Enterprise architecture in public ICT procurement in Finland

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Abstract. The use of Enterprise Architecture (EA) as a tool to achieve interoperable information systems and efficient public administration processes has advanced in several countries. In Finland the use of EA in public organizations has been made mandatory in recent years. While the outcomes of the Finnish national enterprise architecture (NEA) cannot be studied yet, we analyzed publicly available requests for proposals (RFP) in order to gain insight on the current state of NEA usage. Our aim was to find out, how the EA methodology is present in the procurement documents. By using a conceptual framework from software architectures we were able to show that while the EA methodology can be used in different roles in the course of public procurement, it is still rarely present.

Keywords. Enterprise Architecture, public procurement, interoperability

Introduction

Currently much of the public talk on public administration focuses on the efficiency of the public sector. This is driven by the economic crisis, socio-economic challenges such as increasing unemployment rate, and globalization. In this context, information technologies are seen as tools to improve public sector efficiency [7].

Enterprise architecture (EA) has been mentioned as a tool for achieving alignment between business operations and ICT systems that support them [14]. Yet the term enterprise architecture lacks a commonly shared definition [14,15]. While it is typically used to describe a holistic view organization, encompassing the business objectives, the term *architecture* itself originates from engineering and technology [34]. This connotes more towards ICT systems and their interoperability.

EA has been proposed to be used also in the public sector [8], [10], [27]. The goal there has often been to improve the efficiency and achieve inter-organizational compatibility [6,7], [11], [13]. This is also the case in Finland, where the use of National Enterprise Architecture (NEA) has been enforced by using legislation. Finland is one of the few countries that have chosen normative usage of Enterprise Architecture [8], while other countries, for example the Netherlands and Norway have chosen a more lenient approach on the usage of EA frameworks [13], [15]

While the rationale behind the usage of EA in the public sector is evident, the outputs and effects of the EA in the public sector require research [8], [13]. In this paper we investigate how the National Enterprise Architecture (NEA) is concretized, i.e. is used in the IS system implementation level. As public ICT procurement is the major means in renewing any public sector ICT we analyze public ICT procurement documents,

particularly requests for proposals. Those were selected as they play an important role in the realization of the benefits gained using the ICT. Implementing EA principles and practices should be first visible in those documents.

In this paper we will thus conduct a content analysis on the requests for proposal documents. We take this narrow starting point to a more generic level by answering following research question: "*how the Finnish national enterprise architecture can be seen in public procurement documents and in which roles or functions the EA methodology or artifacts are used?*"

1. Background

1.1. Enterprise Architecture in the Public Sector

The terms enterprise architecture (EA), national enterprise architecture (NEA) or government architecture (GA) terms are used[1] to describe the design principles that encompass processes, information and information systems used in the public sector [14]. Yet the concepts are ambiguous [13] as there are no generally accepted definitions for terms architecture [34] or enterprise architecture exists [13].

The enterprise architecture covers the organization's *current* architecture, *future* architecture, and *transition* plan between the phases [1]. Other terms used in this sense are as-is or baseline architecture for the current state and to-be or target architecture for the future state [35]. The architecture descriptions can be divided by the hierarchical level [29], where lower level descriptions add more details. Important term are also *target architecture*, which describes the architecture from organization's viewpoints [35]. *Reference model* or *reference architecture* on the other hand refers to "an abstract framework for understanding significant relationships among the entities of [an] environment" [25], [27], [35].

Several reasons for use of the EA has been presented. Efficiency of the public sector is a common concern [27], as well as business-IT alignment [9]. Enterprise Architecture has been also seen a possible tool in inter-organizational projects [12]. The setting in the public sector is very much the same, as ICT seen as a tool to achieve delivery of services that require co-operation of multiple offices or public agencies [11]. Interoperability of IT Systems has been used as a rationale for adopting EA methodology in Europe and USA [10]. In the USA, EA has been the chosen approach to interoperability in the Office of Management and Budget [8], [11].

1.2. NEA as a Public Management Reform

In September 2011, Act on the Direction of Public IT Governance came into effect in Finland. The Act mandates[2] the use of an Enterprise Architecture Framework, which has to be used to describe each public sector organization's processes. Finnish Government

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[1] The usage of terms Enterprise Architecture and Government Architecture is often mixed in e-Government literature. Here we have chosen to use the term Enterprise Architecture, as Government Architecture refers to a particular implementation of EA, namely Enterprise Architecture in Public Administration.

[2] The mandate is not yet legally binding, i.e. if an organization fails to make its EA descriptions, it won't face any administrative consequences. In practice the EA description work is currently underway in every major organization.

also presented a proposal for Finnish National Enterprise Architecture (NEA), which is based on the TOGAF9 Framework.

The fact that the use of EA has been mandated by the Ministry of Finance, makes the case special. Previous studies have studied the usage of EA in public sector mainly from voluntary basis [13], [15], [27], with some exceptions [8].

In the case of federal enterprise architecture (FEA) in the USA, the use of FEA was mandated by IS budget requirements, which resulted in different patterns for adoption in the organizations. The patterns ranged from minimal compliance to a holistic transformation of business process management. It was shown that the institutional forces at macro- and micro-level were shaping the way in which FEA was taken into use in an organization [8]. In this setting the National EA can be viewed as an example of a public management reform, as the results bear a strong resemblance to the studies of reforms in the public administration [28].

1.3. Role of Architecture

The Finnish National Enterprise Architecture (NEA) consists of several functions: a methodology for EA descriptions, a set of terms and notations used in those descriptions, and a government architecture (GA) representing high-level decisions that are made in the public government[3]. Despite this ultimate objective, the documents and their terms are internally inconsistent consequently being a source for confusion [13]. This necessitates a framework for viewing the different roles of the EA.

Yet different frameworks to analyze the roles and uses of enterprise architecture are rare [30], [33], [36]. They are either very abstract, or highly detailed but very narrow focus [3], [24], [30], [36]. Here we thus adopt the conceptualization from software architectures [34].

Smolander et al. characterize software architecture metaphors by their perceptions by different stakeholders. They further suggest various uses for software architecture descriptions [34]. These resemble e.g. the work of Clerc, Lago, and van Vliet [4]. Yet it has been suggested that the EA use differs fundamentally from the use software architecture [30]. This, again, necessitates broader analysis, setting the stones for future work on understanding the EA artefact use.

There are several different groups of stakeholders in EA [23]. Those can be roughly classified as people producing EA artefacts (e.g. architects and projects), people using them (e.g. architects, projects, IT organization, and management), and people facilitating EA artefact production and usage (i.e. management) [23].

On the other hand, information systems bridge different (business) siloes and provide representations of one or more task domains [2]. This is very similar to EA products and services that represent task domains such as decision-making or communication. EA use can thus follow IS use, and be characterized by its domain, level of abstraction, and time orientation [18], [29], [34]. These factors characterize EA use, for example when making decisions about the EA target state. Similarly architectural decisions on each level of abstraction are impacted by the preceding level, and have an impact on the subsequent levels [29], [31]. Within each level and architectural type, EA guides decision-making on several other domains [29].

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[3] At the time of the writing, only high-level principles exist. The creation of the actual GA is delegated to the ministries.

1.4. Public Procurement

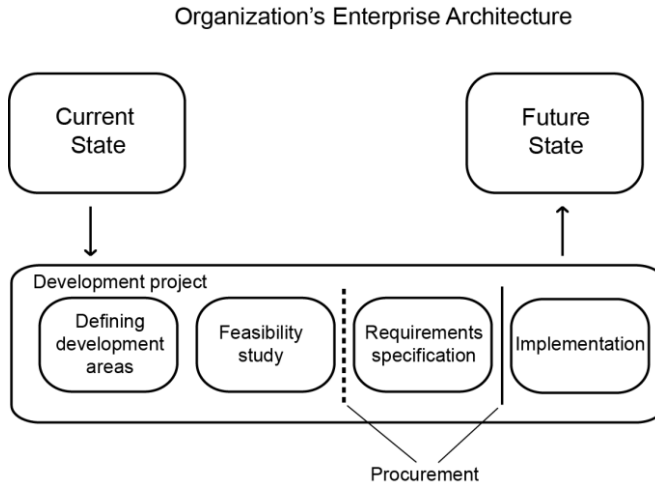Organization's Enterprise Architecture

Figure 1. The realization of Enterprise Architecture through procurement.

Public procurement is the process of acquiring goods and services to public organizations [5]. According to legislation in European Union, procurement must be done in a transparent and impartial way in the European single market [5]

Finnish government has published several recommendations on purchasing new information systems. The process follows the classic phases of problem definition, feasibility study, generating of requirement specification, and implementation phase (Figure 1). If any external resources are to be used, the procurement must be done publicly.

The call for tenders in the public procurement must contain enough information for the potential suppliers. Essential part of the call for tender is the requirements specification attached to the call for tender. Research has shown that producing the documentation for the public procurement is a demanding task. It is a difficult task to specify the requirements for an information system in an open bid [20]. The use of Enterprise Architecture has been suggested as a solution for some of the problems as the EA could harmonize information systems and thus reduce the need for producing new documentation for each procurement [22]. The recommendations of the Finnish government also recognize the role of the Enterprise Architecture in the procurement.

2. Research Methods and Data

2.1. Research setting

The Finnish public sector consists mainly of central government and municipalities. Under the central government are ministries, agencies, and regional administration. In Finland, the central governance is called *steering*, and it is divided in three different forms – steering by norms and rules, economic steering, and steering by information [26]. In inter-organizational setting, the process of co-ordination without direct authority, i.e. steering by information, is often called governance [16]. In the case of national enterprise

architecture, all three forms are used. In this research we view the introduction of national enterprise architecture as a public reform. The reform is initiated by the Ministry of Finance and mandated by the Act on the Direction of Public IT Governance.

Researching public management reforms, and its outputs and outcomes, can be tricky [28]. The effects of the reform can be hard to detect, and there is attribution problem – i.e. what has actually caused the seen effect and would it have happened even without the reform [28].

In the case of Finnish national enterprise architecture, the effects are likewise hard to detect. However, the procurement documents allow us to see some of the *outputs* of the reform across the public sector. Our claim is that, as seen in Figure 1, if the enterprise architecture really is used to increase interoperability and inter-organizational co-operation, *it has to be visible in the call for tenders*. This is because the call for tender is the definition and specification of the system to-be-implemented, and a basis for the contract made between the buyer and the supplier. No essential changes can be made to the content, or at least they are not easy to be made [5]

2.2. Research method

The research method used is content analysis [19]. The analytical construct for the research is adapted from the four metaphors for software architecture presented by Smolander et al. [34]. We have taken different roles for software architecture, and looked for the roles in the data and coded the data accordingly. The motivation for using the framework is that it enables consistent approach to reading the documents, which in turn is related to the reliability of the research [19].

The same categorization is used for all the architecture areas – business, data, information systems, and technology. The *literature* metaphor code is used, when there is a description of the current state in the request for proposal. The *decision* code is used when the high-level principles or goals are listed. The *blueprint* code is used, when the request for proposal gives detailed implementation details or instructions for the supplier. The *language* metaphor is not linked to the time or level of detail. In the analysis EA is understood and coded to be used as a language, when the EA terminology or EA methodology is being used to describe the system under procurement. We do not expect that the roles and thus codes are disjoint, or that they are the only roles for enterprise architecture in public procurement.

2.3. Data

The data used in the research was requests for proposals (RFP) from Finnish portal for public procurement, Hilma. The data was sampled during the period of October – November in years 2012 and 2013. The requests for proposals were selected by their CPV-code, in this case the CPV code division 72000000-5.

At the first stage of the analysis the RFPs were filtered based on whether they were fit for the analysis or not. Some tenders had to be discarded because their subject was not an ICT system, or they were e.g. RFPs for purchase framework arrangements or the subject of the purchase was labor. They are thus on about enterprise architectural implementation but either generic frameworks under which detailed procurements may take place, or just outsourcing some labor.

The total number of RFPs gathered was 78, 35 in year 2012 and 43 in year 2013. From those a total of 55 RFPs were analyzed (25 and 30, respectively).

3. Analysis

3.1. Enterprise Architecture as Literature

Smolander et al. describe the literature metaphor as "*documentation of technical structures that aid in transferring knowledge over time*" [34]. This can be seen in calls for tenders in the descriptions of the current processes, data models, information systems, and technologies used.

The Act on the Direction of Public IT Governance states that organizations are responsible for generating the architecture descriptions of their target architectures. If these architecture descriptions exist, they are candidates for inclusion to the request for proposals.

In the RFPs under analysis, some of them included the existing architecture descriptions. In these cases the apparent function of the descriptions were to give information about the organization's working processes, data, information systems, and technology used in the systems. From the analyzed RFPs it could be seen that a few of the organizations had made the descriptions solely for the procurement under analysis possibly in a requirements specification phase preceding the actual procurement.

As the EA framework is relatively new, only few organizations had the descriptions made in the format given in the national enterprise architecture methodology. The result of this is that the current architecture descriptions usually lack one or more of the architecture areas. Typically information systems and technology architectures are given in more detail but only in few cases the processes or data architectures were described.

3.2. Enterprise Architecture as Blueprint

In the conceptual framework the blueprint represents "*a high-level description of the system, directly guiding more detailed implementation aimed at the production of individual components.*" [34]. In the RFPs this translates to the description of the system under procurement. As the specification of the system is crucial to the procurement [21], this part was present in almost all of the analyzed RFPs.

The requirements for the system under procurement were described using NEA terminology and tools in only a few cases. In most of the cases, the descriptions were made using various notations and methods, and in quite a few cases the requirements were given in the form of excel files listing requirements one by one. In these cases one cannot say that the requirement specification is a high level description of the system, but rather a collection of border conditions the system must fulfill.

In those cases in which EA terminology was used, the advantage was that typically all different architecture areas were addressed. In the other RFPs some of the architecture areas were covered in detail, and the others very superficially. Typically either processes or systems were covered in detail, while technical architecture usually meant the versions of the operating systems and productivity tools and the data architecture was all but non-existent.

In cases where the system under procurement was used in heavily regulated processes, e.g. payrolls or accounting, the description of the system was very superficial. This may be due to the regulation, but also due to the fact that systems used in such a tasks are few in numbers in Finland and they all have the same basic functionality. However, in some cases the same approach were taken in non-regulated systems, which can lead to problems later in the project [20, 21].

3.3. Enterprise Architecture as Decision

The decision metaphor can be described as "*the process and product of decision-making concerning design tactics, strategies and associated resources*" [34]. The high-level decisions should act as steering principles, with which the goals of interoperability and compatibility should be achieved [7], [11]. As this is the actual rationale behind EA framework adoption, it is surprising to find that those decisions cannot be found in the requests for proposals. Only few RFPs included a high-level principles and guidelines of the system. Even the purpose of the system under procurement were absent in some of the RFPs, and only the detailed list of requirements were given.

In the data there were only two cases where the organization had included the organization's EA principles to the RFP. Some organizations had given policy-level principles about processes and technologies, but in most of the cases only the detailed blueprint-level was given. This leads to a situation, where the system under procurement is described only by low-level requirements, and the general purpose and environment is not described at all.

3.4. Enterprise architecture as language

"*The Language metaphor suggests that architecture enables common understanding about the system among stakeholders* [34]". In the RFPs this metaphor can be seen as architecture descriptions and images that use the terminology and notation given in the NEA documentation.

The terminology was used in 6 RFPs in 2012 (out of 25) and in 5 RFPs in 2013 (out of 30). There is surprisingly little change between years, even though the enterprise architecture work has been carried out for over two years by the end of 2013[4]. Actually, a larger share of the data gathered in the year 2012 used EA notation than in the sample taken in year 2013.

The value of the NEA language can be seen when browsing through the data. When the NEA is not used, the images are typically drawn using some kind of ad hoc notation. When the goal is common understanding, the learning and use of NEA notation might help the parties – the buyer and the supplier – to better come into a conclusion for the contents of the system.

4. Discussion

The RFPs illustrate that the literature and blueprint roles for architecture were the most commonly used. Decision was seen only in a few cases, and language in even fewer requests for proposals. Even though the terminology was seldom used, the concepts of business architecture and systems architecture were prominent in most of the RFPs.

The fact that the high-level policies were absent in the call for tenders is contradicting with the high-level objectives of EA adoption in Finnish government. The high-level objectives are to be achieved through novel usage of information systems. Their procurement is obviously a mandatory step. In this sense, the absence of policy-level architectural principles in the RFPs gives insight of the timeframe, in which the

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[4] The reform was well known in advance, and many agencies started their EA projects even before the Act was finalized and came into effect.

benefits can be realized. On the other hand, some policy-level decisions can be considered as general descriptions for the procurement. For instance, several RFPs specifically asked for web-based implementations, which are known to work in different types of computers and mobile devices.

The reasons behind the absence of EA terminology even two and a half years after the introduction of national enterprise architecture cannot be investigated using the content analysis methodology used in this research. Previous research has identified institutional patterns behind the phenomenon [8] and the immature nature of the EA integration to organizational decision-making [6].

In the few cases where the EA had been used in a language role, the resulting RFP had all the architecture areas covered at least in some detail. Thus, we argue that the EA methodology can be used as a checklist for the details to be included in the RFP. Together with the existing EA definitions (literature) it could make the making of the RFPs simpler and increase the quality of the RFPs.

The data analysis was conducted by using the framework from the software architectures [34]. Different metaphors for architecture were used in the data analysis to analyze different functions of software architecture. The existence of metaphors literature, blueprint, and language in the RFPs were evident. While the language was used in only a few RFPs, it clearly had a role in conveying the desired target state to the potential suppliers. However, the role of decision is more multi-faceted than given in [34]. The decisions may lie in every architecture area, and the decisions are made in different levels of public administration. For example, the changes introduced by the new information system typically cover department-level or organizational issues, while the top-level public reforms may change the whole way of organization. The principles governing the whole public sector are broad and their implications to practice are unclear.

Thus, we argue that in the public procurement context, the division between blueprint and decision does not grasp the different levels of abstraction. When compared to frameworks used in private sector [29], [32], the Finnish public sector has more levels than an enterprise, and the levels are not hierarchical. Typically the governance comes from national level, ministries, agencies, regional councils, municipalities, and municipal joint authorities [28]. While the administrative structures are not identical between countries, the same functions exist in western administrative culture in one form or another [28].

Second, there are major development areas that are invisible to the public procurement. Work done by the public sector's own staff or public companies does not fall under public procurement [5]. The collection of the data was systematic, but there were many major agencies, where there were no RFPs in the data gathering period.

Nevertheless, the amount of RFPs using the EA methodology and terminology was surprisingly low. One obvious explanation would be that the creation of the EA descriptions is currently underway in many organizations and the EA documentation is not ready. On the other hand, a question can be raised whether the low portion of RFPs including EA is related to the normative introduction of the EA. As Hjort-Madsen stated in his research, one of the patterns of adoption is to do the bare minimum work required to comply with the law [8]. The Finnish law dictates the creation of the EA descriptions – not their use in the practical work. This question is left to the further research.

5. Conclusions

The objective of the research was to find out how the Finnish national enterprise architecture reform can be seen in public procurement documents and in which roles or functions the EA methodology or artifacts are used.

Four architecture metaphors from software architectures were used in the research [34]. The EA was used in all four metaphors – blueprint, literature, language, and decision. In the research it was found out that the metaphors are suitable for the analysis of EA roles, but the decision metaphor does not grasp the different ways in which EA is used to describe decisions made in different levels and architecture areas.

When compared to the objectives of the EA reform, the findings are contradictory. Publicly stated objective of the EA reform is to improve efficiency using ICT tools and to achieve ICT system interoperability. However, these viewpoints are all but non-existent in the requests for proposals. If these kind of requirements are introduced after the procurement phase, the results are uncertain and, in most cases, costly. The typical lifespan of the systems under procurement is five to ten years [17], in addition to the time that the implementation and commissioning takes. Therefore we argue that currently the EA reform has not produced any rapid benefits. Neither will it do so in the near future. In order to achieve wide-spread ICT system harmonization or the usage of standard interfaces, the requirements must be set in the procurement documents. Currently they are seldom there.

On the other hand, there are many benefits that the EA methodology can offer to the public procurement of ICT systems. The existing EA documentation gives insight of the organization's processes and ICT systems (literature), it can be used to provide a holistic view of the desired future state (blueprint), and it can act as a common language between purchasing organization and suppliers (language). Perhaps even more importantly, EA descriptions can give crucial information about the benefits sought with the new ICT system (decision). Yet future research need to be made on how the decision-metaphor can be translated to the public administration, whose steering and governance principles differ from the ones used in the private sector.

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