

Enterprise Architecture as Enabler of Organizational Agility – A Municipality Case Study

Completed Research Paper

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Abstract

Organizational agility is one of the top management concerns as organizations face today increasingly changing environments. Among enterprise architecture (EA) benefits, organizational agility has been claimed as one of them, perceived as a direct or indirect benefit, for example, through business-IT alignment, another top management concern. However, even with reasonable explanations in the EA literature, there is still a lack of empirical evidence to support such claim. Our research looks for that evidence seeking to understand how the development and use of EA may contribute for organizational agility. Having one of the biggest municipalities in the country as the research setting, using a mix-methods approach, a case study was carried out to identify EA artefacts, understand EA at use and examine agility in a specific change situation. In this case, enterprise architecture was not just used but was developed and improved during the change situation to enable organizational agility.

Keywords

Enterprise Architecture, Change, Agility, Alignment, Case Study, Local Government.

Introduction

The economic situation lived in the last years led usually stable organizations to review their way of operating, and nowadays forces them to suffer major transformations if they want to survive in this volatile environment. Organizations need to be more efficient and prepared to deal with organizational changes. Government agencies, and specifically, local public administrations, are no exception. For these organizations there is a constant strive for better serving citizens and improve internal efficiency, while keeping up with the continuous ever-changing city environment and social context. Besides, competence transfers from Portuguese central administration to local administrations have brought to the last ones more responsibilities, more legislation, and the need for more capabilities in answering citizens' demands. Information Technology (IT) plays more and more an important role to facilitate the integration and management of different parts of the organization, enabling them to pursue a common business strategy and achieve organizational objectives. However, the alignment of business and IT is not easy to achieve and sustain.

The alignment between business and information technology remains a top management concern for researchers and practitioners (Obitiz and Babu 2009; Tallon and Pinsonneault 2011; Tamm et al. 2011). A way of achieving alignment is through the development and use of enterprise architecture (EA). Every organization will benefit from the use of enterprise architecture in different ways, but Tamm et al. (2011) consider that, those undergoing greater rates of organizational change will feel these benefits more strongly.

Organizational agility is perceived as an outcome or a benefit of alignment (Sessions 2007; Tallon and Pinsonneault 2011). From the perspective of the senior-most IT leader in the last Society of Information Management (SIM) IT Trends Study, looking at the top 10 IT management concerns of most importance to the organization, alignment of IT with the Business ranked number one while Business Agility ranked number two, clearly stating the importance of achieving and maintaining alignment while dealing with change in increasingly dynamic environments (Kappelman et al. 2013). If the use of an EA is proved to enable alignment, presumably it will also allow the organization to be more adaptive, while still working effectively (Obitz and Babu 2009), and to anticipate future changes in order to be ready for them (PriceWaterHouseCoopers 2008).

Academic activity in EA area has been almost exclusively related to applied aspects such as how to plan and represent it. What are the benefits of EA for an organization? Why are they important and useful? These questions need to be studied and supported by empirical evidence going beyond exploratory studies where benefits are presented as claims or deductions (Lange et al. 2012; Tamm et al. 2011). A study on the contribution that EA can give to organizational agility is required and so, a case study research at a Portuguese municipality was undertaken with the following research question: How does Enterprise Architecture enable organizational agility in local government? This research was guided by two objectives: the first, to understand the Enterprise Architecture at use in the municipality; the second, to examine the contribution of Enterprise Architecture to organizational agility in a change situation.

The case study was carried out using a mixed-methods approach for more reliable and comparable results resorting to document analysis, interviews and questionnaires for data collection and content analysis to go over the collected data.

Enterprise Architecture and Organizational Agility

Starting in the 80's with the influential work of John Zachman at IBM to address the increasing complexity of IS implementations (Zachman 1987), subsequent extensions and refinements to that work moving from an IS to a business focus and terminology (Zachman 2011) culminated in one of the most recognized frameworks for enterprise architecture, the Zachman Framework, while contributing to the establishment of the enterprise architecture concept.

As an organizing logic, the enterprise architecture provides a broad and long-term view of business processes, systems and technologies in the organization (Ross et al. 2006). This holistic view of the enterprise is one of the most important characteristics of an enterprise architecture, defined as “a coherent set of principles, methods, and models that are used in the design and realization of an enterprise's organizational structure, business processes, information systems, and infrastructure” (Lankhorst 2013 p. 3).

Although organizations are evermore recurring to EA as a means of achieving better business-IT alignment, agility, improved decision making, improved communication and cost reduction (Tamm et al. 2011), there is still a lack of empirical studies to evaluate the success or impact EA has on organizations (Espinosa et al. 2011).

This study looks into organizational agility as a benefit from the development and use of enterprise architecture. Organizational agility may be described as “the ability to move quickly in new directions as needed without breaking the core infrastructure and without putting the organization at undue risk” (PriceWaterHouseCoopers 2008). Being agile means being highly competent at change (Dove 1994) with agility dimensions such as cost, time, quality and scope (Dove 1996) or customer agility, partnering agility and operational agility to take into consideration (Sambamurthy et al. 2003).

Many studies present organizational agility as a direct or indirect benefit of EA, and in some cases, agility is perceived as a result of organizational alignment, which in turn is a result of EA. Some authors (Espinosa et al. 2011; Lange et al. 2012; Tallon and Pinsonneault 2011; Tamm et al. 2011) have already developed frameworks that provide a relation between EA and organizational agility but all of these still need to be empirically studied and validated. Although none of these frameworks was specifically chosen for this study, a main idea was retrieved from these authors' works: the connection between enterprise architecture and business-IT alignment and consequently between business-IT alignment and organizational agility.

Study Phases

To better understand the linkage between EA and organizational agility, a municipality dealing with ever-growing responsibilities and changes in regulations was chosen as a suitable research context. More specifically, the study was conducted inquiring 50 employees at the Information Systems Department (ISD) of that municipality. Since ISD is cross-functional, changes in the ISD are likely to affect the entire organization.

The study was held in three sequential phases as presented in Figure 1. For each phase, tools were developed for data collection having in mind the defined objectives and required data to move on to the following phase.

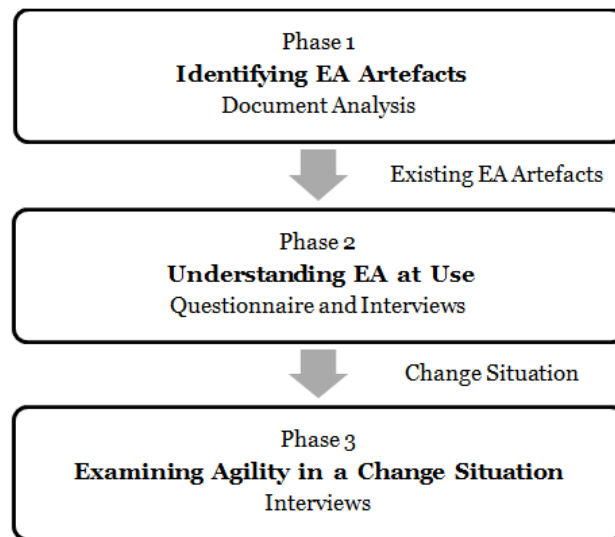


Figure 1 - Study phases

Phase 1 addresses the first objective, whilst phases 2 and 3 address the second objective of this study. Even though phase 1 was the identification of EA artefacts, new elements that could be added to the existing EA were continuously sought throughout the study.

The reason for using a mixed-methods approach comes from the necessity to achieve comparative results that can be validated and combined, facilitating triangulation. A questionnaire was developed to be answered by all the ISD employees and a structured interview was developed to be carried out with high-level managers, most of them from the ISD. This allowed to get more complete information on the subject by contrasting answers (Hartley 1994).

Phase 3 concerns the detailed study of a change situation, the introduction of a new information systems management tool (MIS tool), in order to understand the role of EA in enabling organizational agility. To analyze the change situation, we could mainly count on the assessment of employees that were involved or directly affected by that situation since documentation was scarce and incomplete. Therefore, individual interviews were done to those involved.

Identifying Enterprise Architecture Artefacts (Phase 1)

Identifying the existing EA artefacts was necessary to later understand how they were used in practice and how they contributed to organizational agility. An artefact is a document or work product that describes an aspect of the architecture (The Open Group 2009).

Artefacts search was performed in two existing intranet portals. These two portals contained all the organizational documentation openly available within the organization with a special emphasis on the

Macro Processes – a document where all the main processes are represented and described, providing a process oriented view of the organization.

Document analysis was used to identify existing EA artefacts available in the organization and map them to different EA domains. Which different domains to consider may be still a question for research (Winter and Fischer 2006), but the development and widespread use of The Open Group Architecture Framework (TOGAF), one of the most well-known frameworks, make it a standard using four architecture domains for an enterprise architecture (The Open Group 2009): Business, Data, Application and Technology Architectures. Using this standard, the artefacts were identified and categorized as presented in Figure 2.

Business Architecture	Data Architecture	Application Architecture	Technology Architecture
Mission	Conceptual, Logical and Physical	Application Catalog	Hardware Documentation
Vision	Data Models	Application Components	Software Documentation
Strategic Goals		Application Services	
Values			
Management Policy			
Organogram			
Services			
Macro Processes			
Processes			
BSC			
Project Portfolio			

Figure 2 – Existing EA artefacts in the Municipality

Artefacts categorization made possible to get a better understanding on how the organization is covering EA. Business Architecture is the best-represented domain showing that great importance is given to business strategy in the organization. The other three domains do not have much available documentation that can be associated with EA but are currently being addressed with the ISD help.

Some of these artefacts were then selected to use in the Phase 2 of the study according to their relevance within the organization. Relevance was attributed based on the perception obtained by observation of everyday work and by level of importance given to those artefacts in the intranet portals.

Understanding Enterprise Architecture at Use (Phase 2)

After identifying and categorizing the different existing artefacts, a deep understanding of their utilization and impact on organizational agility was needed. To do this, a questionnaire and an interview were prepared. During the development of the research instruments for data collection, special attention was given to complex concepts that study participants could not easily understand making an adaptation of some concepts to the ones used in the organization.

The questionnaire was developed to understand the knowledge employees had of existing EA artefacts, the use employees make of different artefacts and the employees’ perceptions of the organization in terms of business-IT alignment.

Open and closed questions were developed according to the data sought. To understand the knowledge employees had of the existing EA artefacts, a 5-point Likert scale was presented to indicate how well the respondents knew the artefacts ranging from 1 – I do not know it, to 5 – Know it very well. To understand the use given to each artefact, respondents were asked to indicate the frequency of usage and illustrative situations of use for each presented artefact in an open question. Finally, several questions related with

the perception employees have of the organization were prepared. This perception was measured by the perceived work alignment between organizational units, and goals alignment with the business strategy to understand the level of alignment within the organization, perceived agility and technology adequacy. These themes are associated with the impact of EA in an organization. For each topic, several sentences were presented and respondents had to answer in a 5-point Likert scale indicating their level of agreement with each sentence ranging from 1- 'Totally disagree' to 5 – 'Totally agree'. The questionnaire, created in a Google form, was made available to the 50 ISD employees, getting a total of 26 answers. Respondents were informed that confidentiality and anonymity would be assured.

Questionnaire answers were divided according to the respondent's function in the organization: management and operations, respectively, providing six and twenty answers. Average values for the questionnaire answers were then confronted with the interviewees' answers.

Interviews were carried out to have a broad view of the knowledge and usage given to the EA artefacts by management personnel and to identify a recent change situation. These interviews allowed for a more in-depth study of how EA appeared in the organization, how it has been developed, how it is used and how it has been useful in change situations. The interview was developed based on the Enterprise Architecture Value Framework (EAVF) (Plessius et al. 2012), a questionnaire that we translated from Dutch to Portuguese, the respondents' native language. Some questions were adapted to fit the research objectives whilst others were created. Besides, the EAVF structure was also adapted leading to a semi-structured interview that started addressing the development of the current EA, continued with the benefits and impact of that EA and the utilization of the EA, and finished with the understanding of EA usefulness in change situations. This last section intended to identify a recent change situation within the organization that could be studied in further detail during Phase 3. Interview was made to seven managers because they are the ones more involved in the process of developing and maintaining an EA. They were from the ISD and two other organizational units.

Interviews were recorded, transcribed and coded for further data analysis. Topic coding (Richards 2009) was used, meaning that topics were allocated to passages, labelling text according to its subject. Each segment of text was then analyzed within its subject and compared with other segments to filter important statements that could be used to support or refute questionnaire answers as well as to get a better understanding of enterprise architecture use.

Enterprise Architecture Development

According to interviewees, the last major change in EA occurred one year ago for the reorganization of macro processes, but the development of EA in the organization began in 2002 when a few reorganizations took place leading to the creation of the Information Systems Department (ISD). That was a very important step for the development of the current EA.

EA evolution has been very strategy oriented particularly focused on the Business Architecture domain while the remaining architecture domains have been left behind.

Enterprise Architecture Impact and Benefits

Introducing EA in the organization led to several transformations that interviewees considered useful and beneficial because *"...this architecture methodically arranged the existing models or parts of models. The greatest change was the creation of global procedures that every employee can consult, access, and see how things are done. (...) We now have a set of documents that allows any employee to understand what is done in other services. This was the great step but there is still a lot to be done."* In fact, EA has been leading the organization to show more agility but a lot still needs to be done. Respondents mainly consider agility in its scope and time dimensions, which is not enough.

Another important aspect this study was concerned with was alignment. How do employees perceive organizational alignment and how is that translated throughout the organization, so it can lead to organizational agility? Interview participants expressed their opinion on Business-IT alignment: *"I would say it (EA) accentuated the importance and need that the model will function best if the technology is the business lever in a coherent way. Otherwise it is a very bureaucratic model (...). It has to be agile and the Information Systems department has a very important role highlighting the need for having tools*

that enable process flow.” But also highlighted that “IS must act and make the structure more agile in a cross-functional way; when we have a very compartmentalized structure, some IS steps do not portray or adapt to the defined structure.”

When asked about alignment, technology adequacy and organizational agility, questionnaire respondents attributed the lowest scores to some sentences associated with work alignment and technology as presented in Table 1 such as: “I know the work performed at other units” for the Work Alignment theme which got the lowest global average score or “I am satisfied with the technology I use daily to perform my job” if the Technology theme is considered, but at the same time, one sentence on each category received some of the highest scores, which is the case of “I understand the work performed at my unit” for the Work Alignment theme and “I understand the role technology has on my job”. This last sentence even got a 5 average score for employees with management functions.

		Management (Mgmt.) and Operations (Ops.) Averages		
Theme	Sentence	Mgmt.	Ops.	Global
Work Alignment	I understand the work performed at my unit.	4,5	4,0	4,1
	I know the work performed at other units.	3,5	3,1	3,2
	I understand the relation between my unit and others	4,5	3,8	4,0
Technology	I understand the role technology has on my work.	5,0	4,7	4,7
	I am satisfied with the technology I use daily to perform my job.	4,2	3,8	3,9
	The technology I use is suitable to perform my job.	4,3	3,8	3,9

Table 1 - Work Alignment and Technology

For Goals Alignment and Agility themes, scores were generally high and even as can be seen in Table 2. This leads to the conclusion that agility and alignment within the ISD does not seem to be a problem but, when considering the entire organization, attention should be paid to the lack of alignment between units that can impede organizational agility.

These results were supported by interviewees’ answers. When it came to Work Alignment, the lowest scores related with the relation with other organizational units, can be justified by the fact that “*every area’s competence and functions are compartmentalized*” preventing inter units communication and separating functions that could provide a better service working together. As another participant puts it: “*When unilateral decisions are taken in each unit, it is difficult for the Information Systems department to align applications and tools with different needs*”. This last transcription can also justify the low scores in the technology theme as not totally adequate to perform daily tasks.

For interview participants, the agility concept was clearly related with its time dimension since interviewees considered “*the Municipality is at a reasonable agility level when it comes to meeting deadlines*”. Participants exploited other agility dimensions in the third phase of the study.

Management (Mgmt.) and
Operations (Ops.) Averages

Theme	Sentence	Mgmt.	Ops.	Global
Goals Alignment	I understand the role my job has to attain the unit's goals.	4,7	4,3	4,4
	I understand the role my job has, knowing that when I achieve my unit's goals I am contributing to achieve the organizational goals.	4,3	4,0	4,1
Agility	I do my work within the expected time.	4,0	4,2	4,2
	The work I do has quality. Responds to required demands.	4,5	4,5	4,5
	I easily adapt to unexpected situations.	4,5	4,4	4,4
	My job allows me to be flexible to adapt when a change situation occurs.	4,3	4,1	4,2

Table 2 - Goals Alignment and Agility

Enterprise Architecture Use

Having a defined EA is important but how it translates into everyday use is even more relevant. One aspect studied in this phase was the knowledge and utilization of the existing EA artefacts. Average values from answers about the knowledge the respondents have of the selected artefacts are presented in Table 3.

Artefact	Average		
	Mgmt.	Ops.	Global
Mission	4,2	3,5	3,7
Vision	4,2	3,4	3,5
Strategic Goals	4,0	3,3	3,4
Values	4,2	3,4	3,5
Services	4,2	3,7	3,8
Management Policy	3,7	3,2	3,3
Organogram	4,8	4,0	4,2
Macro Processes	3,3	2,7	2,9
Unit Processes	4,5	3,5	3,7
Unit BSC	4,0	3,1	3,3
Unit Project Portfolio	4,5	3,4	3,7

Table 3 - EA artefacts knowledge

When asked about the frequency of use for each artefact, many answers led to the conclusion that most of the artefacts were rarely used with the exception of the Municipality organogram which is used to “do strategic analysis and quality actions” or to “articulate meetings, proceedings and tasks from all over the organization” just to name some of the situations.

For almost every artefact, answers such as “use when something changes”, “use when solicited” or “not needed to do my job” were given indicating that the existing artefacts, although important to communicate the business strategy and define organizational processes, are not relevant on an everyday basis supporting the conclusion that the other EA domains should be improved. This would result in a more aligned, agile and communicative organization with an EA that could have a positive impact on everyday work.

Enterprise Architecture in Change Situations

The final part of this phase concerns change situations at the organization and the identification of one recent change situation to be studied in greater detail in the last phase.

Agility is not only concerned with being fast, having quality, low costs and scope. An agile organization needs to prepare and anticipate change. According to the respondents' perspective, *"This municipality has anticipated change many times by implementing projects or innovative solutions with the intention to create change but we are more concerned with innovation than with being ready for change"*, which can translate into an organization that is concerned with improving itself as was perceivable studying one of the proposed change situations.

Interviews identified five possibilities for a recent change situation. To be chosen, the situation had to be recent, it had to involve the ISD and it had to have had some impact on the organization. After analyzing the various situations with the ISD director to understand the implications and impacts each one had on ISD as well as on the rest of the organization, the implementation of the MIStool was chosen.

Examining Agility in a Change Situation (Phase 3)

The final phase of the project intended to study how the existing EA was used during the implementation of a new information systems management tool – MIStool, and how it helped the organization to be agile in the implementation process, minimizing costs and the effects on everyday operations. MIStool is mainly used by the ISD helpdesk service to solve technical, hardware, software, applications and other requests from the entire organization, which has around 2500 employees.

Besides analyzing some documentation produced throughout the selected situation and the observation of the MIStool functioning, a semi-structured interview was prepared. Since Phase 3 concerns the study of a specific change situation lived by the interviewees, the objective was for each participant to tell his/her version of the facts focusing on some aspects such as how they did their work before MIStool, during and after its implementation, sources of information available before and after MIStool, and the benefits and impact MIStool has had on the organization. Answers were also transcribed and coded using topic coding.

Interviews were made to eight people involved or affected by the implementation of this new tool. Interviewees included directors, chiefs and operational personnel that felt firsthand the impact of MIStool when it was implemented. From all the interviewees, one was the director of another organizational unit. The choice to interview at least one person from another unit was made to avoid biasing results since it was necessary to also understand the impact MIStool from other organizational units' perspective besides ISD.

Implementation of the MIStool started in 2009 when the ISD was *"messy. Requests came by telephone and e-mail, each employee solved problems when needed but no execution time or any other indicator was measured. Clients were unhappy and no one coordinated the service."* Interviewees also revealed that a lack of communication and knowledge existed as well as artefacts that would be useful in making this an agile service. This lack of organization captured managers' attention leading them to find a solution: *"We wanted to restructure the all unit and so started to look around for good national and international practices... such as ITIL (Information Technology Infrastructure Library), an international reference (...) for public and private organizations."*

As revealed in the first phase of this study, the Business Architecture domain was the best covered among the four architecture domains. Data, Application and Technology Architecture domains were poorly documented and thus of little help for the MIStool implementation. As pointed out in one of the interviews, *"We have a large number of servers and applications that have to communicate, and a lot of these things are not documented"*. EA artefacts at the information systems level were clearly missing: *"Nothing was documented and there was no easy way of knowing each unit software requisites and what was necessary to implement or configure. No knowledge sharing was happening among technicians."*

If we cannot talk about an agile implementation, at least the MIStool implementation turned out to be a way of improving and generating EA artefacts for architecture domains clearly at stake in information systems implementations: *"MIStool is forcing us to discover and register a lot of things that exist only in*

people's heads. When this registering process is complete, we will have great knowledge of the entire organization and its application scheme, both at the technological and services level, which we do not have at the moment."

The MIStool implementation allowed the ISD to improve agility in IT service management, now that "Every incident and service requests are catalogued, has a determined treatment group, and has defined SLAs, specific answer times and an associated workflow." ISD service quality has also improved since "technicians are better prepared because they follow a procedure and a set of tasks". Costs have also been reduced "because as our knowledge on systems increases we realize that certain situations can be solved in a cheaper way".

Overall, the impact of MIS tool implementation was regarded as clearly positive. As agility at the ISD improved having employees performing now a better job and being more agile in satisfying requests, so improved the municipality agility in providing better service level to citizens' demands.

Conclusion

This work described a case study that took place at a big municipality to understand EA use and assess if EA does in fact enable organizational agility as suggested in the literature (Hoogervorst 2004; Tamm et al. 2011). Document analysis, questionnaires, interviews and observations were used in a mixed-methods approach for data collection through three phases using quantitative and qualitative analysis of questionnaire data as well as content analysis of interviews.

In the first phase of the case study, EA artefacts were identified at the municipality. Taking Business, Data, Application and Technology as four commonly accepted architecture domains for EA, the majority of the existing artefacts were categorized in the business architecture domain making it the best covered one. The other architecture domains have been left behind and the lack of artefacts was noticeable.

The second phase was used to validate the importance of the identified artefacts, understand employees' perception of organizational alignment, agility, communication and technology, and to assess the use employees make of EA artefacts, as well as identify a recent change situation to be studied in the last phase. Results showed that many of the existing artefacts, even though known by employees, were rarely used. It seems EA still as a long way to go before it can become an effective practice.

The last phase of this study revealed the most interesting results for the purpose of this project. After understanding in detail what the change situation was and understanding the influence EA had on the organization to overcome it, the main conclusion reached is that, in the case of this municipality, EA was not quite the enabler of organizational agility to face a change situation, but rather the change situation forced the organization to improve its EA and consequently become a more agile organization. It was more the development than the use of EA to work as enabler of organizational agility. Improvements in Data, Application and Technology domains of EA were noticeable and had a great impact on service quality, cost reduction, duplicate elimination and reutilization. As argued by Farwick et al. (2012), projects are fundamental drivers of architecture change and Information Systems projects can act, in fact, as triggers of EA management as a result of change events.

Results presented reveal that the organization still needs to continue developing its EA, with a particular attention to Data, Application and Technology domains to enable greater agility. Any public administration looking to strive and prepare for organizational change requires data, applications and technology models to provide a holistic view of the organization in a business context. Business-IT alignment seems to be central to enable agility and EA is a way of achieving that alignment. Having an effective EA practice will of paramount importance but other challenges lie ahead now that the municipality is planning for a business intelligence project (Yu et al. 2012).

These results are relevant for practitioners such as enterprise architects and managers to whom empirical studies support the importance of EA to achieve organizational agility; for academic researchers, it is one more step to advance knowledge regarding EA benefits, namely, in what concerns the development and use of enterprise architecture as enabler of organizational agility.

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