions must work under delivering services to business and citizens, securing transparency, etc. (Traunmüller and Wimmer, 2003). Unlike most private enterprises, government institutions often spend much of their time fending off challenges from rival institutions (wanting to take some of their turf), coping with the criticism from the media and interest groups, and trying to win or maintain political support (Wilson, 1989). Debates over where (at state, regional or local level) and what public institutions should do and how they should do it are continuous, and the maintenance of support is a never-ending, time-consuming process. In contrast to a private head of a business, who refer to the board of directors and is judged and rewarded on the basis of the firm’s bottom line, the head of a public institution is often judged and rewarded on the basis of appearance of success because their goals are often vague, multidimensional or simply difficult to achieve, and the progress toward their realization is hard to assess (Ibid).

## **2.2 Different architecture disciplines and enterprise architecture**

Enterprise architecture is not an entirely new discipline in IS. As pointed out by Pääväranta and Opdahl (2003) the often broad definitions of information systems architecture have close relations to traditional concepts in the IS literature, like Information Resource Management (Nolan 1973; Nolan 1977; Nolan 1979), Information Architecture or Enterprise Information

#### **4th European Conference on e-Government**

Architecture (Cook 1996) and Strategic Information Systems Planning (Ward and Peppard 2002) because EA addresses the current and planned totality of information systems (Hirschheim et al., 1995). Furthermore, there exist different architecture disciplines like software architectures, hardware architectures, network architectures and system architectures that confuse the meaning of “architecture”. While e.g. software architecture describes the layout of the software modules and the connections and relationships among them, hardware architecture can describe how the hardware components are organized (Armour et al., 1999). The term “architecture” can therefore have a range of meanings, goals, and abstraction levels, depending on the discipline speaking about it. A typical EA, however, encompasses an overview of the entire information systems – including software and hardware. In this sense, EA is a multidimensional discipline with an extensive scope that needs to cover a wide variety of viewpoints, deliverables, and processes across the whole enterprise. A fully articulated architecture constitutes enterprise architecture: the integration of business, data, information, and technology into a coherent whole (Boar, 1999).

The idea of having an information systems architecture to manage and coordinate information systems in an enterprise has been around since 1987 when John Zachman first proposed the idea and conceived a series of frameworks that would help model them. Inspired by Boar (1999) *this paper defines EA as an information systems architecture approach with a series of architectural concepts, principles, guidelines, drawings, standards, and rules which guide an institution through acquiring, outsourcing, integrating, building, modifying, operating and retiring IT resources throughout an enterprise.* In e-government terms, EA is about creating the support over time, which governments and government institutions need to foster the ability to align the institution’s business strategy, IT strategy, and individual programs and projects. In this way, information systems architecture is a manifestation of IT strategy. The goal is to improve efficiency and services through shared infrastructure and services and improved application and data interoperability.

Several approaches exist for documenting an EA, ranging from the Zachman Framework mentioned above; the Federal Enterprise Architecture Framework (FEAF) in the USA; and a number of major consulting organizations with proprietary frameworks. These frameworks differ in their nomenclatures and modelling approach, but they consistently provide for defining an enterprise’s operations in both (1) logical terms, such as interrelated business processes and business rules, information needs and flows, and work locations and users, and (2) technical terms, such as hardware, software, data, communications, and security attributes and performance standards. Although frameworks may differ in some of their descriptive techniques, they all focus on the necessity of integrating a business model with technology, information, and data models that support it. Architecture is a disciplined approach to understanding how components of an enterprise communicate, change, and function together as a whole. The frameworks also provide for defining these perspectives both for the enterprise’s current or “as-is” environment and for its target or “to-be” environment, as well as a transition plan for moving from the “as-is” to the “to-be” environment. Enterprise Architecture does not assume “centrality of control”, but does talk about strong governance and managerial ways of dealing with drifting (Chorafas, 2002).

In Europe little effort has been made by public institutions in implementing such frameworks and very few departments are exploiting their business processes to the minimum extend required to institute the change necessary to realize the benefits of EA. Today, almost every department has its own architecture (conceptualised or not) with a countless number of overlapping systems, bundles of duplicate data and inconsistent presentation to the customer. As Zachman has stated “this is an accident of how technology has matured rather than particularly the fault of a department, individual or supplier” (zifa.com).

In the next section some of the interoperability challenges that governments are facing at different levels are briefly sketched out from an EA perspective and EA is used as an information systems architecture to outline an initial framework for managing IT in government. The main argument is that EA, and information systems architectures in general, are poorly understood and managed in public institutions and e-Government research, at a time where

governments and government institutions in Europe are transforming their traditional service-delivery channels and internal operations by an intensive use of IT and communication technology. EA has been a lost realm in e-government practice and research, lost between organization-level approaches to strategic IS planning and IT management and technology-level approaches to enterprise computing. The goal of the proposed EA initiatives is the articulation of all levels of a public institution, integrating the strategic and business processes with the technology and data systems that enable them.

### **3. The interoperability challenges in government – Laying the foundation for a framework for managing IT in government at different levels**

According to a recent international report published by the consultancy company, Accenture (2003) on e-government leadership, one of the largest challenges in developing an efficient and service-oriented e-government is creating interoperability between IT-systems and business processes across institutional borders in government. As it was pointed out above, public sectors in Europe are today organized in “stove pipes” and “islands” where both business processes and IT-systems have been developed to support a single public institution and little attempt has been made to support the exchange of data and the sharing of information and knowledge across IT-systems and business processes. There is very little reuse of data and functionality and each institution therefore develops their own specific work routines and IT-systems. The challenge of creating interoperability between systems arise because there is no overall coordination of the different e-government initiatives in the “stove pipes” and because different institutions, in sectors or on their own, often have no immediate incentives or opportunities of sharing data and functionality with other institutions.

The challenge here is to ‘re-write the rules’ for how government institutions use EA as an information systems architecture to work internally, interact with their customers (citizens and businesses) and use IT to increase productivity by making business transactions easier to carry out. In this section, the challenges of managing IT in government institutions are briefly examined from an EA perspective and an initial framework for dealing with these issues in the research project is outlined.

#### **3.1 The different enterprise architecture levels of government**

As we saw in section 2.1, institutions within and across the different levels of government - local, regional and national - have different agendas and there is a complex mixture of cooperation and conflict between public institutions with multifaceted goal structures. In EA terms it is therefore challenging to define what the “enterprise” is in a governmental context.

The EA literature typically defines the enterprise as the planning and management of IT in a single organization – small companies as well as large enterprises (see e.g. Chorafas, 2002, Boar, 1999 or Spewak, 1992). In this sense, the management of all kinds of technologies in public institutions at all levels constitutes enterprises on their own as defined in the “traditional” EA literature. However, individual public institution at state, regional and local level might at the same time be part of other enterprises at a higher level in government, just as all government enterprises are also part of the overall national enterprise.

The argument put forward here is that managing IT in government with different levels of enterprises creates some interoperability challenges that are unique to the public sector. At the national level there is rarely a transparent overview over the different e-government initiatives at the federal level, and at the regional and local level there is hardly any (West, 2004). And similarly, different areas of government often lack an overall coordination of their specific area and it is therefore up to the different institutions in the sector to coordinate between each other on a bilateral basis (Bellamy and Taylor, 1994). The argument is that the different enterprise levels in the public sector challenge the traditional EA literature and calls for a multi-level approach to EA. The public sector and the IT-management in public institutions is different from managing private enterprises due to the complex goal structure and the coordination challenges summarized in section 2.1.

In order to place the civilian and business needs at the centre of attention and overcome some of the coordination challenges that are generated through this arrangement, the different enterprise levels must start with a business process perspective that often cut across the traditional levels in government. The different EA levels in government may well be organized in accordance with the traditional state, regional and local categorization. But while the EA ambition is to integrate strategic and business processes with technology and data in one enterprise (Boar, 1999) – governments must do the same across different enterprise levels.

To reach this goal, (at least) three levels in a government are defined below where there is a need for an integration of business processes with technology and data though the use of EA on both logical and technical terms:

- **The national level:** At the national level, the enterprise represents all of government, and all public institutions at state, regional and local level must therefore be included in the EA management effort.
- **The sector level:** At sector levels, e.g. the health care sector, a group of public institutions across the different governmental levels constitute the enterprise that must be managed from a business process perspective focusing on the customers via EA.
- **The institutional level:** At institutional level each institution represents its own enterprise at the state, regional and local level with their own EA guidelines. An institution is de-facto part of the national level, while it can be part of one or many sectors.

The ambition with the introduction of a national level EA that explicitly includes all government institutions and the EA sector focus on business processes that span stat, regional and local institutions, is to use the multi level EA approach to facilitates a better management of e-government initiatives across the different national levels. Coordinating according to principles and the overall business processes in government should help coordinate some of the interoperability problems that arise when there are not well defined standards and guidelines describing the way in which public institutions interact with each other at the state, regional and local level.

### **3.2 Towards a government wide enterprise architecture – Outlining a framework for managing IT in government**

To overcome some of the challenges mentioned above, governments must introduce new ways of coordinating the IT management at the different levels of government. As we have seen, one of the largest challenges in many governments today, is that government is an organization of organizations with both willing and warring federations across several units and inside each unit. Because there is often a lack of governance and coordination between the different levels in government and little have been done to support the exchange of data and the sharing of information and knowledge across IT-systems and business processes, individual e-government projects today have no national, sector, or institutional guide lines to guide them through projects and they are consequently carried out with no consideration to the overall objectives of the national e-government strategy<sup>2</sup>. The challenge here, however, entails more than just comparing different information systems architecture frameworks in different public institutions against each other on a bilateral basis. The process involves a rigorous research program that analyses the planning, development, and implementation of different architecture frameworks and longitudinally follows their life cycle from the formulation of as-is realities to to-be states (Bellman, 2003). The framework outlined below should therefore only be seen as an initial attempt to guide the use of EA as an information systems architecture approach to the management of information systems in government institutions that incorporates organizational as well as semantic and technological issues. In this way, the framework is not an attempt to create a new EA approach like the Zachman framework or the definition of specific EA work products, but a pragmatic framework for the coordination of different e-government initiatives across government.

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<sup>2</sup> See e.g. the Bonnerup-report for a Danish illustration of this lack of coordination (Teknologirådet, 2001).

Using EA in government can help coordinate business strategy, IT strategy, and individual programs and projects in public institutions through a high-level principle driven approach, which leaves room for the bottom-up autonomy that is also a prerequisite for creating new and innovative e-government solutions (cf. Eriksén et al. 2003). To reach this goal the three enterprise-levels outlined above must be taken into consideration and different types of interoperability have to be included in a framework representing different challenges for government institutions. The European Interoperability Framework under the IDA program in EU (see europa.eu.int) outlines three types of interoperability in their definition of interoperability in the eEurope 2005 Action Plan that must be considered at the different EA-levels in government:

- **Organizational interoperability:** The coordination and alignment of business processes and information that span both intra and inter-organizational boundaries.
- **Semantic interoperability:** Ensuring that the precise meaning of exchanged information is understandable by any application or person receiving the data.
- **Technical interoperability:** The technical issues of connecting information systems for the exchange of data or functionality.

The overall objective with the European Interoperability Framework is similar to the traditional EA ambitions: the integration of business, data, information, and technology into a consistent whole. What the EU-framework adds to the traditional EA literature is the multi-level approach that spans all government institutions. By creating interoperability guidelines across the traditional organizational boundaries government institutions, with different internal organization for their operation, can collaborate to make services available, findable, accessible and user oriented while the precise meaning of exchanged information and issues of linking up IT systems and services is secured.

The framework outlined in table 1 on the next page combines the different EA levels outlined in section 3.1 with a principle driven business processes focus and the different interoperability types facilitating the sharing of knowledge, information and data.

**Table 1:** An initial framework for managing IT in government

	<b>Organizational Interoperability</b>	<b>Semantic Interoperability</b>	<b>Technical Interoperability</b>
National level	Streamlining horizontal layered business processes that are common (maybe even consistent) across all public institutions	General agreement upon data definitions across all of government via a common global information model	Agreement on technical standards used and sharing of common services and high-level infrastructure components
Sector level	Coordinate the business processes that span entire sectors (with consideration to national principles)	A sector specific information model including common metadata (with consideration to national principles)	Sector specific technical standards and common services and infrastructure components (with consideration to national principles)
Institutional level	Internal streamlining of business processes (with consideration to national and sector principles)	Institutional specific information models (with consideration to national and sector principles)	Agreement upon standards for the institution (with consideration to national and sector principles)

The suggested framework for managing IT in government in table 1 is not a top-down centralized approach. It could at first glance seem appealing to call for centralized control and top-down management in the EA governance model like many private enterprises and some government enterprises, such as the US Department of Homeland Security, have championed. But this would be a dangerous move forward in government at large. As noted by Allen et al. (2001), governments should not make misguided pleas for decentralizing planning and decision making, and go against the trends in e.g. the NPM philosophy, but rather frame new types of collaborative mechanisms.

#### **4th European Conference on e-Government**

The idea here is that government institutions should not just consider their “own architecture” when developing new e-government initiatives. The individual institutions in government must comply with the general EA guidelines for organizational, semantic and technical interoperability on the national level, and act in accordance with the guidelines laid out by the sector (or sectors) that they are a part of. Working within the framework outlined, government institutions must see themselves as “sub-suppliers” or “service-providers” at the technology as well as the semantic and organizational-levels.

Achieving the EA vision in a single public institution is a huge challenge on its own (Spewak, 1992), and the introduction of the framework above should therefore be seen as an initial attempt to integrate the business models with technology and different information models that span government institutions. The model does not call for a “big-bang” reorganization of the way government or government institutions manage IT today and it is not another EA framework with specific architectural products. The ambition has been to establish a tentative framework on the basis of the information systems management theory and institutional theory from political science to understand and guide the management of IT in government institutions at different levels.

#### **4. Conclusion**

In this paper, theory from information systems management in IS and institutional theory from political science was used to present the first deliberations on a framework for the management of IT at different levels of government. The paper illustrates the limitations in the traditional EA literature on the use of information systems architecture in private enterprises to capture the dynamic interaction between individual institutions in government, and called for a multi-dimensional EA approach in government focusing on the integration of business processes with data and technology.

e-Government research in IS has mainly focused on the interaction between governmental institutions and citizens, while the interdependence and interoperability challenges across institutions in government to a large extent has been neglected. This paper argues that there is a need for further research in the area of strategy and planning, and more emphasis must therefore be put on business strategy and information systems architecture. Public administrators and politicians now expect public administration to be as efficient and effective as the private sector and we must therefore find an integrated architecture approach that goes beyond IT and incorporates all relevant business aspects of the public sector when implementing e-government initiatives.

Still needed is a comprehensive theoretical foundation for the use of EA to manage IT in government institutions at different levels and best practices and lessons to be learnt on the existing use of EA in governmental and private institutions. Institutional theory from political science and IS theory must be combined to understand the logic of managing IT in the public sector, while the successful private sector experiences with the use of EA must be used to grasp the benefits of using EA to manage IT-resources.

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