Enhancing the e-Governance model: Enterprise Architecture as a potential methodology to build a holistic framework

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ABSTRACT

The State has substantially evolved over the past decades. Global phenomena, such as globalization, liberalization and cultural changes, challenge the State to face pertinent changes. More than ever, technology influences and will influence public participation and political mobilization in the future. Our paper is structured into four sections. In the first section, the paper describes our approach towards e-Governance in the framework of State transformation. The second section will point out current definitions and conceptualizations of enterprise architecture (EA) and related frameworks. The explorative third part will on the one hand highlight the potential, EA offers for e-Governance, and on the other hand it will critically examine the approach of putting EA into service for e-Governance. Part four is composed of a complementary perspective to the input of EA. Our paper is thus a contribution to a better understanding of how e-Governance is not only part of, but moreover actively shapes the transformation of the State, government, and public administration. The purpose of this paper is to enhance e-Governance theory towards a general implementation methodology.

Keywords: e-Governance, enterprise architecture (EA), Zachman Framework, TOGAF, DoDAF

1. THE e-GOVERNANCE MODEL

Within the following first chapter, we are going to briefly outline our understanding of the e-Governance phenomenon. We have conceptualized three major dimensions, which we build our e-Governance model on.

Information (and) technology as key drivers of State transformation

The transfer and exchange of information is more important than ever, whereby the development of the internet in the 1980´s was the key driver of such evolution. The revolution of information processing technologies has changed the way societies are being run to an extent, such that federal and private organizations became unconditionally dependent on them. [1] More than ever, technology influences the participation of private actors in public institutional frameworks and will have an essential impact on political mobilization of society in the future.

In the past, the State and its administration was more or less accepted by society. Businesses were running great, profits reached ever increasing margins and taxes were being paid smoothly

Anybody took care of administrative or government related processes, except the standard must-have permission or declaration procedures. However, this has changed. The dot-com hype vanished and globalization came up with its more unpleasant side. A global regression and a market consolidation in almost every business sector urged society and government to react. A very turbulent and downstream oriented economy heavily questioned State-run governance mechanisms and public policy systems. Second to none, information technology, represented by the internet, enables the actors in society and industry to critically asses the role and functionality of governments and administration. Initiated by industry and driven by societal pressures, the State is more then ever forced to apply standard economic methodologies such as process reengineering or outsourcing. Information and technology are forcing governments and administration to challenge their own structures and procedures.

The State transformation, which is about to take place is what we consider as e-Governance. In the following paragraph, we conceptualize the pressures on the public sectors as we perceive them.

Emerging Pressures on government and public administration

Basically, we identify three main challenges, the State is confronted with: operations, regulation and policy making. [2]

The private sector is increasingly challenged with cost-cutting initiatives and is target of performance improvement measures. Economic pressures and deficit budgets force the public sector to improve operational effectiveness and efficiency. Research on information processing technologies has contributed powerful tools to drive the process optimization in public organization, either internal or external processes. Web based technologies enabled administration and government to significantly reduce efforts and costs. However, the current development is too often focused on the transformation of existing processes instead of implementing reengineered procedures, which are aligned with the requirements of the public organization and the powerful capabilities of information technology.

Global competition in almost every industry and concentration on innovation require little administrative burdens for entrepreneurs aiming at creating value for industry and society. Next to the business model itself, the role of State and public administration of setting up rules and regulations for companies is one of the most crucial success factors of ventures.

The processing of regulatory functions is the second challenge, the public sector is confronted with. The ICTs so far have not been discovered profoundly enough to evaluate the impact they have on regulatory systems. Governments and public administration are currently discovering the role information technologies play in managing (de)regulation of their intra-societal and industrial relations.

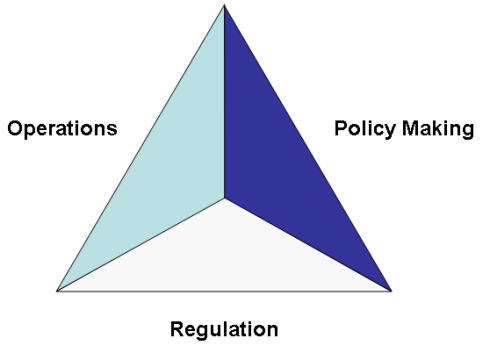

Figure 1: Pressures on the public sector

Thirdly, governments and administration are confronted with the question of how to shape the political system according to multi-dimensional requirements of various groups of interest. In general, government primarily focuses on differentiating its policy making process from its political opponents and secondly focuses the maintenance of power throughout multiple legislation periods. The increasing influence of information (and) technology on policy making procedures is currently not well researched. However, the public sector starts discovering the potential, which information technology has to influence and finally change traditional patterns of campaigning and opinion making procedures. At the moment, electronic voting practices are examined. Although it is only the translation of existing voting practices into means of digital media, the public sector has recognized the variety of opportunities, technology offers for information gathering, processing and distribution.

The magnitude of e-Governance

To summarize the e-Governance phenomenon, the following paragraph outlines the magnitude of e-Governance in the global economic and political system.

As mentioned before, the fundamental redefinition of the State's main functions is more likely than ever. Current developments demonstrate that services, formerly provided by government and authorities, are increasingly processed by private or third sector actors. This is what we call e-Governance. It takes place from local to global, above national levels. [3] To a lesser extent, but nevertheless, the State's policy making and regulation responsibilities are affected as well. Globalization results in fundamental constraints, which conflict with the demands a State has to manage from a below-national level. The State tries to integrate non-State actors in governmental processes; e.g. policy-making. Formerly government owned functions are given away to private and third sector actors, which links back to careful regulation. [2]

Our e-Governance model takes into account four major dimensions, which we consider as necessary to describe the transformation process of State. Each dimension is split up into an individual spectrum. The model offers a framework to assess the state of transformation for governments and administration.

In detail, we interpret the four dimensions of the e-Governance model as follows.

LEVEL: Level describes on the one hand the area (local, national, trans-national) in which State transformation is taking place. On the other hand, Level describes the extent to which State transformation is taking place: e.g. are there only procedural changes or do the implemented e-Governance measures reengineer the organization as a whole.

ACTOR: On each level, actors built up their areas of influence. There are key actors having taken care of policy and decision making, while the regulatory dimension is disregarded.

FUNCTION: Our model sharply separates three functions: *service-delivery*, *policy-making* and *regulation*. Each function can be found on each level and can be fulfilled by each actor.

TECHNOLOGY: ICT so far has had and in the future will have a huge impact on the fabrication of a State's functions. From our point of view, ICT will be one of the major drivers for State transformation.

On a more graphical basis, the e-Governance model looks as follows.

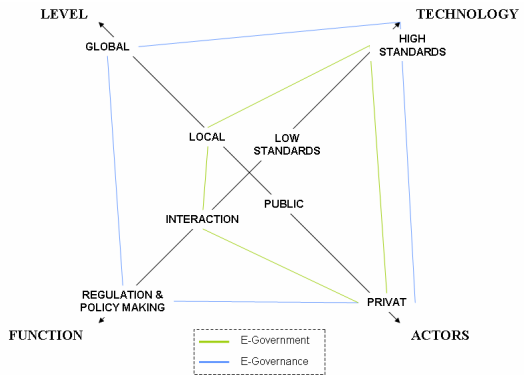

Figure 2: The e-Governance model

With the e-Governance model in mind, the purpose of the following paragraph is to explore various frameworks in Enterprise Architecture. The paper aims at examining to which extent EA might me an appropriate methodology to foster e-Governance development.

2. ENTERPRISE ARCHITECTURE FRAMEWORKS

The research community discovered EA for the first time, when Zachman introduced his framework for information system architecture in 1987. [4]

EA is complex in nature. Depending on the definition, an *enterprise* can be regarded as 'a unit of economic organization' or even as 'a systematic purposeful activity'. *Architecture* is defined as the 'art or practice of designing and building structures'. It is 'a method or style of building' [5]. Consequently *EA* is a body, dealing with methodologies and styles of designing purposeful activities.

Sounding dynamic and innovative the term 'enterprise architecture' is used in various contexts. According to Zachman, some people refer to EA as logical; others state it is conceptual or physical. It was also named to be principles as well as requirements.

To settle the resulting confusion, Zachman defined EA as being

> the set of primitive, descriptive artefacts that constitute the knowledge infrastructure of the enterprise. It is purely structural. [6]

According to this definition at the first place, EA simply means to document a knowledge infrastructure, regardless of how this goal is achieved. An other definition supporting that view was stated by West et al., where EA is seen as a

> ”blueprint” that documents all the information systems within the enterprise, their relationships, and how they interact to fulfil the enterprise’s mission. [7]

To sum it up, the original meaning of EA is simply the idea of documenting processes and cross-level dependencies that exist in an enterprise. It does not state anything about the way the processing should be done. Nor does EA, as the pure process, result in any changes in the way an organization is operated.

Within the following chapter, we briefly describe the ideas and outline the key elements of EA, by examining exemplary EA frameworks. In doing so, we aim at evaluating the applicability of EA to e-Governance development.

The Zachman Framework

The basic principle of the Zachman Framework is the alignment of an organization’s processes, structures and objectives. The framework is a ‘*logical structure for classifying and organizing the descriptive representations of an enterprise that are significant to the management of the enterprise as well as to the enterprise’s system*’ [8].

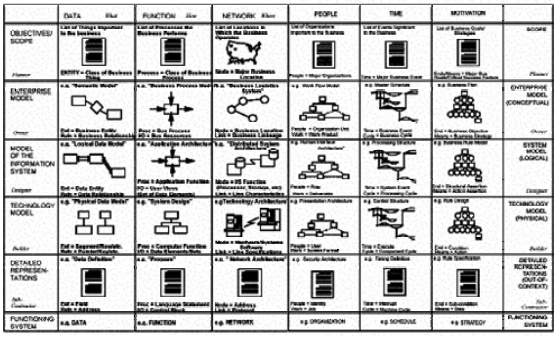

Figure 3: The Zachman Framework (source: zifa.com)

The Zachman framework is composed of two dimensions, which are both, comprehensive and primitive.

The horizontal dimension is comprehensive in the way it distinguishes an issue from the six linguistic interrogatives: *Who*, *What*, *Where*, *When*, *Why* and *How*. Moreover, it is primitive, because once a problem was analyzed from these six perspectives; it can not be fragmented any further. The vertical dimension contains an extensive set of perspectives, which are relevant to analyze complex entities. Within the framework, the perspectives are necessary to place the entities into context. Again, the vertical dimension of the framework is comprehensive and easy to outline.

To describe the content of the different cells, many names have been used in the past. The framework intends to address each potential issue in an EA process.

However, the framework should not result in different piles of paper; cells should have concrete relationships to other cells in the matrix. Goals of business processes should relate to corporate goals and strategies.

In parallel, the underlying technical architecture should support the functioning of those processes as well. [8]

The framework is not dependent on determined subjects. It can be applied to any complex system, in order to map relationships between the networked entities. No matter if the relation is on a meta or on a basic level. [9] Consequently, the Zachman Framework is a means to study and describe intangible subjects. It enables a focused in-depth-analysis without getting lost in details and without loosing the awareness of interlinked entities within the same subject.

According to Zachman, EA aims at mapping and designing an organization entirely: in a horizontal and a vertical dimension. EA captures and aligns any kind of internal information and relationship, which is necessary to successfully run a *purposeful activity* named enterprise.

The Open Group Architecture Framework (TOGAF)

Within the next paragraph we are going to outline, how Enterprise Architecture is interpreted in the Open Group Architecture framework (TOGAF). The described EA is mostly oriented towards efficient information technology implementation.

The Open Group defines EA as a superior level of ‘architectures’ in general relevant to business purposes. Accepted subsets of EA are *Business Architectures*, *Data Architectures*, *Application Architectures* and *Technology Architectures*, whereby data and application architecture is commonly used as Enterprise Information System Architecture. [10]

TOGAF reflects different levels of abstraction in an architecture development process in order to facilitate the understanding and collaboration between actors at different levels. From the EA point of view, TOGAF wants to make ‘enterprise architects’ leverage relevant architectural resources and assets in developing organization-specific architectures. TOGAF is an information technology oriented architectural framework, which drives the design, evaluation and the construction of an appropriate IT architecture for an organization. [11]

Based on the business requirements, the Open Group Architecture Framework offers two major dimensions, which are a generalized *foundation of architectures* and a *methodology* to develop efficient target architectures.

- The ***foundation architecture*** is composed of a set of generic services, functions and standards, an enterprise IT architecture can be built on. It is a reference database containing best-practices and industry standards
- The ***architecture development method*** contains a technique to design and implement the organization-specific EA. The method is composed of business-related scenarios, which are linked to specialized development tools. [12]

TOGAF, as an information technology oriented EA approach, provides a common sense, easy to use and effective methodology to implement enterprise information system architecture.

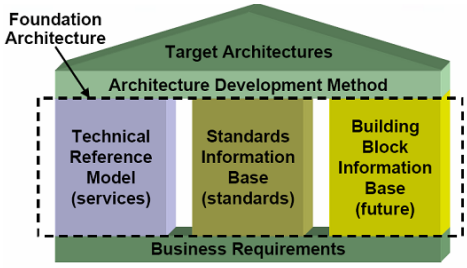

Figure 4: TOGAF [12]

According to the conceptual model, TOGAF follows its own specific architecture development method (ADM). The enterprise architect starts implementing the EA by setting up the foundation architecture.

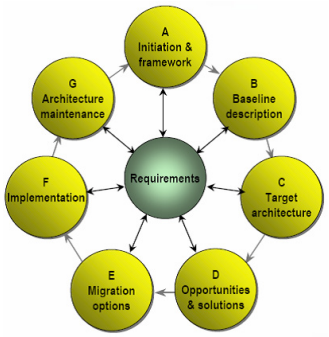

Figure 5: The architecture development method [12]

The different phases of the ADM result in a reusable organization specific architecture. The ADM cycle is followed multiple times in order to iterate to the most effective EA. [12]

In summary, TOGAF aims at providing a practical, standardized methodology of implementing successful EA to organizations. TOGAF offers a set of methods and tools for developing a broad range of IT architectures.

The DoD Architecture Framework (DoDAF)

The following paragraphs describe the DoD Architecture Framework as the last one of our three sample EA frameworks.

The DoD Integrated Architecture Panel describes architecture as '*the structure of components, their relationships, and the principles and guidelines governing their design and evolution over time.*' [13] According to the definition of the U.S. Department of Defence (DoD), the architecture framework defines a common approach to conceptualize the development, presentation and integration for both, war fighting operations and business operations and processes. The framework aims at providing a unified language to communicate through organizational processes and intra- and international boundaries. According to a private sector analysis, the DoD Architecture Framework targets the integration of command, control, communications, computers, intelligence, surveillance and reconnaissance. The architecture framework is used to support planning, decision making and execution processes. [14]

Basically, the DoDAF is a methodology enabling interactions and interoperations of individual architectures. The DoD defines four major views of architecture, which are required to describe complete architectures.

OPERATIONAL VIEW:	The OV identifies the needs for implementing an architecture framework and documents the approach of how to implement.
SYSTEMS VIEW:	The SV relates existing and future systems and physical interconnections that support the operational view.
TECHNICAL STANDARDS:	The TSV describes standard system parts or components and their interconnection. The view aims at providing the SV with technological details.
ALL VIEW:	The AV represents the overarching aspects of architecture, that relate to all three of the views. It enhances the other views by providing overview-level information.

In addition to the views, the DoD architecture framework defines products, which are those items (text, graphics, tables) describing characteristics pertinent to the purpose of the architecture. Different products may have relationships under each other. The products are directly linked to the views. A view is composed of different products. Products are aimed at representing specific information and templates. [15] To distinguish views and products, it is important to note that an architecture view is something different than an architecture product. While the view is a specific perspective on an already existing architecture, an architecture product is the specific representation of an aspect of that architecture. A view consists of one or more products.

To describe DoD architecture frameworks, common practice is to talk about *integrated architectures*. If in one view products and their constituent architecture data elements are the same as architecture data elements referenced in another view, the regarded EA is *integrated*. Integrated architectures have integrated Operational, Systems and Technical Standards views. They can clarify roles, boundaries and interfaces between components of large systems of systems.

The DoD architecture framework is composed of four major guidelines for architecture development.

- **Directives** provide a set of principles and guidance for building architecture complying with the architecture as a whole.
- **High level processes** explain the method of using the architecture framework.
- **Architecture data** and **architecture tools** foster the development and implementation of efficient architecture frameworks.
- Detailed **product descriptions**.

In summary, the DoD architecture framework provides a critical mechanism for understanding operational concepts and their relation to capabilities, anticipating changes in operational concepts or changes in automated capabilities. [16]

3. FROM ENTERPRISE ARCHITECTURE TO AN e-GOVERNANCE FRAMEWORK

In this section of the paper, we aim at discussing how existing EA frameworks can foster the development and enhancement of our e-Governance model.

A summary on EA frameworks from an e-Governance perspective

From our point of view, EA frameworks (EAF) aim at providing general approaches to capture, (re-) design, enhance and implement complex intra- and inter-organizational complexities. These complexities can either mean the alignment of corporate strategy and information systems or the alignment of business processes and strategy. [8] EAFs are used to implement information and communication means, which enable various actors in multiple hierarchical and functional levels to 'talk to each other in a common language'. Moreover EAF support organizations' planning, decision-making and execution processes. [16]

Regarding the exploitability of EAF towards an e-Governance framework, we so far concluded the following.

- The *Zachman Framework*'s philosophy of fragmenting a complexity from a hierarchical top-down perspective, while fragmenting the same complexity by the six linguistic interrogatives, is very similar to the requirements of e-Governance. Our understanding of State transformation by information (and) technology goes far beyond the pure translation of existing processes into technology driven alternatives. We distinguish various dimensions, which have to be examined from different perspectives. They are related and dependent on each other due to their common goals. The *Zachman framework* enables a focused in depth study of complexities, which is equally required in e-Governance analysis.
- The *Open Group Architecture Framework* (TOGAF) mainly focuses the implementation of efficient information system architecture. The separation of different architectures and multiple levels of abstraction are also required within an e-Governance framework. Regulation, Service-Delivery and Policy Making differentiate in the architectural set-up. To conceptualize a potential e-Governance framework, case databases as well as an efficient analysis, design and implementation methodology are absolutely required

The DoDAF offers a good methodology to capture, (re-) design and implement organizational complexities. System interoperability and communication are the key success factors of that EAF. For e-Governance architecture development, it is likewise.

Towards an e-Governance framework

From our point of view, e-Government, as we observe it today, is an important, but not the final step towards State transformation. It will generate dynamics, nobody can foresee at the moment. Enterprise architecture frameworks, as evaluated before, more or less address occurring dynamics in complex systems. EA as a whole provides fundamental advice to manage those institutional complexities. According to theory, an EA framework serves as starting point, project guidance and project management instance for architectural analysis and reengineering of organizational bodies.

We conceptualize the basis of our e-Governance framework using a two level hierarchy.

- The *top level layer* spans a two dimensional vector space, which is composed of **STATE TRANSFORMATION** and **TECHNOLOGY**. The vector space itself is subdivided into specific views.
- The *second level layer* spans a four dimensional vector space. We call each dimension a driver. The four drivers of the vector space represent the four dimensions of our e-Governance model.

This two-layer approach allows us to distinguish between architecture set-up and architecture implementation. We have defined a 2x2 matrix (namely 'e-Gov Matrix').

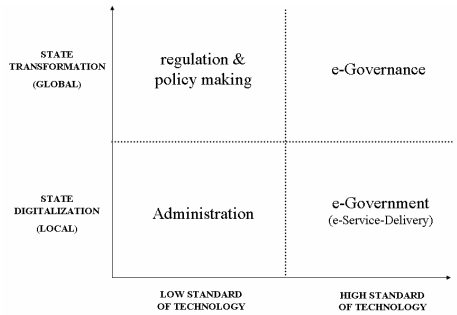

Figure 6: The e-Gov Matrix

The e-Gov Matrix is based on various case studies of e-Governance implementation initiatives. Our research resulted in the following assumptions.

- Current activities in the domain of e-Governance are primary technology-driven and target the improvement of internal and external processes, without following the 'big architectural picture' of transformation.
- Although e-Governance strategies are formulated, the implementation of e-Governance lacks the holistic architectural approach. Consequently, well-structured approaches do disappear due to changing political and administrative environments or simply due to very long lasting, non-vision project lifecycles.
- Each sub-domain of e-Governance, namely electronic Regulation, Service-Delivery and Policy making, must be regarded as a specific architecture, which is part of the overall architectural e-Governance framework. The sub-domains are linked and dependent on each other.

The e-Gov Matrix considers the *rules* of EA, which is aligning goals and objectives of a purposeful activity with the processes and structures of large organisations. The framework, we propose, consists of two dimensions: *State transformation* and *technology*.

STATE TRANSF.: The role of the State is shifting. In the past, the State was seen as a huge administrative body. In the future, the State will only focus on regulatory and policy making functions. To take a more business-related terminology, the State will have to manage and supervise a variety of public services offered and processed by private and public organizations.

TECHNOLOGY: Information and communication technology (ICT) is the major means for enabling State transformation. Federal organizations adapt to the changing ICTs and discover new forms of collaborative problem solving.

In summary, we consider the e-Gov Matrix, as the *top level layer* of our e-Governance framework, as a potential starting point for architectural analysis. Each of the quadrants represents another 'view' on e-Governance.

Complementary to the matrix, the *second level layer* of our framework, the four dimensions of the e-Governance model provide guidance for architecture implementation. While the e-Gov Matrix globally positions an e-Governance initiative within the overall framework, LEVEL, ACTOR, FUNCTION and TECHNOLOGY, as the core 'drivers' of the second layer, represent a roadmap and progress indicator for architecture implementation. The second level layer takes into account the key drivers to describe the development of efficient e-Governance architectures. Each driver possesses its individual spectrum.

4. COMPLEMENTARY PERSPECTIVES TO THE INPUT OF ENTERPRISE ARCHITECTURE

EA is a methodological approach providing coverage for the multi-dimensional facets of enterprises in terms of coupling efficiently the strategic organisation level with operations' requirements. Its strength resides in the cross-cutting relationship of all these dimensions making the sustainable substance of organizations. However, we encounter deficits in the following areas, which we aim at deepening in our prospective research:

- The treatment of process implications lacks viable performance measurement. In theory, we have not been able to identify proven analysis methods to quantitatively capture results of EA implementation projects, although commercial products for cost-benefit analysis are offered on the market.
- The consideration of the organization's future development issues is covered by the strategic dimension of the EA frameworks. However, there are so far no effective anticipatory capabilities in EA frameworks.
- In terms of e-Governance enhancement, knowledge management requires to be much deeper addressed in a potential framework. Our research in the e-Governance domain has proven that governments and administrations are arguably applying EA frameworks. However, they are note able to profit from the gained Know-How within the boundaries of their organizations.

We consider EA frameworks as a rich approach to build an e-Governance framework on. We thus aim at looking for complementary approaches in EA in order to link EA methodology and e-Governance theory. From our point of view, the pinpointed EA perspective on e-Governance has resulted in a consistent screening of meaningful issues and actions. For our prospective research, we aim at building a toolbox of methodologies, from that initial starting point, to help the e-Governance scheme to become more effective - for all involved actors.

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