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Katja Penttinen

The Long and Winding Road of Enterprise Architecture Implementation in the Finnish Public Sector



UNIVERSITY OF JYVÄSKYLÄ
FACULTY OF INFORMATION
TECHNOLOGY

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**The Long and Winding Road of
Enterprise Architecture Implementation
in the Finnish Public Sector**

Esitetään Jyväskylän yliopiston informaatioteknologian tiedekunnan suostumuksella
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ABSTRACT

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This thesis examines the implementation of enterprise architecture (EA) in the Finnish public sector. EA is a systematic approach for analysing, visualising, developing and governing the functions and structures of organisations. It describes how organisations businesses, information and systems function as a whole. Research and practice have shown the implementation of EA is challenging and slow to advance. Finland provides a prolific area for research since the use of EA is mandatory in public sector, which is rare amongst countries taking a whole-of-government EA approach. In order to research EA as a method for systemic change, a suitable theoretical framing was necessary. The context, content and process (CCP) model was chosen because it was developed for researching organisational change and acknowledges the substantial, temporal and contextual nature of change. In this study, a longitudinal case is described using the CCP model and the results are presented within modified CCP model that includes stakeholders. The data was collected at various time points during 2007-2017, using different methods, and analysed with a mixed methods approach. The results of the articles included in this thesis are combined as challenges of EA. A retroductive analysis was conducted to recognise the mechanisms of change influencing the Finnish EA implementation. The mechanisms are divided into supportive and unsupportive. Supportive mechanisms were common language, co-operation and co-creation. Unsupportive mechanisms were unclear goals, tight structures and fragmentation, lack of resources and support, and resistance. The results contribute to existing knowledge on implementing EA in the public sector by offering longitudinal empirical evidence that can be used by governments around the world in their whole-of-government EA efforts. Improving current understanding of the complexity and mechanisms of EA implementation in the public sector provides new insights for both research and practice for the benefit of future EA adoption.

Keywords: enterprise architecture, public sector, challenge, mechanism, longitudinal case study

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TIIVISTELMÄ (FINNISH ABSTRACT)

Penttinen, Katja

Kokonaisarkkitehtuurin käyttöönoton pitkä ja mutkikas tie Suomen julkishallinnossa

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Tämän väitöskirjatutkimuksen kohteena on kokonaisarkkitehtuurin (KA) käyttöönotto Suomen julkishallinnossa. KA on systemaattinen menetelmä organisaation toiminnan, tietojen ja järjestelmien muodostaman kokonaisuuden kuvaamiseen, hallitsemiseen ja kehittämiseen. Tutkimus ja käytäntö ovat osoittaneet, että KA-menetelmän käyttöönotto on haastavaa ja hidasta. Suomen julkishallinnon organisaatioille KA-menetelmän käyttö on pakollista lain nojalla. Vastaava velvoittavuus ei ole tyypillistä maissa, joissa KA-työtä tehdään koko julkishallinnon tasolla ja tästä syystä Suomi on hyvä tutkimuskohde. Kokonaisarkkitehtuurin tutkimiseen systeemisen muutoksen välineenä tarvittiin teoreettinen kehys. Tällaiseksi valittiin organisatorisen muutoksen tutkimiseen kehitetty kontekstin, sisällön ja prosessin huomioiva malli, joka ottaa huomioon muutoksen ajallisen ja kontekstisidonnaisen luonteen. Mallia käytetään tässä tutkimuksessa pitkittäisen tapaustutkimuksen kuvaamiseen ja tulokset esitetään sidosryhmät sisältävän mallin laajennoksen avulla. Data on kerätty useana eri ajanhetkenä vuosien 2007-2017 aikana, käyttäen useita metodeja ja analysoitu monimenetelmällisesti. Väitöskirjan artikkelien tulokset on vedetty yhteen KA-työn tärkeimmiksi haasteiksi ja retroduktiivisen analyysin avulla tunnistettiin Suomen julkishallinnon KA-käyttöönottoon vaikuttavat muutosmekanismit. Mekanismit on jaettu muutosta tukeviin ja estäviin. Tukea antavat mekanismit ovat yhteinen kieli, yhteistyö ja yhteiskehittely. Estävät mekanismit ovat epäselvät tavoitteet, tiukat rakenteet ja sirpaloituminen, resurssien ja tuen puute, ja muutosvastarinta. Väitöskirjan kontribuutio on osa tietämystä KA-käyttöönotosta julkishallinnossa. Kontribuutio muodostuu pitkittäisestä empirisestä tutkimusaineistosta, jota voidaan hyödyntää maissa, joissa tehdään KA-työtä koko julkishallinnon tasolla. Parantunut ymmärrys julkishallinnon KA-käyttöönottojen monimutkaisuudesta ja muutosmekanismeista tarjoaa uutta näkemystä hyödynnettäväksi tutkimuksessa ja käytännön KA-työssä.

Avainsanat: kokonaisarkkitehtuuri, julkinen hallinto, haaste, mekanismi, pitkittäinen tapaustutkimus

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I dedicate this thesis to my late little sister Saara, who encouraged me to pursue my own way.

Siilinjärvi 25.11.2018
Katja Penttinen

*"Life is not easy for any of us. But what of that?
We must have perseverance and above all confidence in ourselves.
We must believe that we are gifted for something and
that this thing must be attained."
-Marie Curie*

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- II Penttinen, K. & Isomäki, H. 2010. Stakeholders' Views on Government Enterprise Architecture: Strategic Goals and New Public Services. In K. N. Andersen, E. Francesconi, Å. Grönlund & T. M. van Engers (Eds.) EGOVIS 2010, Lecture Notes in Computer Science 6267, pp. 1-8.
- III Liimatainen, K., Heikkilä, J. & Seppänen, V. 2008. A framework for evaluating compliance of public service development programs with government enterprise architecture. In D. Remenyi (Ed.) ECIME 2008 Proceedings of the 2nd European Conference on Information Management and Evaluation, pp. 269-276.
- IV Seppänen, V., Heikkilä, J. & Liimatainen, K. 2009. Key issues in EA-implementation: Case study of two Finnish government agencies. In B. Hofreiter & H. Werthner (Eds.) IEEE Conference on Commerce and Enterprise Computing, pp. 114-120.
- V Seppänen, V., Penttinen, K. & Pulkkinen, M. 2018. Key issues in enterprise architecture adoption in the public sector. *The Electronic Journal of e-Government*, vol. 16, no. 1.
- VI Penttinen, K., Isomäki, H., Seppänen, V. & Tyrväinen, P. 2018. Revisiting and revising the grand challenges of public sector enterprise architecture. Revised and resubmitted to the *European Journal of Information Systems*.

I, Katja Penttinen (nee Liimatainen), was the first author of Articles II, III and VI and did the majority of the work on those articles. For Article I, the first author was responsible for the data collection; however, we both contributed to the conception and design of the research, and the data analysis and writing were a joint effort. The research presented in Article II came from the same study that was presented in Article I. I was mainly responsible for the data analysis and writing. For Article III, I was in charge of the conception and design of the research, the acquisition and analysis of the data and the writing of the article. My co-authors participated in the data analysis and contributed to the writing of the article. Article IV was a joint collaboration by all the authors. The first author was the main person responsible for the data collection. For Article V, the first author was responsible for the data collection. The first author and I jointly interpreted the data and wrote the article. For Article VI, I was in charge of the conception and design of the research, the acquisition and analysis of the data and I wrote the article. The second and third authors participated in the data collection, and all of the co-authors critically revised the scientific content.

1 INTRODUCTION

*"We cannot solve our problems with the same thinking we used when we created them."
Albert Einstein*

Today's governments function in a complex and uncertain world and face the reality of diminishing budgets, ageing citizens, technological change and globalisation. At the same time, there is a need to offer better access and better and more efficient services to citizens, companies and other governmental agencies. The drive to accomplish more with fewer resources has induced investments in information and communication technologies (ICT) to redesign internal and external processes based on the opportunities provided by technology (Andersen, Grönlund, Moe & Sein, 2005). This has led governments to invest in ambitious and costly e-government programmes to provide electronic access to government services (Peristeras & Tarabanis, 2004). The first e-government services were disjointed, and the cross-sector viewpoint and co-ordination were largely missing (Saha, 2010). The recent demand for an integrated approach forces governments to overcome silo-based structures and to promote co-operation at the different levels of government in order to develop whole-of-government strategies (OECD, 2017a).

The implementation of enterprise architecture (EA) in the Finnish public sector provides the context for this thesis. Accordingly, EA is defined as follows: EA is a systematic approach for analysing, developing and governing organisations' functions and structures, and it describes how organisations' businesses, information and systems function as a whole. EA offers structured description models to make the whole visible, manageable and understandable. (FINEA, 2017) This definition shares similarities with many EA definitions in Information Systems (IS) studies (e.g. Gregor, Hart & Martin, 2007; Kaisler, Armour & Valivullah, 2005; Lankhorst, 2005; Radeke, 2010). It needs to be noted, however, that the definition of EA is both ambiguous and varied in documentation of the Finnish national EA. The definition above was selected due to its holistic nature and resemblance to well-known definitions by researchers. Researchers of public sector EA have applied different concepts to the government-as-a-

whole EA; for example, national enterprise architecture (Janssen & Hjort-Madsen, 2007; Lemmetti & Pekkola, 2012), government enterprise architecture (Ojo, Janowski & Estevez, 2012; Peristeras & Tarabanis, 2004; Saha, 2009), and government architecture (Janssen, Flak & Sæbø, 2013).

More than a decade ago, EA was a promising planning method to provide the comprehensive and consistent guidance that fragmented e-government projects lacked. EA can be used as a business management tool that supports communication, decision-making and change management in the organisational entities under development (e.g. de Boer et al., 2005). EA explains how the elements of an organisation its systems, processes, organisations and people work together as a whole to achieve defined business objectives (Kaisler et al., 2005; Morganwalp & Sage, 2004). EA's general strengths are co-operation between different stakeholders, co-ordination, decreased overlap in development and systems, modelling and increased transparency. The general weaknesses of EA are that its use requires special skills, is time-consuming and the focus is often on planning and modelling instead of action. Unfortunately, EA programmes have not been very successful in meeting the goal set for the work (Foorthuis, Steenbergen, Brinkkemper & Bruls, 2016; Hope, Chew & Sharma, 2017; Saha, 2009). The incapability of EA to fulfil promises and the challenges of EA have been researched to some extent (Banaeianjahromi & Smolander, 2016; Bui & Levy, 2017; Dang & Pekkola, 2017b; Hauder, Roth, Schultz & Matthes, 2013; Hjort-Madsen, 2006; Kaisler and Armour, 2017). It has been argued that demonstrating the benefits of EA is difficult (Morganwalp & Sage, 2004; Niemi & Pekkola, 2016) because many of the expected benefits are indirect and intangible (Niemi, 2006). Recently, the need for EA to reinvent itself has been discussed (Janssen, 2012; Lapalme et al., 2016).

The original content of the change in the Finnish national enterprise architecture (FINEA) implementation was the advancement of interoperability in public sector. The FINEA consists of the EA method, the model for EA governance and continuous development, EA capabilities of organisations and authorities and descriptions of the common EA. FINEA implementation is the process wherein the EA method was planned, executed and institutionalised. In this thesis, the term 'FINEA implementation' is used to refer to the implementation process at the national, whole-of-government level and the term 'EA adoption' is used to refer to the organisational level adoptions. This is in accordance with Seppänen (2014), who stated that EA adoption is the process during which the EA practices are initiated, deployed and institutionalised in an organisation.

Early implementation experiences with the FINEA indicated that the work would be a tedious and complicated process, and that exactly characterises the implementation process over the past decade. The feedback for the first version of the FINEA method acknowledged the need for EA and its use as a common language and intertwining business and information technology (IT). At the same time, EA was considered as too IT oriented, bureaucratic and resource intense; moreover, the viewpoints of customers, services and demand were

missing. (Siponen, 2007) It is somewhat surprising that while many of the problems were visible from the beginning of the work, no significant changes were made to the implementation plans. Instead, EA implementation became more complicated once the municipalities were included into the EA work, and although EA was already considered overly bureaucratic, it was made compulsory by law. Even today, the structures of the government and the financing mechanisms supporting the existing structures hamper co-operative EA work. This has made it almost impossible to model the common architecture at the state level. These observations are in line with Hjort-Madsen's (2007, p. 345) view that "administrative and political changes can only be driven by IS planning innovations if the institutional settings allow it". This clearly has not been the situation in the FINEA implementation.

In 2007, at the beginning of the research process for this thesis, EA was a relatively understudied area although interest was increasing among IS researchers and practitioners. The implementation of EA in the Finnish public sector had barely started. From the outset, my research interest was in the need for a better understanding of EA adoption in real-life public sector settings and the challenges inherent in that process. At the time, there was a lack of empirical research on the subject. According to Orlikowski and Baroudi (1991), nearly 90 percent of IS research represented a single-snapshot data collection method (see also Avital, 2000; Pollock & Williams, 2009). Similarly, longitudinal research is rare in EA studies. For instance, out of 71 studies included in a recent systematic literature review on public sector EA (Dang & Pekkola, 2017a), only one was a longitudinal study. In that study, Ask and Hedström (2011) presented a longitudinal case study on the problems encountered during the development and implementation of an e-government initiative in Sweden. Additionally, two longitudinal case studies of EA in railroad companies in Switzerland (Aier, Weiss, Winter & Rytz, 2016) and the United States (Thummadi & Ocker, 2017) have been published. To my knowledge, the setting of my research is unique, since it offers a longitudinal view of EA implementation at the national level.

As Hjort-Madsen (2009) stated, extracting the most potential out of EA relies on an ability to understand the complex adoption process in public organisations. The FINEA work has been ongoing over a period of ten years and the use of EA is mandated by law, but the adoption is progressing slowly and many organisations are still reluctant to do EA work. My main interest is uncovering the mechanisms that hamper the process and those that support the EA implementation. This thesis is framed by a critical realist view of social systems, and thus the explanation for empirical phenomena is given in terms of their underlying mechanisms. Mechanisms are the capacities (properties, powers or tendencies) of real entities to bring about or prevent change in a system (Bunge, 1997). The research method is a longitudinal case study and the research questions were selected accordingly. The main research question is:

"Why is implementing EA a long and challenging task in the public sector?"

To be able to answer the question in a rigorous manner, the main question is divided into three sub-questions:

- a) How do the stakeholders perceive the EA work?
- b) How can the challenges of EA implementation be overcome?
- c) How have the challenges evolved over time?

The answers to the sub-questions are given in the articles included. The results of the articles are intertwined and a retroductive analysis is made in order to answer the main research question.

The rest of the thesis is organised as follows. The theoretical foundations are provided in Section 2. The research methodology is described in Section 3. Section 4 outlines the research case. An overview of the included articles and their interrelationship is given in Section 5. Section 6 presents the answer to the main research question and outlines the contributions and the limitations of this study, along with suggestions for future research.

2 THEORETICAL FOUNDATIONS

“As any poet knows, a system is a way of looking at the world.”
Gerald Weinberg

In this section, the central concepts are defined and the theoretical background of the thesis is presented. First, EA as a research area is described; second, the focus is narrowed to public sector EA research; and third, a model for organisational change that is used to frame the research is introduced.

2.1 Enterprise architecture as a research area

As stated in the introduction, the definition of EA used in this thesis is that of the FINEA (2017): EA is a systematic way to analyse, develop and manage organisations’ functions and structures, and it describes how organisations’ businesses, information and systems function as a whole. EA offers systematic ways to make the whole visible, manageable and understandable. However, this is not the only definition that can be found in the FINEA documentation and is a good example of the conceptual disruption of EA as a research field.

Enterprise architecture can be seen as a subfield of IS, which is a fragmented field and has no solid tradition for its problem-solving activity. The IS field has no coherent conceptual foundation or unified scientific language. Different schools of thought within different disciplines have developed different conceptual viewpoints and linguistic conventions for their own purposes (Koskinen, 2005). There are also varying schools of thought within EA. These are recognised, for example, by Lapalme (2012), Simon, Fischbach & Schoder (2013) and Rahimi, Gøtze & Møller (2017) and they differ in research focus. Researchers from different geographical backgrounds also concentrate on different areas. The IT artifact is at the core of EA research based in the United States (US) and organisational artifacts are the centre of research based in Europe

(Schelp & Winter, 2009). European research focusing on organisation and strategy is common within the IS field (Stein, Galliers & Whitley, 2016).

Different perceptions of the focus of EA research are also visible in the varying definitions of the term 'enterprise architecture' (see, for example, Lapalme, 2012; Löhe & Legner, 2014; Radeke, 2011; Rahimi et al., 2017; Schelp & Winter, 2009; Schöenherr, 2009; Simon et al., 2013). Hence, researchers of EA have different views of whether there should be a clear definition of EA. For example, it is argued that a definition of EA depends on its use and that the purpose, scope and definition are perspective-dependent and conceptually interdependent, suggesting that each instance of architecture is its own truth (Berg & Steenbergen, 2006; Hope, 2015). By contrast, others support an unambiguous definition (Lemmetti & Pekkola, 2012) or argue that when the discipline matures, one precise definition will be adopted (Boucharas, van Steenbergen, Jansen & Brinkkemper, 2010).

In practice and research, people use the term enterprise architecture both as a noun (meaning the result or outcome of an activity) and as a verb (meaning the activity that produces such a result) (Fehskens, 2015). Distinguishing between these different interpretations is important because people are often discussing different things when they use the term EA. This means that they frame differently what they think of as being the same concept (Fehskens, 2015). Ylinen and Pekkola (2018a) recognised two somewhat distinct groups of EA experts. One was modeling focused and other development focus. Both groups emphasised a comprehensive visualised and modeled view of organisation and its operations. Modeling focused experts saw the comprehensive view as a result of EA work and development focused saw it as a means of organisational development.

Some researchers differentiate between EA and EA management (EAM), where EA is defined as an enterprise's inherent structure and EAM is a management approach that helps organisations plan, develop and control their enterprise architecture (Buckl, Schweda & Mathes, 2010; Labusch & Winter, 2013; Lux, Riempp & Urbach, 2010; Radeke, 2011; Rahimi et al., 2017). Winter (2014) makes a distinction between architecture management and architecture thinking. The latter is a less formalised approach aimed at non-architects and people outside the IT function to help adopt holistic and long-term considerations and for the purposes of enterprise-wide thinking.

EA as a research area has no core topic (Dang & Pekkola, 2017) or theoretical foundation (Schöenherr, 2009). However, there are some signs that the EA field is maturing as an area of research. Kudlawicz et al. (2015) analysed EA research using Popper's scientific demarcation criteria. They stated that the area has made strides in problem formulation, use of theory, presenting solutions and testing theories. For example, Rahimi et al. (2017) suggested a taxonomy for EA management, which is one type of theory (Gregor, 2006). Traditionally, EA research has focused on meta-models, methods and frameworks (Aier, 2014; Mykhashchuk et al., 2011; Schelp & Winter, 2009; Schöenherr, 2009). At the same time, it seems that the different schools of EA research are assuming a

more explicit form. For example, Rahimi et al. (2017) mentioned a hierarchical approach and systems view of EA. Thus, there is not a coherent and unambiguous core in the EA field.

Early EA research focused on the “what”, i.e. enterprise modelling methods and notations, and little attention was paid on “how” EA is adopted to organisations (Löhe & Legner, 2014). This methodological focus is reflected in empirical research results. For example, Hope et al. (2017) conducted a case study on the critical success factors (CSFs) of EA and validated three CSFs that represent the sociological processes of EA implementation. Hope et al. (2017) were unable to validate three other CSFs that represent the technical sophistication of EA tools. They concluded that successful EA implementation perhaps depends less on what is done than on how it is done. Aier and Schelp (2010) also found support for the hypothesis that the success of EA is only partly dependent on formal EA structures and processes. Hope et al. (2017) viewed this as reflecting the most influential EA framework, the Zachman (1987) framework, which is about creating technical artifacts to produce organisational outcomes. It has been argued that EA research is strongly technology oriented and that most of the results have not proven its value or feasibility (Boucharas et al., 2010; Schöenherr, 2009).

Many IS researchers divide EA into four viewpoints: business, information, information systems and technology (Hirvonen & Pulkkinen, 2004; Hoogervorst, 2004; Jonkers et al., 2006; Kaisler et al. 2005; Lankhorst, 2005; Lemmetti & Pekkola, 2012). These four architecture viewpoints can also be found in commonly used EA models, such as the TOGAF (The TOGAF® Standard, 2018), and in public sector EA, such as the FINEA. Since EA work is not only technical, it should be a part of an organisation's planning processes, thereby creating a need for organisational and executive support and funding (Kaisler et al., 2005). At the beginning of adopting EA, each organisation should define the purpose and scope of the EA work. From the purpose and the scope emerges the definition of EA in that particular instance (Hope, 2015). Thus, the first step in building a relevant EA programme is to understand and embrace the most appropriate implementation approach for the organisation (Bui, 2015). To increase the maturity of EA practice, top management commitment, participation of business units and strong project governance are needed (Ojo et al., 2012). Shanks et al. (2018) introduce EA service capability concept that is formed from four components: EA content, EA standards, EA stakeholder participation and EA skills and knowledge. They conclude that the EA service capability should be positioned within organisation in way that it is possible to advise both IT-driven and business-driven initiatives. To reap the most benefits, it seems necessary to position the EA project within the organisation so that it will not be perceived by the stakeholders as merely an IT project. EA adoption can be seen as a social intervention into the open system of the organisational setting in which the interaction between social structures, technological conditions, key agents and influential cultural aspects occurs through the social action of planning activity.

2.2 Public sector enterprise architecture

In this subsection, we concentrate on EA in the public sector. Governments are large organisations. They can be characterised by complex structures where work is organised into silos. This easily leads to fragmented business processes and duplicated information systems and technologies, which creates obstacles for interoperability. These problems could be solved by the appropriate use of government-wide EA.

In the public sector, policymakers often initiate EA programmes to improve interoperability, enhance productivity and improve the standard of service systems (Hiekkanen et al., 2013; Hjort-Madsen, 2006; Janssen et al., 2013; Lemmetti & Pekkola, 2014). The main goal of EA is generally interoperability (Janssen, 2012). Interoperability is defined holistically in the European Interoperability Framework (EIF) as “the ability of organisations to interact towards mutually beneficial goals, involving the sharing of information and knowledge between these organisations, through the business processes they support, by means of the exchange of data between their ICT systems” (European Commission, 2017, p. 22). The EIF is an approach to the delivery of European public services in an interoperable manner. The EIF defines interoperability guidelines in the form of common principles, models and recommendations, and it includes four layers of interoperability: legal, organisational, semantic and technical. (European Commission, 2017) In practice, non-technical issues, such as cultural, human communication and human domain-specific knowledge, are barriers to achieving interoperability (Kotzé & Neaga, 2010).

EA’s focus varies from the government-as-a-whole to specific domain architectures developed for a particular organisation. There are domain architectures, for example, for e-healthcare (Kaushik & Raman, 2015), online public service provision (Tambouris, Kaliva, Liaros & Tarabanis, 2014), federated identity management (Baldoni, 2012) and cloud technology-enabled transformation (Gill, Smith, Beydoun & Sugumaran, 2014). A government-as-a-whole approach has been taken by developed countries, such as Canada, Denmark, Japan, the Netherlands and New Zealand (Christiansen & Götze, 2007; Janssen & Hjort-Madsen, 2007). Lately, there has been a rise in interest for EA in developing countries (Dang & Pekkola, 2017), for instance in Namibia (Shaanika & Iyamu, 2014), Malaysia (Bakar, Kama & Harihodin, 2016) and Vietnam (Dang & Pekkola, 2016). There are countries that have judged EA unsuitable as a government-as-a-whole method. This is the case, for example, in Sweden, where there is a high level of local autonomy and several authorities already have their own EA (Larsson, 2011). In only a few countries is the use of EA either mandatory or controlled by legislation (Liimatainen, Hoffmann & Heikkilä, 2007).

Denmark and the US are known forerunners in government EA, although its adoption has been challenging. In Denmark, the EA governance model is based on incentives and there is no legislation or regulations dictating the adoption, hence, agencies are free to design their own architecture. The Danish gov-

ernment EA focuses mainly on interoperability that would require a strong governance model, which is lacking. (Janssen & Hjort-Madsen, 2007) The EA work in the US is, at the federal level, controlled through several mandatory regulations. This, along with the encouragement of the National Association of State Chief Information Officers, has compelled US state governments to invest in EA. Twenty-four states (of 50 US state governments) have already adopted and implemented EA. (Bui, Markus & Newell, 2015) US state governments can choose which EA vendor to use, and the vendors promote at least three different ideal EA designs. The states themselves adopt and adapt the ideal designs (Bui et al., 2015). Other countries that are advanced in EA work are, for example, New Zealand and South Korea. New Zealand has federal EA and uses the e-Gif framework but does not use legislate EA governance. South Korea does well in the e-government rankings and has several laws governing the use of EA. (Saha, 2010)

The EA approach views public administration as a collection of heterogeneous organisations that have different business processes and information systems. Traditionally, EA serves above all else to ensure system interoperability, even if administrative branch-specific information systems are maintained. This is a key difference between EA in the private and public sectors. Private sector EA is often used within a single organisation. Public sector EA has a wider variety of stakeholders (Niemi, 2007), domains and diversity and this may result in more complexity than in the private sector EA (Janssen et al., 2013). EA programmes face challenges related to integration and interoperability within and between public agencies, and overcoming these challenges in government is difficult (Hjort-Madsen & Burkard, 2006). Dang and Pekkola (2017b) identified problems in EA programmes in the public sector and classified them into four groups, namely organisation, EA project teams, EA users and the EA itself. They did not identify any problems relating to technology. This is in accordance with the notion that EA is often used as a management approach in complex socio-technical settings. Often the problems related to technology are complicated and can be handled with the use of best practices and standardisation.

Government organisations have performed poorly in their EA efforts when compared to private businesses, mainly because governments invest significantly less money in EA (Foorthuis et al., 2015). Hjort-Madsen and Pries-Heje (2009) concluded that EA cannot transform government by itself. Fundamental changes will happen only if institutional forces at the micro- and macro-levels promote transformation (Hjort-Madsen, 2007). Government structures often prevent EA programmes from succeeding (Bui & Levy, 2017; Hjort-Madsen & Gøtze, 2004). Whole-of-government EA is irrelevant if it has not been implemented and used in public organisations (Janssen & Hjort-Madsen, 2007). As Janssen (2012, pp. 28-29) described, "A huge barrier to effective use of EA is the lack of understanding about how decisions are made, what processes are being implemented, and what the desired outcomes are. EA should be understandable by all stakeholders in order to make it work. The creation of a shared

vision, communication among stakeholders, and evaluation of the impact seem to be crucial aspects.”

The FINEA has also been studied by other researchers in Finland. Lemmetti and Pekkola (2012) revealed that most benefits of the FINEA concerned the strategic level, such as increasing interoperability, and that the majority of the problems were seen on the operative level, being organisation specific. According to them, EA was viewed by the public organisations as a new mandatory routine or as a new tool for achieving strategic goals of interoperability and efficiency. Poutanen (2012) presented a case study identifying the following key issues related to the use and adoption of the FINEA: unclear concept of EA, lack of common language between business and IT personnel, unclear division of work and lack of co-operation between departments. He concluded that the differences in the public organisations’ histories, cultures, knowledge and EA maturity should be taken into account during the EA adoption (Poutanen, 2012). Hiekkänen et al. (2013) argued that the adoption and application of the FINEA were still relatively immature and that the linkage between organisational decision-making and EA was missing. Lemmetti and Pekkola (2014) studied the use of EA requirements in public ICT procurement. They found a contradiction existed between the objectives of the FINEA and the requests for proposals by public administration that could lead to costlier and less interoperable ICT systems. Seppänen (2014) studied the critical success factors of EA adoption. He proposed a “3D” model consisting of determination, destination and dexterity to be used in organisations adopting EA. There is also research on the adaptation of the FINEA method (Valtonen & Leppänen, 2009; Valtonen, Seppänen & Leppänen, 2009) that has aimed at engineering an EA planning method and constructing an adaption model that can be used to support EA work. Based on a case study Ylinen and Pekkola (2018b) suggest that research should not solely focus on EA as a tool in the change initiative but instead on operational environment and underlying tensions.

2.3 Researching systemic change

Today, organisations and their utilisation of ICT evolve together, and it is senseless to examine them as separate areas. Business opportunities and administrative services also evolve in symbiosis with the possibilities provided by ICT. This leads to symbiosis in planning and operations as well, which requires holistic planning, connectedness and resilience.

Some researchers call this “a new sociotechnical reality in which social actors (humans) interact closely with digital-technological actors (information technology), while jointly controlling and managing physical-technological actors (cars, smart-buildings, machines, heating systems, lighting systems, traffic control, factories, etc)” or the so-called ‘ActorWeb’ (Magalhães & Proper 2017, p. 2). According to Junginger (2017, p. 25) the ActorWeb is a challenge “for most if not every organisation to reduce or avoid the frictions that can result when

people, digital technologies and physical realities meet". One key problem in organisations has been integrating social and technological architectures (Hope et al., 2017; Zammuto et al., 2007). This development aligns well with the traditional IS research that is "commonly constructed around the interplay of people, activities and technology, informed by theory, conducted with methods and reflective of epistemological stances. Research is also situated in a particular context or contexts." (Davison & Martinsons 2016, p. 241) There is a major gap between these types of architectures, and the IS discipline is still trying to find solutions to bridge this gap (Magalhães & Proper, 2017). Accelerating change and the crucial role of information in the digital era occurs in the systemic and semiotic interaction that is an essential part of IS research (Koskinen, 2006; Koskinen, Liimatainen & Pekkola, 2005).

There have been different holistic considerations within IS. For example, the Multiview approach consists of five viewpoints for the development of information systems: human activity system, information modelling, socio-technical system, human-computer interface and the technical system (Wood-Harper, Antill & Avison, 1985). Multiview is one of the earliest information systems architecture frameworks (Proper & Lankhorst, 2014). At the same time, several human roles, i.e. stakeholders, involved in information system development were identified by the CRIS Task Group of the IFIP working group 8.1 (Proper & Lankhorst, 2014). Ehn (1989, p. 27) urged IS researchers to "transcend the disciplinary boundaries between the natural sciences, the social sciences and the humanities". Similarly, Koskinen (2005) proposed that IS research is interested in the complex systemic dependencies between IT, organisation and institution and human beings. This systemic interaction is fundamentally semiotic: it is about the creation, use and mediation of data, information, and knowledge between human beings who use language and various technological and institutional artifacts and act as its media. This semiotic interaction penetrates the personal, social, institutional and technological spheres of IS phenomena. Koskinen (2005) also asserted that studying change that appears in this systemic and semiotic interaction is an essential part of IS research.

According to Hoogervorst (2017, p. 56), "the current practices almost exclusively focus on structures and systems and ignore culture and management behavior as crucial determinants of employee behavior and thus of enterprise performance and successful enterprise change". Based on Archer's (1995; 2013) work on a morphogenetic approach, which explained how processes of change occur for agents and social structures in emerging and complex ways, Hoogervorst (2017) proposed a morphogenic enterprise system model. The relationships within the morphogenic social system are based on language, communication, and cultural aspects. In Hoogervorst's model, two groups of people manifest human agency through their behaviour: employees and management. However, in a public sector context, the relationships between the agents cannot be simplified into two distinct categories.

To be able to research EA as a means for systemic change using the chosen critical realist research approach (see subsection 3.1 for a detailed introduction),

a suitable theoretical frame was needed. The context, content, process (CCP) model (Pettigrew, 1985) was chosen for this thesis because it was originally developed for researching organisational change. The CCP model is therefore suited to understanding the socio-political context of public sector EA. Pettigrew (1990) criticised episodic views of change for being limited to snapshot data and for not being able to provide data on the mechanisms and processes through which the change happened. In the model, the *context* is the environment in which the change takes place, and at the same time, it represents the drivers of the change (i.e. 'why' there is a need for change). It consists of inner and outer contexts. The inner context is the organisational culture and structures, and the outer context is the social, economic and political environment. The *content* is the area in which the transformation should happen; it is the purpose, objective and goals of change (i.e. 'what' is pursued). The *process* of change consists of the actions, reactions and interactions of stakeholders and the methods that are used to implement the change (i.e. 'how' the change is pursued). (Pettigrew, 1987) Consequently, understanding and evaluating the change requires a thorough understanding of each of these concepts as well as how they interact and affect each other. CCP's three concepts are broad enough to facilitate different kinds of arguments and ideas and at the same time provide parameters for reviewing them (Stockdale & Standing, 2006). In this way, the model sufficiently guides the process of data-driven analysis while also allowing interpretative space to exist for the researcher's views.

The CCP model was first introduced to IS research by Symons (1991) to investigate and analyse important elements in IS evaluation. Stockdale and Standing (2006) divided the CCP concepts further into elements of what, why, who, how and when to facilitate more precise reflections within an interpretive evaluation approach. They also added the external and internal environment of evaluation. Stockdale and Standing (2006, p. 1098) argued: "The evaluation of an IS project requires consideration of the internal organisational environment and the wider external environment. The perceived success of a system is framed by the expectations of the stakeholders. These expectations are shaped by the organisational culture." These additions to the original CCP model are well suited to the purposes of this thesis.

Finally, the CCP model is used in various studies in IS (Avgerou, 1995; Bernroider, Koch & Stix, 2013, Huerta & Sanchez, 1999; Lyytinen et al., 2009; Mondorf & Wimmer, 2017; Song & Letch, 2012, Venable et al., 2016). Additionally, the model is useful because it can be tailored to fit different research settings, depending on the environment, the research context, what is researched and the inclusion of stakeholders.

3 RESEARCH METHODOLOGY

*"The answers you get depend upon the questions you ask."
Thomas S. Kuhn*

This section presents the philosophical underpinnings and practical applications of the methodology chosen to explore the research questions. Adopting the philosophy of critical realism, a longitudinal case study was conducted. This approach has been recommended for conducting a critical realist search for causal mechanisms in IS (Wynn & Williams, 2012). Critical realist philosophy was not considered when the research was originally planned. The explanatory power of this approach emerged during the final stages of the dissertation work, and once familiar with the idea it was not possible to disregard. First, the research approach and the philosophical perspective are discussed. Second, the research method is described, followed by descriptions of the data collection and analysis.

3.1 Research approach

In recent years, critical realism (CR) has garnered the interest of IS. Often it is presented as an alternative philosophy to positivism and interpretivism, which are the major philosophical distinctions in IS (Lee & Baskerville, 2003). The fundamental distinction between these two is that interpretative researchers emphasise understanding the subjective meanings that participants assign to a given phenomenon within a specific context (Klein & Myers, 1999; Orlikowski & Baroudi, 1991; Walsham, 1993), whereas positivist researchers are concerned with the testing and predictive ability of generalisable theories about an objective reality (Chua 1986; Orlikowski & Baroudi, 1991). CR leverages elements of both and offers new approaches for developing knowledge (Wynn & Williams, 2012). CR combines a general philosophy of science with a philosophy of social science to describe an interface between the natural and social worlds (Daner-

mark, Jakobsen & Karlsson, 2002). Hence, CR simultaneously confronts the central concerns of both the natural and social sciences, and this makes CR of particular interest in the IS field (Zachariadis et al., 2010).

Critical theory derives from Kant's (1996) seminal book "Critique of Pure Reason" that was first published in 1781. In the book Kant introduces his transcendental idealism as a critical reaction to realism and rationalism. Since Kant the critical theory has developed in many strands (Mingers, 2000; Cecez-Kekmanovic, 2011). In IS field there seems to be at least two somewhat distinct research strands: critical and critical realist. These strands build on different conceptions of critical theory and therefore use different references. Critical research builds on Habermas's contribution to critical social theory. Habermas wanted to show that critical approach with a broad notion of rationality was needed to ensure society's maximal utilisation of benefits of technology (Ngwenyama, 1991). This strand of critical research in IS is promoted and further developed by several researchers (e.g. Lyytinen & Klein, 1985; Ngwenyama, 1991; Ngwenyama & Lee, 1997; Päivärinta, 2001; Myers & Klein, 2011; Young, Kuo & Myers, 2012). A narrower strand in IS research that builds on Foucault's philosophy is presented by Cecez-Kekmanovic (2011). Critical IS research and CR are critical towards different aspects. Critical research is critical towards society and culture and in IS it is an alternative to traditional functionalist and managerialist views towards understanding IS (Richardson & Robinson, 2007). CR is mainly critical towards traditional positivist worldview. Further elaboration on the differences is beyond the scope of this thesis. Next, a thorough introduction of CR approach is given.

CR was originally formulated by Bhaskar (1975). CR-based research methodologies offer opportunities to investigate complex phenomena in a holistic manner. CR approaches provide "detailed causal explanations of a given set of phenomena or events in terms of both the actors' interpretations and the structures and mechanisms that interact to produce the outcomes in question" (Wynn & Williams, 2012, p. 788). CR supports multi-level analysis; it enables looking beyond single layers of influence, such as structure or agency (Archer, 1995). Within CR, the focus is on explicitly describing causality by detailing the means or processes by which events are generated by structures, actions, and contextual conditions involved in a particular setting (Wynn & Williams, 2012).

CR asserts that reality is encountered in experience while at the same time accepting that our understanding of it is necessarily limited by our historical, cultural and linguistic situation and that our knowledge of reality is fallible (Bhaskar, 1975). CR recognises that reality manifests across three domains, the real, the actual and the empirical. Reality consists of structures, along with the powers or tendencies inherent to the components of these structures, and the interactions between them (Wynn & Williams, 2012). Research following CR focuses on answering the question of what the components and interactions within this reality must be like in order to explain the occurrence of a given set of events (Bhaskar, 1975). Next, we discuss the ontological assumptions of CR.

Basically, ontology studies the nature of being or what kinds of things exist. There is a common problem that is called *epistemic fallacy*, meaning “a failure to distinguish between ontology and epistemology or, more specifically, a translation of ontological questions (about what exists) into epistemological questions (about limitations of our knowledge of what exists)” (Mingers, 2004, p. 2) Critical realist ontology is based on the following basic assumptions: independent reality; a stratified ontology comprised of structures, mechanisms, events and experiences; emergent powers dependent upon but not reducible to lower-level powers; and an open systems perspective (Wynn & Williams, 2012).

Independent reality means that reality exists regardless of human knowledge or our ability to perceive it. The nature of reality is not easily and unproblematically comprehended, characterised, or measured and humans experience only a portion of it (Wynn & Williams, 2012). *Stratified ontology* consists of three levels: 1) the empirical level is the realm of events as we experience them; 2) the actual level where events occur whether or not we experience or interpret them; and 3) the real level, which is the level where structures and causal mechanisms exist (Figure 1). The primary goal of CR is to explain events through reference to causal mechanisms and the effects they can have throughout the three-layered reality. (Fletcher, 2017) These three levels have four ontological components: events, experiences, mechanisms and structure.

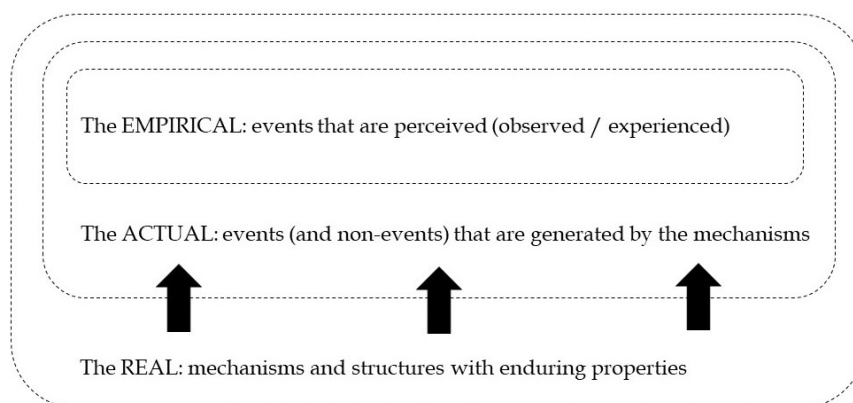


FIGURE 1 Levels of stratified ontology (adapted from Mingers, 2002, p. 299)

An *event* is a specific happening or action resulting from the enactment of one or more mechanisms (Wynn & Williams, 2012). Events have two aspects. First, they have a particular duration (a start and finish time); and second, events include an element of change. If nothing changes, there is no event, but an absence of change may be an event, if something was expected to happen but did not. (Mingers & Standing, 2017) *Experiences* are events that we are able to directly observe, and experiences are only a subset of the actual events generated in a given context (Wynn & Williams, 2012). *Mechanisms* exist at the level of the real and are ontologically independent of how they are described by observers. Mechanisms may be physical, social or conceptual and they may be observable

or unobservable. Human beings are also examples of generative mechanisms and have a whole range of often complex powers to bring about various events, some being physical while others are cognitive, emotional or creative. (Mingers & Standing 2017, p. 176) Mechanisms are inherent to structures, enabling or limiting what can happen within a given context (Sayer, 2000). *Structure* is a set of internally related objects or practices that constitute the real. Structures can be part of larger structure and may contain a number of substructures (Wynn & Williams, 2012).

According to Bhaskar (1975), social structures or mechanisms have different properties and characteristics than physical ones. Mingers and Standing (2017, p. 176) elaborated on this:

1. Social structures manifest only through the activities that they govern and through them social structures are changed and transformed. They cannot be directly observed. Social structures exist only virtually as a set of practices or roles which govern or enable social activities.
2. Social structures rely to some degree on the knowledge and understanding of social actors. Actors must be aware of what they are doing and how to do it.
3. Social structures are localised in time and space in the sense that they belong to particular cultures at particular times rather than being universal. Exceptions are only very general ones like the human ability to use tools or language.
4. Social systems are open and in principle unpredictable.

Properties of a given structure *emerge* from the interactions between the components and their causal powers. The structure cannot be defined by identifying the characteristics of the components. (Wynn & Williams, 2012) This is particularly relevant when studying social structures and phenomenon since their explanation is dependent on how the properties and various powers of human beings causally intertwine (Archer, 1995). It is important to pay attention to the chosen levels of analysis. Since CR views reality as *an open system* that cannot be controlled directly, it is not possible to design laboratory experiments as more or less closed systems (Bhaskar, 1998; Wynn & Williams, 2012). Because social systems are open without solid boundaries, it cannot be assumed that the mechanisms that were enacted in a given system at a specific time and in a particular context will generate the same events in the future (Wynn & Williams, 2012).

3.2 Research method

This thesis presents a longitudinal case study. This method was found to be suited to answering the chosen research questions. Case studies are well suited to how and why questions which can be explanatory in nature. "This is because such questions deal with operational links needing to be traced over time, ra-

ther than mere frequency or incidence” (Yin, 2003, p. 6). This research offers an evaluative perspective of FINEA implementation. According to Wynn and Williams (2012), several researchers have identified the case study method as the best approach for CR-based research. The critical realist search for causation can help in explaining social events and in suggesting practical policy recommendations to address social problems (Fletcher, 2017); hence, it is suitable for research on public sector EA.

Yin (2003, p. 13) described a case study as “A case study is an empirical inquiry that investigates a contemporary phenomenon in depth and within its real-life context, especially when the boundaries between phenomenon and context are not clearly evident”. Case study research provides a contextualised interpretation of the phenomenon of interest, and the phenomenon can be studied from the perspectives of multiple stakeholders using multiple levels of analysis (e.g. individual, organisational and state government). Other strengths of case study research are that it can be used for theory building and theory testing and the research questions can be modified in the middle of the research process. (Bhattacharjee, 2012) According to Bhattacharjee (2012), the weaknesses of case study research are its weak internal validity, the quality of the results is dependent on the researcher’s abilities and contextualisation limits the generalisations to other contexts. Wynn and Williams (2012) propose five methodological principles that can be used in conducting and evaluating CR-based case studies (Table 1).

TABLE 1 Principles of conducting and evaluating CR-based case studies

CR principle	Description of principle	Visibility in this research
Explication of Events	Events are identified and used as the foundation for understanding what really happened in the underlying phenomena.	The case and related events are described in Section 4.
Explication of Structure and Context	Components of social and physical structure, contextual environment, and relationships among them are identified.	Structure and context are explicated in subsection 4.1.
Retroduction	Identification and elaboration of powers/tendencies of structure that may have interacted in the generation of the events.	The results of the articles included in the thesis are used for retroductive analysis of causal mechanisms in Section 6.
Empirical Corroboration	Analysis and analytical validation of proposed mechanisms.	The process unfolding the events is described in subsection 4.3 and longitudinal data is used to corroborate the mechanisms described in Section 6.
Triangulation & Multimethods	Use of a variety of data types and sources and employment of multiple approaches.	Multiple data types and sources are used and analysed in various ways, as explained in subsection 3.3.

CR is not restricted to a single form of research; rather, it involves attitudes toward the purpose and practice of research. Mingers (2002) gives three explanations for this. First, CR aims at explaining why things are as they are, to hypothesise the structures and mechanisms that shape observable events. Second, CR recognises different types of objects of knowledge (material, conceptual, social and, psychological) and that each of these requires different research methods for understanding them. Third, CR recognises the inevitable fallibility of observation and the need for the researcher's awareness of the assumptions and limitation of the research. (Mingers, 2002) In accordance with the realistic evaluation model (Pawson & Tilley, 1997), CR emphasises what works and how and why policies work and in what contexts (Lewis, 2007). In this longitudinal case study research, rich empirical data gathered via various data collection techniques is used. The collection of the data is discussed next.

3.3 Data collection and analysis

This research is longitudinal and the data is collected at various time points using mixed methods. The use of mixed methods and triangulation are basic principles of CR (see Table 1, above). An overview of the different data sets is given in Table 2.

TABLE 2 Description of the data sets used in the thesis

Time	Data sets	Description	My contribution
2007-2010	Finnish enterprise architecture research (FEAR) project	Research project at the University of Jyväskylä financed by the Ministry of Finance and IT companies.	Project manager and researcher. Participated in the governance model planning subproject.
2007	First-round interviews	21 semi-structured interviews of representatives of public sector and IT companies participating in the planning project of FINEA.	Participated in the planning of the interviews and data analysis.
2008	Pilot project interviews	10 theme interviews, 5 participants from each EA pilot project.	Participated in the planning of the interviews and data analysis
2013	Survey	Online expert survey on the challenges of EA adoption. Respondents were representatives of public sector and IT companies with expert knowledge of FINEA.	Participated in the data analysis.
2017	Second round interviews	26 semi-structured follow-up interviews with the representatives of public sector and IT companies.	Participated in the planning and data collecting and analysed the data.
2006-2018	Documents	Documents produced by the government and municipalities concerning EA.	Collected and analysed documents over the years.

The data was collected and analysed using mixed methods (Table 3). The interview data was analysed with qualitative methods and the survey data with quantitative and qualitative methods. Traditionally, using multiple methods in IS research has been rare (Mingers, 2003). CR has a role in demonstrating the utility of mixed methods in IS research. The use of qualitative and quantitative research methods in conjunction can lead to achieving a systematic understanding of the relationships, structures and mechanisms constituting the material and social world. (Zachariadis, Scott & Barrett, 2010)

TABLE 3 The use of data and analysis methods in the articles of the thesis

Article no.	Data	Analysis
I	First-round interview data	An interpretive analysis
II	First-round interview data	An interpretive analysis
III	Government reports; FEAR research	An inductive analysis and construction of the framework
IV	Two EA pilot cases, interviews, reports and observations	An interpretive analysis
V	Survey on EA challenges	Principal axis factoring accompanied by qualitative data in a triangulation setting
VI	Second-round interview data	Analysis with coding framework

The results of Articles I, II and IV were based on an interpretative analysis. During the analysis an interpretation of the interviewees' utterances was carried out by iterating between the interdependent meaning of the parts and the whole that they form (Klein & Myers, 1999). In this way, the whole data was the source of the results, which reflects the various meanings that the respondents assigned to EA. In Article VI, the first-round interview data was combined with the second by generating the coding framework for an analysis of the second interviews based on the categories developed according to the first-round interview results. The aim was to explicitly address change over time in the interviewees understanding of EA challenges.

The construction of the framework in Article III was based on an inductive analysis. In inductive analysis, "the researcher begins with an area of study and allows the theory to emerge from the data" (Strauss & Corbin, 1998, p. 12) and uses approaches for detailed readings of the data to derive concepts, themes or a model through the researcher's interpretations of the data (Thomas, 2006). For this analysis, multiple sources of data were used, and the main sources were our research findings and discussions with the representatives of the Ministry of Finance and IT companies participating in the FEAR research project.

In Article V, the results were based on an online expert survey on EA challenges. The quantitative approach was chosen to allow for an assessment of the prevalence and criticality of the problems hampering EA adoption. For the data analysis, principal axis factoring was used and accompanied by qualitative data

in a triangulation setting. The collection and analysis of different data sets was reported in a detailed way in the articles included in the thesis.

To be able to answer the main research question and to identify the mechanisms of change that may have interacted in the implementation process of FINEA, a retroductive analysis (Bhaskar, 1975) was conducted. In retroduction, an empirical observation is made and then the mechanism(s) that might explain the particular outcome are hypothesised (Danermark et al., 2002; Sayer, 2004). Retroduction differs from induction and deduction, thus it is “neither going from empirical examples to a general rule (induction) nor going from a rule or law to consequences (deduction) but instead generating a plausible explanation” (Mingers & Standing, 2017, p. 175). The concept of retroduction in general is the same as Peirce’s (1958) concept ‘abduction’. Hypotheses about mechanisms are formulated by exploring the system of interest, but since the evidence for mechanisms is not always apparent in empirical data, the task is challenging for the researcher (Miller, 2015). It can be said, that proposing mechanisms is a fallible act of imagination motivated by the data and other background knowledge, including prior theory and models (Bunge, 2004; Miller, 2015). While being a challenging task for the researcher, CR-based theorising of causal mechanisms is considered to be both recognisable and applicable to practitioners of researched subject (Williams & Wynn, 2018). When researching a practical subject, such as EA, this is an advantage. The aim of retroductive analysis in this research was to find a plausible explanation for the slow progress of FINEA work.

Next section uses CCP model in describing the research case. The model was introduced in subsection 2.3 as a suitable method for researching EA as a means of systemic change. Pettigrew (1985; 1987) conceptualises change as a continuous process involving emerging mechanisms and temporal connections between context and action. Understanding change requires understanding of context, content and process. CCP approach gives emphasis to the holistic (versus episodic) explanation of change and focuses on multiple and interconnected levels of analysis (Wong, 2005). Critical realism offers a framework which focuses on the interactions between structure and agency and considers temporal aspects (Archer, 1995). Sminia (2009) has categorised Pettigrew’s contextualism as critical realist, because of the underlying assumptions of the CCP model.

4 CASE STUDY: CONTEXT, CONTENT AND PROCESS

*“For every complex problem there is an answer that is clear, simple, and wrong.”
H. L. Mencken*

The CCP model is used to describe the case study examining the implementation of the FINEA. The context is the environment in which the change takes place, which in this research is the Finnish public sector at the level of the state government and its ministries, civil service departments and municipalities. The content is the purpose and goals of the change. The original main content of the change in the FINEA implementation was the advancement of interoperability. The process of change describes how the change is pursued. The process is the development and implementation of the FINEA across different levels of the public sector.

4.1 Context: Finnish public sector

Finland is a country in northern Europe with population of 5.5 million. Finland is a republic with decentralised administrative structures. Finland’s administrative structure consists of the highest state bodies, the central government and other public administration. The highest level includes the parliament, the president of the republic, and the government. The central government consists of the independent courts and the state’s central, regional and local administration. Currently, the state's central administration consists of ministries and government agencies and institutions in their administrative branches. There are 12 ministries and approximately 100 organisations (e.g. police departments, prosecutors’ offices and Employment and Economic Development Offices). (Ministry of Finance, 2018a) There is ongoing reform that aims at adding an administrative level between the central and local administration. The reform is due to come into force at the beginning of 2020, and after that, there will be 18 counties

(autonomous regions) in Finland that will organise all public healthcare and social services in their area. (Regional Reform, 2018) Other public administrative bodies includes municipalities with local self-government, the administration of the church, and indirect public administration. Indirect public administration comprises independent bodies governed by public law (such as the Social Insurance Institution of Finland, the Bank of Finland and universities). (Ministry of Finance, 2018a)

Finnish public administration has progressed through five recognised periods of development (Stenvall et al., 2016, p.35):

1. Building the foundations of the own national government (1809-1917). Finland became independent from Russia in 1917.
2. Administrative and constitutional state (1918-1955)
3. Welfare state (1960-)
4. New public management (managerialism) (1990-)
5. New public governance (2005-)

A sixth period began in 2010 and the periods are still stratifying. There are currently many different (new and old) development trends influencing public administration. It is notable that the time frame of this research covers periods five and six, but the development of EA as a method started during the fourth period (see, for example, one of the earliest frameworks presented by Zachman, 1987).

The starting points of the fourth period were productivity and productivity evaluation and measurement. The role of innovation was emphasised and state investment in support of private businesses increased. New public management has accelerated structural reforms in the public sector. (Stenvall et al., 2016, p.35) The idea has been that public administration needs to be a multipolar system and independent organisations need to have access to resources for the cost-efficient implementation of policies (Virtanen & Stenvall, 2014). This has led to increased tensions in public sector development. A challenge has been, for example, how to intertwine regulations and cost efficiency or service equality and cost efficiency (Stenvall et al., 2016). The fifth period in the evolution of Finland's public administration is the new public governance model that is also guiding the development witnessed in other developed countries (e.g. Dunleavy et al., 2006). The focus has shifted from results to the enhancement of processes. A growing interest is in co-operative development and connectedness, instead of the development of single organisations. (Stenvall et al., 2016)

At the moment, new trends are appearing in the Finnish public sector, but a couple of the previous periods of administration are both continuing and partly even strengthening. Reforms in Finland mainly follow the patterns of the welfare state and new public management. Sometimes reforms are justified by productivity and effectiveness, economic factors and the need to ensure the ability of public organisations to carry out welfare services. There is an ongoing balancing between different needs and contradictory development efforts. (Stenvall et al., 2016)

The main drivers for change in Finland are an ageing population, the country's international competitiveness, society's capabilities and role as a service provider and the development of ICTs. The operation environment of the Finnish public sector is currently very complex in many ways. Reforms and phenomena are ambiguous, connected and intertwined. They complicate development and understanding the cause and effect relationships becomes more difficult.

Finland has always been among the top countries in e-government readiness and currently holds fifth position (UN 2016). The challenge has been in changing the structures of government and developing operations and governance. These challenges are often brought up in the reports produced by the National Audit Office. The recession and disruptive changes that began in 2009 weighed heavily on the economy, affecting Finland's productivity growth and international competitiveness. This affected the country's innovation policy and there have been cutbacks in investments in research and development. To be successful in the future, Finland needs better co-ordination and co-operation among policy actors at the national and regional levels, as well as further internationalisation. (OECD 2017b)

The Finnish public sector is strong in terms of building platform solutions, such as Suomi.fi, to legacy environment. However, the possibilities offered by technology are not fully utilised in service production. Problems have been reported in strategic know-how at the level of local government (i.e. municipalities) and in terms of insufficient nationwide steering (Stenvall et al., 2016). This has resulted in wasting resources, problems in interoperability of information systems and in uneven regional services renewal and development based on digitalisation (Valkama & Anttiroiko, 2011). This makes it difficult to evaluate the effects of digitalisation because they are visible at different administrative levels and in different sectors. Some services have been digitalised, but it has not always led to process renewal or reform in a customer-oriented way, thus the benefits of scale and efficiency have not been achieved. (Stenvall et al., 2016)

4.2 Content: Towards improved interoperability

In the 1990s, Finland was a leader in exploiting ICT to renew its economy and to reform its public administration (OECD, 2003). At the beginning of the 21st century, Finland implemented the Information Society Programme that aimed at boosting competitiveness and productivity to promote social and regional equality and improve citizens' well-being and quality of life through the effective utilisation of information and communications technologies throughout society. The goal was to cut costs through harmonisation and use the savings for the overall development of the 'information society'. Within the Information Society Programme were the government's ICT development programmes. These included a programme to reform the state's information management, establishing the state's IT management unit within the Ministry of Finance in

spring 2005, and the Interoperability Programme, whose goal was to increase flexibility by developing the interoperability of the state administration's ICT system and to decrease overlap in information collection and maintenance and in the number of ICT systems. The Finnish government recognised four key focus areas: 1) shared information systems; 2) common basic technology; 3) shared services; and 4) cross-public sector processes. (Liimatainen, 2007)

The original content of the change was the advancement of interoperability to unify the development processes of functions and information systems. The aim was to consider the strategic goals of public service development, which included the enhancement of customer centredness, sustainable development and service production.

4.3 Process: Implementation of Finnish national enterprise architecture

The FINEA work started in 2006 by customising the EA framework, method and governance model. This was comparable to the approaches taken by other countries, since most governments use customised frameworks and applications fitting the country's administrative structure (Janssen & Hjort-Madsen, 2007). The aim was to create whole-of-government EA to be used as a tool in the development of functions and ICT systems at all levels of state administration. To maintain the EA and to be able to utilise the EA descriptions in steering the projects and in the planning of ICT systems, there was a plan to implement a governance model. (Liimatainen, 2007) The Interoperability Programme ran until 2011. Timeline of the FINEA implementation is presented in table below (Table 4).

The first version of the FINEA method consisted of descriptions of the business, information, application and technology architectures realised using the common description languages and methods. The FINEA method was in accordance with the TOGAF process and utilised known frameworks (such as EIF, FEAF, TOGAF and NAF) in reference models and architecture descriptions (EA Method Project, 2007a). At the state level, the FINEA was in accordance with the European Interoperability Framework (EA Method Project, 2007b) and in the cost-benefit analysis model adopted by the United States' Federal Enterprise Architecture's Performance reference model (Architecture Governance Model Project, 2007a). The FINEA had guidance for describing the current state, target state and the roadmap of EA. For the evaluation of the current state, a maturity model based on the common CMM (capability maturity model) and the NASCIO models was developed (Architecture Governance Model Project, 2007b).

TABLE 4 Timeline of the FINEA implementation

Year	Action	Description
Initialisation of the FINEA		
2006	Interoperability Programme	The FINEA work began with the Interoperability Programme that aims at efficiency and interoperability in operations and IS by using EA. Co-created by the Finnish public and private sectors and the FEAR research project.
2007	First version of the EA method	Method is based on TOGAF and co-created by the Finnish public and private sectors.
	<i>First-round interviews</i>	
Institutionalisation of the FINEA		
2009	Interoperability Portal	First portal for EA descriptions. Later replaced with Arkkitehtuuripankki.fi.
2011	EA method 1.0	The first official version of the EA method and published as a public sector recommendation.
	The Finnish Act on Information Management Governance in Public Administration	To ensure IS interoperability, public sector organisations have legally mandated obligations to plan and describe their EA using FINEA.
2012	FINEA 1.0	FINEA is the structure for the co-ordination and development of interoperability between public sector organisations and services. It consists of an EA method, EA governance model and EA maturity model.
2013	Arkkitehtuuripankki.fi	National EA solution including education, EA modelling tool, EA repository, EA description publication tool and EA modelling support services.
	<i>Survey</i>	
2015	Avoindata.fi	Web service for sharing Finnish open data and interoperability standards and guidelines.
2016	National Architecture for Digital Services (NADS)	Based on the Estonian X-Road, NADS is a compatible infrastructure that facilitates information transfer between organisations and services. NADS includes a national data exchange layer, a national e-identification model and national solutions for the administration of roles and authorisations for organisations and individuals.
2017	Suomi.fi	Web service offering citizens, companies and authorities a single point of access to government and municipality services, to the customer's own information and to electronic messages.
	EA method version 2.0	More comprehensive than 1.0. Tighter connection with general management processes. Added guidance for capabilities, business models, visualisation models, semantic interoperability, integration and cloud services.
	<i>Second-round interviews</i>	
	FINEA 2.0	Defined as before, but now consists of an EA method, EA governance model and continuous development, along with EA capabilities of organisations and authorities and descriptions of common EA.

The planning project for the first version of the FINEA was led by an administrative council put together by the Ministry of Finance. The project was divided into subprojects that were led by consultants from various IT companies. In every subproject, there were representatives of different organisations of public administration. Two researchers from the University of Jyväskylä also participated in two of the subprojects. This type of co-operation was a new development style in the Finnish public sector at the time. This co-operation was a good start for the implementation of the FINEA, since after the planning project many people from different administrative sectors had become familiar with the EA concept. The initialisation phase of the FINEA went as planned, although the work started to slow during the implementation phase.

When the implementation period started, there were plans for a quick implementation of the FINEA. The planned actions presented by the administrative council of the Ministry of Finance in the beginning of the FINEA implementation were:

- State level EA descriptions that are used to guide development work in the ministries.
- Recognition and modelling of cross-sector processes to advancement of customer and lifecycle viewpoints. Aims at producing services efficiently especially from the viewpoints of customer services, shared services and corporation efficacy.
- Interoperability portal to help in compilation of planning data, advancement of open information and reuse.
- EA school for ministries to get to know the EA method and to plan EA development for their organisation. (Siponen, 2008)

To achieve the above-mentioned practice-oriented goals, there was a need for a lot of cross-sector co-operation and a need to get management and development personnel to support the use of EA. These were considered challenges (Siponen, 2008). The latter two goals were reached. The assessment of the former two is more complicated. They are the ones that would have required a lot to changes in the structures and operation models of the public sector. According to the planned timetable, the modelling of the state-level architecture and cross-public sector processes was to be done in 2008.

In 2009, the first Interoperability Portal was established. It was somewhat hard to use and not many EA descriptions were included. The portal was later shut down and replaced with Arkkitehtuuripankki.fi in 2013. The first official version of the FINEA method was established in 2011, four years after the initial version. To hasten the implementation of the FINEA, the Finnish Act on Information Management Governance in Public Administration was passed in 2011 (Finlex, 2011). It makes the use of EA mandatory, for example, in central government offices, courts of law and local government agencies when they conduct tasks set down for them by law. Public sector organisations should use the FINEA method and its guidelines in EA planning and management. Regardless, few public organisations have undergone an EA adoption project and the penetration and maturity of EA are still low and slow.

Second official version of the EA method was published in 2017 (JHS179, 2017) after a renewal project that had lasted two years. The Ministry of Finance had received feedback and decided to renew the method, mainly for two reasons. First, because the FINEA method was too loosely connected to the overall planning and development of the public sector. Second, because version 1.0 contained mistakes. Approximately 50 people participated in the renewal of the method. The participants were drawn from state government, municipalities, the private sector and universities. The method was more comprehensively connected to the management processes of the public sector and almost 100 new examples of visualisations of EA descriptions were included in the recommendation. New additions include guidance for the use of strategy maps, business models and capabilities in EA planning, a method for semantic interoperability, description models for integrations and interfaces, and virtualisation and cloud services in technology architecture planning. Also, a set of the minimum required EA descriptions was developed and published as a separate recommendation (JHS189, 2017). The minimum set consists of over 30 description models.

At the end of 2017, the development of the FINEA method was relocated from the Ministry of Finance to the Population Registration Centre that is also responsible for the National Architecture for Digital Services and the Suomi.fi portal.

The adoption rate of the FINEA is not very high considering the length of the implementation period. Nonetheless, all ministries have started EA work. According to the annual report on state IT governance the mean of the EA maturity level's is 2.5 in the ministries. The scale is from one to five, 1 = not governed, 2 = partly, 3 = defined, 4 = governed and 5 = strategic. Only four percent of the total working hours of IT government personnel at the state level is spent in the development and maintenance of EA. (Ministry of Finance, 2017) Thus, the low maturity level matches the resources spent.

Data collected in 2013 (Survey on IT in the Municipalities 2013 by the Association of Finnish Local and Regional Authorities) indicated that approximately half of the Finnish municipalities had adopted any of the recommended EA practices. The data showed that a larger population correlated positively with the use of EA, whereas only a few of the small municipalities with populations of less than 10 000 had adopted these practices.

What has been achieved from the viewpoint of change? According to a recent report (Demos Helsinki, 2018), the goal of the FINEA is the development of a common EA method and modelling framework and their implementation in the public sector organisations. In the report, the implications of the FINEA were found to be:

- Common modelling documents/descriptions are in use.
- EA is a tool for communication between representatives of business and ICT sectors.
- Positive impacts in cross-sector development projects as a common language.

The report did not estimate how widely the EA description models are used. For example, the Ministry of Finance has not provided EA descriptions of the ministry. Siponen (2008) listed the use of EA in the Ministry of Finance as one of the key issues determining the success of the FINEA. The Ministry of Finance is the ministry responsible for steering public sector information management, structural development, and joint services and service provision. Having a common language for development work is important, but it is not a change in itself; rather, it is more like an enabler of change. The same is true for the FINEA: while it has the means and the methods for the change, it is not the change. The challenges of the FINEA are discussed in the articles included and summarised in Section 5. To conclude, thus far, EA has not had a significant impact on change of the Finnish public sector in terms of moving towards better interoperability.

5 OVERVIEW OF THE INCLUDED ARTICLES

*"Those who can't change their minds can't change anything."
George Bernard Shaw*

This section provides a brief summary of the articles included in the thesis. For each, the summary includes a description of the research objective, the research methods, the content and the main results. Articles I and II are based on the same interview data and present the results of the data analysis from different viewpoints. Article III includes a tentative framework for the advancement of EA in development projects. Article IV is based on the first pilot projects of the FINEA and presents key issues in EA implementation in the public sector. Article V further elaborates on these issues based on a survey. Article VI takes a longitudinal view of the challenges of public sector EA.

5.1 Article I: "Challenges of Government Enterprise Architecture Work – Stakeholders' Views"

Isomäki, H. & Liimatainen, K. 2008. Challenges of government enterprise architecture work - Stakeholders' views. In M. A. Wimmer, H. J. Scholl & E. Ferro (Eds.) EGOV 2008, Lecture Notes in Computer Science 5184, pp. 364-374.

The first article presents the challenges of public sector EA work as perceived by the first-round interviewees. Interviewees were participants in the planning projects of the FINEA. The article includes descriptions of the research method, an analysis of the results (presented as challenges divided into three categories) and makes brief conclusions. The challenge categories are: 1. *implementation ability and governance*; 2. *structure of state government*; and 3. *advancement of interoperability*. This article concentrates on the FINEA work at the national level and makes two recommendations. First, the governance level of EA needs to be leveraged. EA should form the foundation of business-driven development and

decision-making. Second, EA needs to be a tool for business-driven development. This requires the involvement of general management and people who participate in the development of substance functions. These recommendations come from the holistic EA view that emphasises the social side of EA instead of the technical. They also reflect on the idea of the whole-of-government viewpoint aiming at an overall strategy that guides the modernisation of the government. The three challenge categories form the basis of the data analysis framework for Article VI.

5.2 Article II: “Stakeholders' Views on Government Enterprise Architecture: Strategic Goals and New Public Services”

Penttinen, K. & Isomäki, H. 2010. Stakeholders' views on government enterprise architecture: Strategic goals and new public services. In K. N. Andersen, E. Francesconi, Å. Grönlund & T. M. van Engers (Eds.) EGOVIS 2010, Lecture Notes in Computer Science, 6267, pp. 1-8.

The second article includes the same data results as in Article I. This article focuses on different stakeholders' perceptions on the issues related to business architecture level. Article II includes descriptions of the research method and the stakeholders' views on: 1. government EA; 2. strategic goals for EA work; and 3. new public services. It also offers brief conclusions. The main conclusion of the analysis for this article is that *differences in interviewees' organisations were visible* in their opinions regarding EA and that *the FINEA work was considered technology oriented*. We argue that the development of interoperability was presumably easier at the state government and ministry level. State government is generally more advanced in EA than municipalities. Municipalities have not developed their own EA or interoperable solutions. It can be argued that stakeholders' perception of EA as technically oriented has hampered the implementation of the FINEA.

5.3 Article III: “A Framework for Evaluating Compliance of Public Service Development Programs with Government Enterprise Architecture”

Liimatainen, K., Heikkilä J. & Seppänen V. 2008. A framework for evaluating compliance of public service development programs with government enterprise architecture. In D. Remenyi (Ed.) ECIME 2008 -Proceedings of the 2nd European Conference on Information Management and Evaluation, pp. 269-276.

This article presents the idea of advancing government EA (GEA) with development projects and using *a framework for compliance evaluation*. The development of the framework started based on the researchers' understanding that the FINEA work faces major challenges ahead. It was acknowledged that most GEA initiatives in the public sector encounter difficulties, because building the required capabilities is slow, the implementation of EA is complex and existing structures hamper the implementation. The framework is based on government reports and research done in the FEAR project. The article presents an initial version of the framework, including the GEA and a programme initiative that is viewed through the prism of the GEA requirements. The evaluation process starts with a programme eligibility analysis done at the same time as an analysis of organisational maturity. Next is the GEA compliance evaluation that includes quality assurance. The next stage is business modelling, where the different ways of organising the resulting service are determined in a most meaningful and profitable way. It is beneficial to do this in co-operation of interested parties in the public and private sectors. After designing the business model, the next stage is to choose the operations model from among the suitable alternatives and based on a round of quality assurance. After completing these stages, the programme initiative can proceed to competitive bidding.

5.4 Article IV: "Key Issues in EA-implementation: Case Study of Two Finnish Government Agencies"

Seppänen, V., Heikkilä, J. & Liimatainen, K. 2009. Key issues in EA-implementation: Case study of two Finnish government agencies. In B. Hofreiter & H. Werthner (Eds.) IEEE Conference on Commerce and Enterprise Computing, pp. 114-120.

This article is based on the two first pilot projects of the FINEA. The first author carried out the interviews with the project participants about a half year after the projects had ended. Documents, such as project reports and minutes from project group meetings, were used as contextual data. In the article, we give a brief description of the pilot projects and describe the three key findings in a detailed way. The key issues related to organisational EA implementation presented in the article are *the failure to establish proper EA governance, insufficient support for the development of EA and inadequate resources to do either*. This article emphasises that the major challenges of EA work are not of a technical nature.

5.5 Article V: “Key Issues in Enterprise Architecture Adoption in the Public Sector”

Seppänen, V., Penttinen, K. & Pulkkinen, M. 2018. Key Issues in Enterprise Architecture Adoption in the Public Sector. The Electronic Journal of e-Government (EJEG), vol. 16, no. 1.

The fifth article includes the results of an expert survey, conducted by the first author on the challenges of EA adoption in the Finnish public sector. The analysis of quantitative survey data is supported with qualitative data gathered from responses to open-ended questions. The analysis reveals a structure of three interrelated factors: *resistance towards EA*, *relevant EA goals* and *EA practices in use*. The key issues identified through classification into these three broad concepts are prerequisites for institutionalising EA and making it a legitimate practice in an organisation. The findings extend the current knowledge of public sector EA with practicable ideas for how to increase the level of penetration and maturity.

5.6 Article VI: “Revisiting and Revising the Grand Challenges of Public Sector Enterprise Architecture”

Penttinen, K., Isomäki, H., Seppänen, V. & Tyrväinen, P. 2017. Revisiting and Revising the Grand Challenges of Public Sector Enterprise Architecture. Revised and resubmitted to the European Journal of Information Systems.

The sixth article presents the challenges of public sector EA work perceived by the second-round interviewees. The interviewees are stakeholders of the FINEA. This article is based on a qualitative longitudinal research method. The first-round interview data was combined with the second by generating the coding framework for an analysis of the second-round interviews from the categories developed using the first-round interview results. Article VI includes descriptions of the research approach, research method, research context, results and a discussion. The results section first revisits the old challenges (presented in Article I) and then new challenges are introduced. From the second-round interview data, two new challenges emerged: *practising EA* and *reconceptualising EA*. To prove a broader context, the challenges are situated within the context, content and process model of organisational change. The main conclusion is that EA needs to be revised in order to determine the requirements of digitalisation and understand the complexities of the turbulent environment that governments face.

5.7 The interrelationship between the articles

This thesis includes six articles. The research question is divided into three sub-questions. Articles I and II are based on the same interview data and answer the sub-question “*How do the stakeholders perceive the EA work?*” Articles III – V take different approaches to answering the sub-question “*How can the challenges of EA implementation be overcome?*” Article VI that is based on the results of Articles I and II, along with new follow-up interview data, and answers the third sub-question “*How have the challenges evolved over time?*” In Articles I, II and VI the level of analysis is the FINEA and in Articles IV and V the level of analysis is an organisation implementing EA. The results of Article III can be applied at the national and organisational levels. These interrelationships between the articles, research questions and levels of analysis are summarised in Table 5.

TABLE 5 The interrelationship between the articles and research questions

Research question	Article no.	Data	Analysis level	Main results
How do the stakeholders perceive the EA work?	I	First-round interview data	FINEA	Main challenges: 1. implementation ability and governance; 2. structure of state government; 3. advancement of interoperability.
	II	First-round interview data	FINEA	Involvement of different stakeholders with varying perceptions of EA work and EA’s IT orientation are challenges.
How can the challenges of EA implementation be overcome?	III	Government reports; FEAR research	FINEA and an organisation implementing EA	A tentative framework for advancement of EA in development projects.
	IV	Two EA pilot cases, interviews, reports and observations	Organisation implementing EA	Key issues in organisational EA implementation: the lack of establishing proper EA governance, insufficient support for the development of EA and inadequate resources to do former either.
	V	Survey on EA challenges	Organisation implementing EA	Key issues of EA adoption in an organisation: resistance to EA, relevant EA goals and EA practices in use.
How have the challenges evolved over time?	VI	Second-round interview data	FINEA	Old challenges still exist, new challenges have appeared: practising EA and reconceptualising EA. Recognition of the need to renew EA for the changed context.

The initial answer of the sub-questions is given in the articles included in the thesis and the ideas are developed further in the next section. Answering the main research question: *“Why is implementing EA a long and challenging task in the public sector?”* requires a combining the results of all the articles, along with an additional retroductive analysis, which is presented in the next section.

6 RESULTS AND CONTRIBUTIONS

“Essentially, all models are wrong, but some are useful.”
George E.P. Box

First, the following section provides further elaborated answer to the sub-questions. Second, the main research question: *“Why is implementing EA a long and challenging task in the public sector?”* is answered through a retroductive analysis of the results in the articles included. Third, the section gives an overview of the contributions of the thesis, limitations and sets possible directions for future research.

6.1 Main challenges of enterprise architecture

To give a more nuanced answer to the sub-questions “How do the stakeholders perceive the EA work?” and “How have the challenges evolved over time?” the main results of the articles (see Table 5 above) were rephrased into challenges and categorised with extended CCP model of organisational change. While results included same challenges, the overlaps were combined. Table 6 shows how the results were further elaborated into larger groups that depict the main challenges of FINEA implementation and their relation to the CCP model with stakeholders. The CCP model is introduced in subsection 2.3. Advancement of interoperability was grouped with relevant goals, since it is the main goal of the FINEA. The idea behind the main challenges is that they might be challenges of EA in similar contexts and not solely in Finland and therefore they are phrased as general challenges that are not specific to a certain context. Practicing EA combines four challenges that are all related to practicing EA. Implementation ability is combined with governance, since it is often stated that being able to implement EA requires governance.

TABLE 6 Main challenges and the related CCP with stakeholders' categories

Main results rephrased into challenges	Main challenges	CCP with stakeholders
Structures	Structures	Context
Advancement of interoperability	Setting relevant goals	Content
Relevant goals		
EA's IT orientation	EA's IT orientation	Content
Practising EA	Practising EA	Process
Connecting EA to the development projects		
Insufficient support for the development		
Inadequate resources		
Governance	Governance	Process
Implementation ability		
Reconceptualising EA	Revising EA	Process
Diverse stakeholders	Diverse stakeholders	Stakeholders
Resistance to EA	Resistance	Stakeholders

The context-related challenges relate to the structures of public sector organisations. Their complex and stagnant structures and siloed functions are hindering the FINEA work that was aimed at increasing interoperability and cross-sector co-operation. Development work begins in existing structures and this often makes it impossible to plan the best possible solution.

There are two content challenges. First, setting relevant goals for the work has been problematic, mainly at the level of organisations adopting EA. It is important that goals are relevant from the business perspective, not merely from an IT perspective. At the FINEA level, increasing interoperability from a non-technical viewpoint has been a challenge, and this is related to setting relevant goals that are also actionable. The second content challenge is EA's orientation as an IT method. This has made it hard to get management and development personnel to engage and invest in EA.

The three process challenges hamper implementation of the FINEA. First, practising EA is problematic. The support and the resources for the development work have been insufficient, and there have been problems in connecting EA to other development projects. Practising EA has been challenging since it requires resources and capabilities; moreover, the tool support has been insufficient. Governance was something that was thought to happen through the steering of the FINEA work by the Ministry of Finance, thus governance has been lacking. FINEA work started over ten years ago and EA is past the hype stage. Even so, many see EA as a curse word that should be replaced in order for the work to proceed. The world has also changed and the drivers for EA are somewhat different. There is a need to revise EA methodologically.

In the public sector, stakeholders of EA are diverse and there is resistance against EA and change in general. Thus, it is important to acknowledge that successful EA work requires the involvement of the various stakeholders. The involvement of stakeholders has been well understood from the beginning of

the FINEA implementation, but there have still been challenges in taking the various perceptions of different stakeholders into account.

The main challenges are the ones that hamper EA work in different ways and overcoming them requires different measures. Most of the main challenges have been acknowledged since the beginning of the FINEA work, and it is important to understand what kinds of mechanisms are behind the challenges. Over the course of time, the drivers for the FINEA have changed (Figure 2), and the changed drivers increase the importance of overcoming the challenges in practising and revising EA.

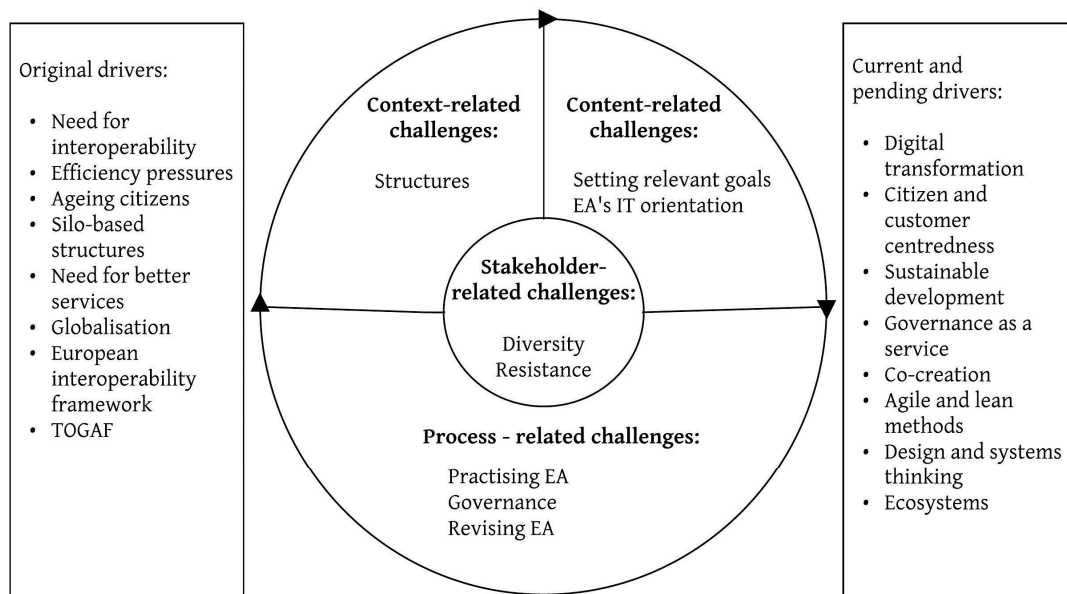


FIGURE 2 Drivers for the FINEA, main challenges in the adapted CCP model

6.2 Overcoming the main challenges

The included articles gave III-V gave the initial answer to the sub-question “How can the challenges of EA implementation be overcome?”. It included proposing a framework for advancing EA work in the development projects and providing knowledge of key issues that need to be addressed in the EA implementation and adoption.

The application of CR philosophy in EA research led to one fundamental realisation in terms of how future EA research and practice could be improved. The traditional EA approach, similar to the FINEA implementation efforts, recognises the problem and offers a solution and an action (Figure 4). This has resulted in only partial success. In the FINEA case, the main goal – improved interoperability – has been achieved in a limited way. The main improvement is

at the technical level after the implementation of the National Architecture for Digital Services and Suomi.fi services.

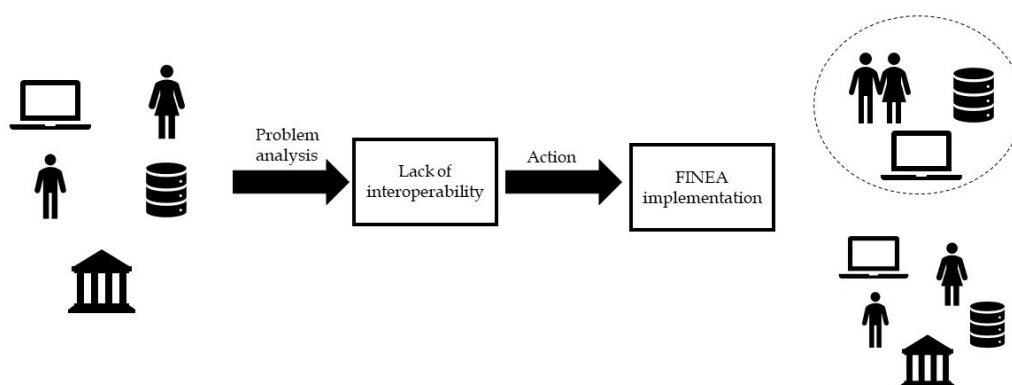


FIGURE 3 Traditional EA approach in Finland

The revised EA approach would be somewhat different (Figure 5). The problem is first analysed to get an explicit definition. Then the contexts are analysed to understand the complex open system of structures, agents and levels of the varying contexts. The chosen actions are context- and time-dependent and thus the solutions and results are also different. For example, the FINEA implementation could have led to different solutions with better interoperability within and between organisations. In the revised EA approach, the chosen actions are more effective and there is less waste.

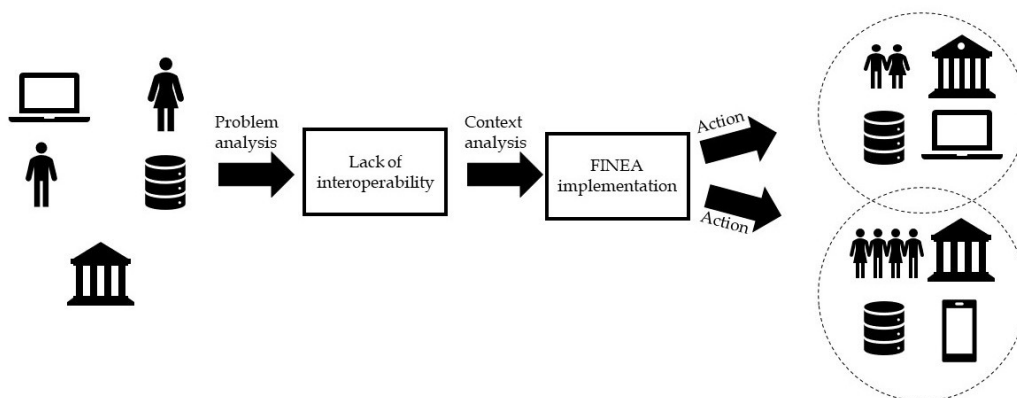


FIGURE 4 The revised EA approach

In both versions of the figure, the left side consists of the four viewpoints of IS research: human, organisational, technological and semiotic (Koskinen, 2005; Koskinen, Liimatainen & Pekkola, 2005). These viewpoints interact in a complex systemic interaction. "This systemic interaction is fundamentally semiotic: it is about the creation, use and mediation of data, information, and knowledge between human beings who use language and various technological and institutional artifacts and acts as its media" (Koskinen et al., 2005, p. 3). The traditional

EA approach covers three of the viewpoints (organisational, technological and semiotic), but the human viewpoint is largely missing.

6.3 Identified mechanisms of change

The recognised challenges are instantiations of the underlying mechanisms of change. The mechanisms of change induce conflict with humans and the structures that other humans have created and both constrain and enable their actions (Archer, 2007; Mutch, 2010). Mechanisms can have supportive and un-supportive effects and a given mechanism can have different effects in different situations. The presumed continuity of mechanisms within a system provides a basis for theoretical explanations of empirical phenomena (Miller, 2015). This is in accordance with Pawson and Tilley's (1997) distinction between mechanisms that generate a problem in a social setting and others that countervail the problem mechanism (Morton, 2006).

In this longitudinal case study supportive and un-supportive mechanisms are proposed as the basis of a causal explanation of the outcomes of the FINEA implementation (Table 7). Supportive mechanisms are a common language, co-operation and co-creation. Un-supportive mechanisms are unclear goals, tight structures and fragmentation, lack of resources and support and resistance. The mechanisms are based on a retroductive analysis of the results of the longitudinal case study.

TABLE 7 The main challenges and related mechanisms

Main challenges	CCP with stakeholders	Unsupportive mechanisms	Supportive mechanisms
Structures	Context	Tight structures and fragmentation	
Setting relevant goals	Content	Unclear goals	
EA's IT orientation	Content	Resistance	Common language
Practicing EA	Process	Lack of resources and support	Co-operation and co-creation
Governance	Process	Tight structures and fragmentation; lack of resources and support	
Revising EA	Process	Resistance	Common language, co-operation and co-creation
Diverse stakeholders	Stakeholders	Resistance	Co-operation and co-creation
Resistance	Stakeholders	Resistance	

The mechanisms have varying powers and tendencies and they act as promoters of and obstacles to change. The FINEA implementation is itself a mechanism

that triggers responses from existing social structures and agents, and the outcome of the implementation was unpredictable. The observable outcomes of the implementation are the empirical manifestation of the interaction of the mechanisms (Morton, 2006). In the FINEA case, the outcomes are not as manifold as expected and the unsupportive mechanisms are obstacles to change. The supportive mechanisms are not as strong. The explanation for each recognised mechanism is given in Table 8.

TABLE 8 Explanation of supportive and unsupportive mechanisms

	Mechanisms	Explanation
Promoters of change	Common language	EA work has created a common language between different professional groups. The key enablers are the four viewpoints (business, information, information systems and technology) used in the FINEA method. These viewpoints help in holistic development work, making considering various viewpoints a necessity.
	Co-operation	From the beginning, the FINEA work was done in co-operation with various stakeholders. The co-operation has continued and is visible in different organisational EA adoptions.
	Co-creation	The FINEA is co-created with different stakeholders and consultants from IT companies. Organisational adoptions are often co-created.
Obstacles to change	Unclear goals	Poorly set or irrelevant goals make it hard to commit to the work. The relationship between FINEA and its goals has been somewhat unclear. This has been a major problem in organisational EA adoption. It is hard to commit to EA when it is not clear why the work is done and what are its possible benefits.
	Tight structures and fragmentation	The complex and stagnant structures at different levels of government, organisations and between groups of individuals (accompanied by a fragmented administrative system) create perhaps the most powerful obstacle to the FINEA.
	Lack of resources and support	From the beginning of the FINEA work, it has been clear that most organisations lack resources that can be allocated to EA work. In organisations doing EA, there has often been a lack of managerial support. Without management's commitment to EA, it is hard to make any changes in the organisational settings.
	Resistance	EA as a method originates from IT and it is not accepted as a general management or development method. Since the FINEA and its organisational adoptions have been problematic, resistance to EA has increased.

Social systems are inherently open; it is not possible to specify how a mechanism behaves without considering its context and the other mechanisms that operate at the same or at different hierarchical levels (Mingers & Standing, 2017). The macro, meso and micro levels in this research context are govern-

ment, organisation and individual. The FINEA implementation process has been long, the mechanisms have affected the outcomes and the outcomes have affected the mechanisms that influence the various contexts (Figure 3).

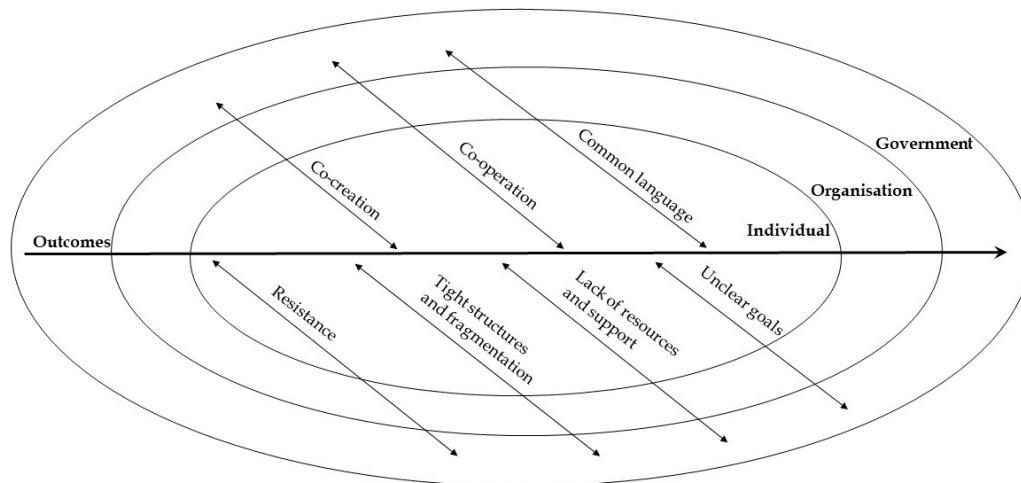


FIGURE 5 Contexts, mechanisms and outcomes

Interestingly, according to Pawson (2002), it is not the change initiative that works; it is the resources the initiative offers to enable the stakeholders to make things work. In other words, change will happen “if those subjects are persuaded to accept, install, maintain and act upon it” (Pawson, 2002, p. 344). The stakeholders (i.e. agents) are constrained by the structures, but at the same time, stakeholders influence and shape the structures. One event in the FINEA implementation process is the Finnish Act on Information Management Governance in Public Administration, which makes the use of EA mandatory. Passing of the law in 2011 increased the EA adoption rate, but mainly in government organisations and not in the municipalities. It must be noted that the mandatory use of EA has not led to significant changes in the Finnish public sector. The FINEA implementation has not been a strong enough intervention to produce the planned changes in the context of the Finnish public sector.

The context of the change in this longitudinal study is Finland, and the content is improving interoperability through the implementation process of the FINEA. The context and the levels of the context, i.e. whole-of-government, organisation and individuals, influence the process and time is an important factor in the process. The goal is to change part of the context. The multilevel nature of the implementation process makes it very complex and multifaceted. The mechanisms of change influence the implementation of EA at the different levels. Structures shape actions and actions shape structures in a loop. In the public sector, some structures are very stagnant; for example the foundations of Finnish government are over a hundred years old.

In the Finnish model for EA implementation there has been a lack of strong incentives to use EA. Its use is mandated by law, but there are no sanctions for not using EA. There are no rewards, either. This makes one question whether some other means for governance would have been better. Information guidance was considered insufficient by the Ministry of Finance. Yet, financial steering has not been tested. The situation has been challenging since financial resources to be used as incentives for EA are lacking and time the municipalities are strongly autonomous.

General benefits of EA are claimed, but there is little evidence of actually successful adoptions. The lack of resources hampers work, especially since the need for EA is ambiguous. The Ministry of Finance has been responsible for the development and governance of the FINEA. It has provided the method, software, repository and training. The biggest shortfall has been in the governance of the whole-of-government development. Through the implementation process, EA work has been done in co-operation between stakeholders from various levels of administration, different organisations and the private sector. Co-operation and co-creation and the shared language resulting from them have been the strongest promoters of change. Since the context has been in turmoil in recent years and the drivers for change have altered, it is possible that in the future the public sector will be more prepared for the changes offered by the effective use of EA.

The answer to the research question *“Why is implementing EA a long and challenging task in the public sector?”* is given above by presenting the main challenges of FINEA and its related mechanisms of change. The argumentation is based on the knowledge acquired in the longitudinal research process. The objective was to identify the most complete and compelling explanation for the events of the FINEA implementation.

6.4 Contributions

In considering the six individual scientific publications outlined in Section 5, this subsection summarises their coherent set of contributions to practice and research. The main objective of the research was to understand the implementation of EA in the Finnish public sector. From the outset, applying a concept that originated in IT to the existing structures and management traditions of the public sector was considered challenging. Therefore, it has not been a surprise that its implementation has been tedious. Of course, there are organisations in which the adoption of EA has been a success, but for the majority of the organisations this has not been the case. Although the law mandates its use, there are still organisations that have yet to do any EA work. This is the case for the majority of Finnish municipalities. Reasons for not engaging in EA work are mainly, lack of understanding of the benefits by the management and therefore lack of resources for the EA work. The intertwining theme of the individual articles is the challenges of EA work. By combining the results in the previous chapter

with the initial recognition of the underlying mechanisms, the aim of this thesis was to paint a holistic picture of why the implementation of the FINEA has been challenging and slow. This gives us a better understanding of EA adoption in a real-life public sector setting, especially at the whole-of-government level. The results can be used as a starting point to understanding other whole-of-government efforts, not just EA-related development. In interpreting the results, it can be said that the Finnish way of implementing EA cannot be recommended for other countries to follow. Nevertheless, the results of this research provide new insights for both research and practice on how to improve the EA adoption process. Since this is a longitudinal study and parts of the results were published several years ago, it is possible to write a follow-up about their contributions to research and practice.

Article I has attracted some interest and has been cited in other academic articles. Its main contribution is its role reporting the challenges of EA work as perceived by different stakeholders at the beginning of the FINEA work. The results were also published in Finnish by the Ministry of Finance and were used in the FINEA work; thus, they have played an important practical role.

Mondorf and Wimmer (2017) used the results of Article II in their article on the creation of the EA framework for Pan-European Government Services (PEGS). They compared the business drivers for stakeholder engagement in PEGS and included our results, along with two other articles (Götze et al., 2009; Scholl et al., 2012). Mondorf and Wimmer (2017) concluded that the consideration of business drivers for EA helps in creating effective stakeholder strategies. This is in line with the results of this thesis in two regards: 1) in recognising that the involvement of different stakeholders is important; and 2) in setting relevant goals for EA work.

The initial framework published in Article III was developed further in the FEAR research project, named the FEAR governance model and published as a research report (Heikkilä et al., 2010). Unfortunately, it did not get to be part of the FINEA work as such. Only very recently is a similar development taking place at the state level, since the Minister of Local Government and Public Reforms has formed a working group for the development of a new model for coordination and governance of investments in state digital projects (Ministry of Finance, 2018b). The aim of the new governance model is to direct and evaluate investment projects that advance digitalisation and involve the development of ICT and operations. This model shares notable similarities with the FEAR governance model. On a smaller scale, the FEAR governance model has been influential. For example, it was used in the development of Espoo's and Turku's own model. In 2017, Turku was the first Finnish city to win the Committed to Excellence award from the European Foundation for Quality Management for its development model as the first city from Finland (Turku, 2017). The national EA for social welfare uses the FEAR governance model for connecting EA governance to project portfolio management (THL, 2011).

Article IV is the most-cited article of all the articles included in this thesis (57 citations according to Google Scholar as of 6.5.2018). According to the litera-

ture review carried out by Dang and Pekkola (2017), the most-cited article on public sector EA was written by Peristeras and Tarabanis (2000), which has 176 citations. This indicates the scale of citations in the research area of public sector EA. Article IV is based on the first two pilot projects adopting the FINEA method. One representative of each project's management was interviewed again in the second-round interviews. Resource problems were still visible in both organisations, although the situation had been better at one point. In the State Treasury, EA work was not well institutionalised after the pilot, because the practical skills required for the work was lost with the consultants. The consultants were talented and did the EA work in the pilot project. At a later point in time, an enterprise architect worked for the State Treasury, but the organisation was still unable to institutionalise EA. The EA work was bureaucratic and documentation was produced afterwards; thus, the benefits of EA were not visible. At the time of the interview, there was no longer an enterprise architect working for the State Treasury, only an IT architect. It was going to relaunch the work as business-driven EA to be able to respond to the requirements of digitalisation. Trafi (the Road Administration during the pilot project) has gone through many changes in the operations environment and organisation structures and there have been some problems with transferring the skills of the employees. The resources for EA work have been limited the whole time, and even more scarce at the time of the interview. The person responsible for the EA could only commit ten percent of total working hours to EA work. Trafi has actively kept the EA viewpoint visible, and in the development projects EA is handled well, but at the whole organisation level the EA governance is missing. I argue that these two organisations adequately represent EA work in the administrative sectors.

The scientific contribution of this thesis is will be a theory for explanation. This kind of theory "provides an explanation of how, why, and when things happened, relying on varying views of causality and methods for argumentation. This explanation will usually be intended to promote greater understanding or insights by others into the phenomena of interest" (Gregor, 2006, p. 619). This thesis contributes to research by providing a set of mechanisms that explain how EA implementation in a particular case in the public sector has proceeded. The scientific significance comes partly from the empirical research on the area of public sector EA work that is not currently an overly well-studied area. Therefore, this thesis contributes to the body of knowledge within IS on public sector EA, the use of CCP and a critical realist research approach. Its theoretical contributions include a thorough consideration of the research context. According to Davison and Martinsson (2016), the importance of context is not always appreciated in research designs, although cultural and institutional constraints should always be considered as part of the research process.

The practical contribution of this thesis emerges from its explication of the mechanisms. Successful EA implementation requires the participation of various stakeholders. This widens the scope from merely being an IS or IT issue and acknowledges that social structures and their underlying mechanisms are key

aspects in the implementation of EA. This knowledge can help to close the gap between the academic development of EA and the requirements of practice. This is inline with Ruohonen's (1991) findings on strategic IS planning, which emphasise the need to consider context and cultural factors in stakeholder analysis as a way of avoiding challenges in implementation process. This thesis and similar CR-based research offers one means of increasing the value of IS research to praxis (Wynn & Williams, 2012).

Above, I have made arguments for how components of the results have influenced real-world practice and academic research. These contributions can be used to improve further efforts in EA implementation and they set the foundation for further study of the mechanisms of change and the EA phenomenon.

6.5 Limitations and future research

"Most theories in the social sciences are implicitly limited by cultural or contextual circumstances" (Davison & Martinsons, 2016, p. 244) and this results in placing limits on generalisations. Generalisability provides a means to leverage existing statements of mechanisms to explain observed events in another context, not to predict outcomes in the new context (Wynn & Williams, 2012). The type of generalisation within CR-based case study research is a generalisation to theory (Lee & Baskerville, 2003; Yin, 2003). It is possible that the findings of this study have significance in other contexts, but that is subject to validation in future research. The meaningfulness of the findings off any study must be assessed in the light of the study's limitations. This study consists of one longitudinal case. However, case study is the preferred research method in critical realism because, as in this case, it can reveal the specifics of causal mechanisms.

The FINEA implementation has been a long process with limited ability to change in the Finnish public sector. According to Lewis (2007, p. 549), "The absence of change may be a positive as well as a negative finding: it may reflect stability, consistency or maturity". Finnish society and its government have been stable and mature. The need for change has been less powerful than the forces that maintain stability. Thus, this case is not a success story of EA-driven organisational change. The results of the FINEA implementation are therefore somewhat limited. This gives several reasons to engage in future research.

CR-based theorising of causal mechanisms is considered to be both recognisable and applicable to practitioners of researched subject (Williams & Wynn, 2018). An intriguing future research agenda would be to present the recognised supportive and unsupportive mechanisms to interviewees who participated in the second-round interviews of this longitudinal study. This would be a good test of validity of the results.

In future research, the extended analysis of the mechanisms of change at the different levels of administration could be carried out. This would create a better understanding of which mechanisms work at the macro, meso and micro levels and eventually help in planning further implementation of the FINEA

and organisational adoptions of EA. There are also possibilities to engage in a further analysis of the longitudinal interview data, for example, to research whether the perceptions of stakeholders of EA at the individual (i.e. micro level) have changed.

I see two possible futures for EA as an approach to research and practice. *Remain the same and perish* or *revise and flourish*. I prefer the positive option and suggest that there are possibilities for future research. Traditionally, EA work is considered slow and time consuming; thus, intertwining EA and the concepts of agile and lean methods would be valuable. Therefore, the context-related issues and placing the focus on relevant things would lead to an appropriate use of resources and more meaningful results. In addition, in terms of the process improvements, focusing on agility would allow for the realisation that humans are an integral part of the organisational system. Better inclusion of humans in EA could be achieved through the use of design thinking. Since the resources for development in the public sector are scarce and doing EA work as a separate function is not reasonable, it would be beneficial to integrate EA into the wider organisational development efforts.

YHTEENVETO (FINNISH SUMMARY)

Tänä päivänä julkishallinto toimii monimutkaisessa ja epävarmassa maailmassa, jossa haasteina ovat pienevät budjetit, vanhenevat kansalaiset, teknologinen muutos ja globalisaatio. Samaan aikaan on toiveena tarjota parempia, saavutettavampia ja tehokkaampia palveluita kansalaisille, yrityksille ja julkishallinnon organisaatioille. Tästä on seurannut kunnianhimoisia ja kalliita sähköisen hallinnon ohjelmia, joissa rakennetut sähköiset palvelut ovat olleet usein irrallisia ilman sektorirajat ylittävää näkemystä ja kehittäminen on tapahtunut ilman kokonaisuuden hallintaa. Viime aikoina on herännyt tarpeita yhtenäistävillä menetelmillä, jotka mahdollistavat siiloutuneiden rakenteiden ylittämisen ja yhteistyön edistämisen julkisen hallinnon eri osien välillä.

Yli kymmenen vuotta sitten kokonaisarkkitehtuuri (KA) oli lupaava kokonaissuunnittelumenetelmä, jota tarvittiin yksittäisten sähköishallinnon projektien yhdistämiseen ja hallinointiin. Kokonaisarkkitehtuurin avulla voidaan kuvata miten organisaation järjestelmät, prosessit, rakenteet ja ihmiset toimivat kokonaisuutena. KA-työn keskeisiä hyötyjä ovat yhteistyö eri sidosryhmien välillä, parantunut koordinointi, vähentynyt päällekkäisyys kehittämistoiminnassa ja järjestelmissä, kuvaaminen ja lisääntynyt läpinäkyvyys. KA-työn keskeisiä heikkouksia ovat, että se vaatii paljon erityisosaamista, on aikaa vievää ja työn keskiössä on usein suunnittelu ja kuvaaminen kehittämistoiminnan sijaan. Tutkimusten mukaan KA-ohjelmat eivät ole yleensä menestyneet kovin hyvin. Tämä pätee myös Suomen julkishallinnon KA-työhön, joka on edennyt hitaasti, vaikka julkishallinnon organisaatiot velvoitettu siihen lailla.

Suomen julkishallinnon KA-työ alkoi vuonna 2006, jolloin tavoitteeksi asetettiin yhteentoimivuuden edistäminen kehittämistoiminnassa ja tietojärjestelmien välillä. Tietojärjestelmien yhteentoimivuuden varmistamiseksi vuonna 2011 julkisen hallinnon organisaatiot velvoitettiin lain nojalla suunnittelemaan ja kuvaamaan kokonaisarkkitehtuurinsa hyödyntäen kansallista KA-menetelmää. Nykyään Suomen julkishallinnon KA sisältää KA-menetelmän, KA-hallintamallin, jatkuvan kehittämisen mallin, organisaatioiden ja viranomaisten KA-kyvykkyydet ja yhteiset KA-kuvaukset. Eri organisaatiot ovat hyödyntäneet KA-menetelmää ja tehneet KA-työtä vaihtelevin resurssein ja tuloksin.

Jo varhaiset kokemukset KA-työstä viittasivat siihen, että edessä on työläs ja hankala prosessi, jollaiseksi KA-käyttöönotto on myös osoittautunut. Tässä väitöskirjassa mukana olevissa artikkeleissa esitellyt haastattelutulokset vuodelta 2007 toivat esiin, että sidosryhmät kokivat KA-työn teknisen luonteen, KA-menetelmän käyttöönoton, julkishallinnon rakenteet ja yhteentoimivuuden edistämisen haasteiksi. Esiin nousi myös haaste moninaisten sidosryhmien tarpeiden ja toiveiden huomioimisesta.

Väitöskirjan artikkeleissa on esitetty myös mahdollisia ratkaisuja haasteisiin ja menestyksellisen KA-työn edellytyksiä. Yhtenä ratkaisuna resurssipulaan on ehdotettu KA-työn edistämistä kehittämisprojekteissa. Keskeisinä KA-käyttöönötossa huomioitavina asioina on nostettu esiin muun muassa työn riit-

tävä resurssointi, muutosvastarinnan huomioiminen, relevanttien tavoitteiden asettaminen ja toimivien KA-käytänteiden luominen.

Väitöskirjatutkimus on pitkittäistutkimus ja vuonna 2017 kerättiin seuranta-aastatteluaineisto, jonka tulokset osoittivat vuonna 2007 esiintyneiden haasteiden säilyneen ja niiden rinnalle nousseen uusia haasteita. Uusiksi haasteiksi tunnistettiin KA-työn tekeminen ja tarve KA-menettelmän uudistamiseen. Koska KA-työn vaikuttavuus on ollut huono ja se on edennyt hitaasti, on julkishallinnossa havaittavissa koko käsitteeseen liittyvää kyllästymistä ja tympääntymistä. Tästä syystä väitöskirjassa ehdotetaan myös kokonaisarkkitehtuurityön uudistamista huomioimaan paremmin toimijat, toimintaympäristö ja systeemin rakenteet. KA-työ tulisi aina aloittaa kunnollisella kehittämiskohteiden ja -haasteiden analysoinnilla.

Väitöskirjan artikkelien tulokset on vedetty yhteen KA-työn tärkeimmiksi haasteiksi ja retroduktiivisen analyysin avulla tunnistettiin Suomen julkishallinnon KA-käyttöönottoon vaikuttavat muutosmekanismit. Mekanismit on jaettu muutosta tukeviin ja estäviin. Tukea antavat mekanismit ovat yhteinen kieli, yhteistyö ja yhteiskehittely. Estävät mekanismit ovat epäselvät tavoitteet, tiukat rakenteet ja sirpaloituminen, resurssien ja tuen puute, ja muutosvastarinta. Parantunut ymmärrys julkishallinnon KA-käyttöönottojen monimutkaisuudesta ja muutosmekanismeista tarjoaa uutta näkemystä hyödynnettäväksi tutkimuksessa ja käytännön KA-työssä.

KA-tutkimuksella ja -työllä on nähtävissä kaksi mahdollista tulevaisuutta: pysyä ennallaan ja kuihtua tai vaihtoehtoisesti uudistua ja kukoistaa. Koska aihealueen tutkimukselle ja työlle on edelleen tarve, uskon uudistumisen tien olevan edessä. Perinteisesti KA-työtä on pidetty hitaana ja aikaa vievänä ja siksi näen uudistamisen ketterämpään suuntaan tarpeellisena. Toimintaympäristön huomioiminen menetelmällisessä uudistamisessa ja suuntaamalla työ relevantteihin kehittämiskohteisiin, johtaisi vähien resurssien parempaan hyödyntämiseen ja merkityksellisempiin tuloksiin. Toimijoiden eli ihmisten parempi huomioiminen KA-työssä voitaisiin toteuttaa esimerkiksi muotoiluajattelun keinoin. KA-työn uudistamisen keinojen tarkempi selvittäminen on kiinnostava jatko-tutkimusaihe.

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INCLUDED ARTICLES

I

CHALLENGES OF GOVERNMENT ENTERPRISE ARCHITECTURE WORK - STAKEHOLDERS' VIEWS

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Challenges of Government Enterprise Architecture Work – Stakeholders' Views

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Abstract. At present, a vast transformation within government systems is executed towards electronic government. In some countries, this change is initiated as enterprise architecture work. This paper introduces results from an empirical study on different stakeholders' views on enterprise architecture development within Finnish state government. The data is gathered from 21 interviews accomplished during spring 2007 among participants of the Interoperability Programme of Finnish state administration. The interviewees represent different sectors and levels of Finnish government and IT companies. On the basis of qualitative data analysis we discuss challenges of enterprise architecture work in the context of state government. The key conclusion is that the governance level of enterprise architecture needs to be adequately adjusted and enforced as a tool for the development of business operations.

Keywords: State Administration, Enterprise Architecture, Interview Research.

Track: Transforming Government.

1 Introduction

The development of the contemporary information society typically includes the construction of electronic services into the service systems of public administration. In fact, both private and public organizations have already during three decades increasingly developed and decentralized customer-oriented functions, which are based on information technology [1]. At present, public administrations all over the world promote ambitious and costly e-government programmes to provide electronic access to government services [2]. The development of information and knowledge intensive electronic services within these new types of service systems have generated action models that often regard solely information and communication technologies (ICT), in particular, the integration of electronic services into the everyday lives of people, as the basic assumption of the development work.

Consequently, e-government approaches have not been able to solve many organisations' concern how to utilise ICT to its fullest strategic extent. There are difficulties in the practice of e-government [3], with government targets reported as vague [4], and many e-government initiatives described as chaotic and unmanageable [5]. One solution has been to initiate an enterprise architecture (EA) program. EA is

seen as a comprehensive approach, for example: “*enterprise architecture is a coherent whole of principles, methods and models that are used in the design and realisation of an enterprise’s organisational structure, business processes, information systems, and infrastructure.*” [6] Further, Enterprise architecture is used to describe how different elements in an organisation – systems, processes, organisations, and people – work together as a whole [7]. By identifying, structuring and categorizing these elements, EA can increase the potential for cross-public sector reuse and reduce duplication and hence reduce costs. Both business enterprises and governments all over the world have recognised the special value of EA [8]. As well as e-government, EA promises results in better, faster, and cheaper information technology, which satisfies organizational goals and objectives. Compared to e-government initiatives EA programs are often more holistic approaches that intertwine and focus disjointed e-government projects to increase cross-public sector reuse and reduce duplication. Governments usually have several independent e-government projects, which may have limited coherence and remain largely uncoordinated [9]. EA can serve as an umbrella for explaining the relationships among the projects and managing change instead of exclusively concentrating to implement ICT.

EA as a holistic development approach aiming to interconnect different functions, information processes and systems as well as technologies is seen to have many benefits. Especially, it is seen an approach that supports communication, decision and change management in the organizational entities under development [e.g. 10]. In taking EA into use as a holistic development tool for e-government, it is of utmost importance to take into account the views of the stakeholders involved. For instance, when developing enterprise systems, it is necessary to notice the stakeholders’ views [11]. From an information-legal basic rights viewpoint, the most pivotal issues of catering for the stakeholders concern the right to receive information, the right to communicate, the right to free information, to exchange information freely, and the right to information sovereignty [12]. Thus, when using EA as a tool for e-government, attention should be paid to its informativeness, especially how the stakeholders understand EA in the context of developing e-government.

However, there is little research that discloses how the stakeholders actually understand EA as a tool for development work of e-government. In this paper, we introduce results from an empirical study concerning different stakeholders’ views on Enterprise Architecture development, in particular, the stakeholders’ views of the challenges that they see in the EA work initiated as an Interoperability Programme of Finnish state administration. In the following we first we depict the research setting and method. Second, we present the results as stakeholders’ perceptions of the challenges of EA in e-government. Finally, we state the conclusions and topics for future research.

2 Research Method

According to its aim to understand different stakeholders’ views in particular organizational context, the study merges with the principles of interpretive research that is seen to produce deep insights into human thought and action [13]. An interpretive analysis was carried out with data from semi-structured, in-depth interviews. The interviewees were asked a written informed consent, and the questions were asked in a manner that excludes interviewer bias [14].

The interview themes and related questions were derived from an underlying theoretical EA framework developed for Finnish state administration. The framework consists of four generally known EA viewpoints:

- Business (e.g., clients, organisation, stakeholders, services, processes)
- Information (e.g., strategic knowledge capital, vocabulary)
- Information systems (e.g., information system portfolio, systems' life-cycles)
- Technology (e.g., technology and standard policies, model architectures)

These issues are placed within three levels in the framework. The highest is the level of state administration, which is the top level of decision making. The second level is the level of administrative sector, which includes independent decision-making bodies under state administration level. The lowest level refers to civil service department level. This structure was implemented in this study by selecting interviewees from each level. The interview questions concerned the respondents' views of current and future condition of state EA. These levels form the basis for interconnections between the different sectors in that the level of state administration operates in a cross-sectional manner, and thus is able to delegate cross-sectional tasks to the lower levels. In this way also the participants from the state administration level possess essential decision making power.

The data is collected from 21 interviews accomplished during spring 2007 among participants of an Interoperability Programme of Finnish state administration. At the time of the interviews, the Programme was just started, and was in its planning phase. The interviewees represent stakeholders from different levels and also sectors of Finnish government and IT companies. Their concern related to the development of EA varied according to their occupational position (Table 1). The selection of interviewees was based on purposeful sampling [15] in order to capture variation in the data in terms of both assumed information intensiveness and stakeholder population. The interviewees consisted of 11 state employees and 10 IT company employees. Six of them were female and 15 were male. Purposeful sampling together with the number of interviews is regarded to provide for saturated analysis of the information available [e.g. 16].

Table 1. Interviewees by occupation, organisational level, experience in EA, and number

Occupation	Organisational level	Experience in EA (yrs)	No
Administrative counselor	State administration	25	1
Chief Secretary	State administration	10	1
Operations Manager	State administration	7	1
Vice Director	State administration	30	1
Senior Lawyer	Administrative sector	1	1
Information Specialist	Administrative sector	7	1
Senior Adviser	Administrative sector	4	1
Data administration manager	Civil service department (city)	2	1
Data administration manager	Civil service department	15-30	3
Consulting Manager	IT company	4	2
Chief Consultant	IT company	4-10	4
Consultant	IT company	1-10	3
Director, Business Operations	IT company	10	1

The transcribed interviews were analysed with the aid of ATLAS.ti –software. During analysis an interpretation of the interviewees' utterances was carried out by iterating between the interdependent meaning of parts and the whole that they form [13]. In this way the whole data was the source of the results, which indicate the various meanings that the respondents assign to EA. In the following, the citations from data are selected on the basis of representativeness within data.

3 Challenges of Enterprise Architecture Work

The most pivotal challenges emerging from the data during analysis are divided into three main categories comprised of the following subcategories:

1. Implementation ability and governance
 - Shared understandings
 - Implementation ability
 - Business and IT alignment
 - Governance
2. Structure of state government
 - Legislation
 - Professionalism
3. Advancement of interoperability
 - Shared IT infrastructure
 - Crossing the administrative sectors
 - Understanding the influences of technology and information systems

3.1 Implementation Ability and Governance

According to the interviewees there are several challenges in EA implementation in state government. These challenges focus on shared understandings in the development of new services, implementation ability, business and IT alignment, and governance.

3.1.1 Shared Understanding

Employees of state government feel that developing electronic services is challenging, for instance, there are conflicts in focus and road map:

Researcher: "Are there any new services that your organization could produce?"

Interviewee: "Internet services are for us, I think, a big challenge...that those are really services that work in the net...we have a lot of conflicting thoughts about how to proceed in these matters and also discussion about focus areas...but as far as I can see there is a lot of potential for development...at the same time these singular processes are changed into Internet services and the information from these should be recovered."

Transformation of traditional services into electronic services, used by the customer via Internet, is seen difficult. There seems to be a need for a strategy discussion in the level of management in the organizations. Without a shared understanding it is not possible to modernize the service production in a holistic manner.

3.1.2 Implementation Ability

If the strategies developed in the government are not taken as the foundation of operations, their governance and implementation ability remain inadequate. This is partly due to the funding mechanisms that are founded on fixed-term projects:

“There is a huge amount of paper produced in state government...but their governance or this kind of – is it a problem of implementation. I have certainly read ten different strategies of state government strategy and implementation plans, implementation programmes within the past ten years –what fine papers, but the governance and implementation ability need to be changed...they are written directly to the bookshelves...they have fixed-term funding...they do as told and then they are left into that.”

There is a danger that EA implantation is insufficient when there is a lack of mandate and employees. For EA work to be successful, collaboration and communication between management and operational personnel is needed while constituting the organizations strategy and practices [17]. Lack of strong leadership and coordination of development work in state government are recognized as essential obstacles in service modernization [18]. The interviewees hoped that the operational personnel and management would commit themselves in a new way to service production. This can not be done merely in the level of the IT function:

“I do not see that management of IT function is the problem in this because they have for a long time been doing this basic work –it is more about chief secretary, top management and also in municipalities then...development personnel’s...this kind of getting them involved...Better planning of operations with the operational personnel.”

3.1.3 Business and IT Alignment

An IT expert of EA work sees it challenging to get the government EA as a governance tool:

“One very important thing is that how this architecture work -which has now just begun and is an persistent thing, is get to be ongoing and in the other hand...will be spread there as a governance method for these organizations...Architecture is a governance instrument which then guides us towards these principles we want to do or faster service, better service, more proactive service.”

EA includes a governance model which describes principles for EA management and maintenance through organizations steering processes. Finnish government’s EA work takes into consideration the whole organization and its functions through strategic management and utilizes possibilities provided by IT. EA is a practical tool for business and IT alignment [17]. According to the data EA can be used to direct all kinds of development projects in different situations. The challenge is to make people see EA as a tool for overall development:

“...to me this matter is important because if one uses enterprise architecture only as a tool - though it is useful as a method and description device, and even as a mental model it is ok - but then it only has an instrumental value instead of becoming, not necessarily a world explanation, but yet sort of framework for holistic development,

and only then one can get the whole effectiveness out of it...so it becomes the basic framework on the basis of which a project can be built regardless the situation."

3.1.4 Governance

Interviewed IT function managers state that concrete governance for the IT function is a requirement for EA. According to them given EA principles and strategies do not serve the work of ministries and departments if they are open to interpretations or loose:

"There should be sufficient steering...clarity and governance...now there is a fear that it...will be so loose that it does not have enough governance...it [EA strategy] remains so ambiguous then that it does not sufficiently guide and in a way does not serve then...when we are there with the statistics management discussed about the matter so there affirmative is expected that it really would steer our work and the architecture...would be that kind that you would be able to catch it and it would steer the work..."

This is a challenge for government EA work. The EA and its principles need to have a governance power but at the same time they can not be too restrictive:

"...it should be adequately steering that it would steer the practices together...coherent practices in long-term...in the other hand is should enable it that within the strategy it is possible to compete different suppliers..."

In the long-term coherent practices are seen as a very important goal. Interviewees feel that opportunity for competition of IT suppliers is an advantage and they hope that EA strategy will support in arrangement of competitions. Success factors might be open communication and stakeholder originated development [19].

3.2 Structure of State Government

The complex governance and organizational structure of state government was seen as a challenge from various viewpoints. EA work should be planned in a way that it takes existing structures into consideration [20].

3.2.1 Legislation

Interviewees see a tension between the legislation regarding state government and administrative sectors. This tension is visible also between the national and international legislation. EA is one solution for unifying the national legislation, service and IT solutions.

"For example...Ministry of Interior has build a system for police administrations information management in which...steering features is efficiency of police, international contacts of police and support of police work...then it is said that for rational reasons you need to transfer to common architecture, common data level solutions and common service solutions. Then there comes a conflict –this is not a conflict of legislation but this is a conflict of systems...Customs is a good example...Customs is not officially business of Finnish state government and it is a system owned by the EU...and we are a national department of Brussels. EU forms a joint customs area –it has one common customs legislation and customs is lead from Brussels..."

3.2.2 Professionalism

The work within state government has traditionally been organized by professions. This might make it more difficult to question or change the work practices:

“...these kind of professional services...state government –the structure is explained by this kind of professionalism in a great extent...juridical system is owned, managed and run by lawyers and they do not take criticism from others... National Land Survey of Finland is owned by surveying engineer and they do everything by themselves...doctors they are...equally big trouble...so this kind of cohesion of professions and unwillingness to see any other possibilities for organization...”

Interviewees anticipate that the employees of government wish to maintain the current organization structure, since professionalism constitutes an obstacle for creating new insights. The data shows that people are afraid of moving support functions away from the authority of own department, because, they think that it influences the organization of the substance functions. This threat might be genuine, provided the changes are not made in a controlled manner. Finnish government’s EA work aims at enabling controlled strategic changes in management control and it offers development models and methods and tools for controlling the changes. The challenge in EA work is altering work procedures, conceptions and beliefs. Emergence of conceptions that are professionally bound reflects the need for encountering and consolidation of the organizational cultures [21]. This seems to be necessary also in government EA work. It is challenging to motivate the change of work practices towards new ways of working.

In the state government data exchange has traditionally been paper based. The transition to electronic data exchange is a massive change, in which, according to the interviews, all employees are not ready or willing:

“We are still pretty much in the pattern that rationalizing information management and processing by technique is...quite in the beginning...Council of State works fine as paper-based and management can have collected information without any problems regardless of these systems... motivation level for [EA work] is reduced by that the management do not need these development steps for themselves.”

3.3 Advancement of Interoperability

EA is one solution for state government’s integration and interoperability challenges [9]. Interoperability is an ability of information systems and processes supported by them to share and exchange information [22]. However, the interviewees see interoperability issues as challenging.

3.3.1 Shared IT Infrastructure

Interoperability of services and information systems can be improved by shared infrastructure for information systems and technology. According to interviewees this supports common practices for financial and human resources:

Researcher: “What the corporate governance mean in practice?”

Interviewee: “...common financial steering, common human resources management to a certain limit and now...building common IT for this production instrument, for improving its steer ability and interoperability and efficiency...for improving the

effectiveness of corporate governance common IT infrastructure is a fundamental question...

Interoperability of the IT infrastructure is seen as the core of EA work. However, interoperability is a wider goal than that. Common IT infrastructure can be the beginning for electrification of services. This was accomplished successfully in Canada by accommodating operational needs of administrative sectors and departments [23]. It would be beneficial if IT infrastructure could be developed subordinate to the business vision and strategy.

3.3.2 Crossing the Administrative Sectors

Interviewees participating in IT strategy work in the administrative sectors see development challenges in crossing the administrative boundaries:

“IT strategy work in administrative branches...there has explicitly been an intention to consider this administrative branch’s...key transformation factors and needs and principles...how much do we have integration needs in this branch...mostly in regard to information architecture...but also outside this branch...I wish that the State IT Unit would solve those problems we want to solve at the moment...besides in our department also in the whole administrative branch and as far as I can see in the whole state government...”

There are integration needs in all levels of state government. The need for crossing the administrative sectors unfolds frequently in the interview data. The government EA work is hoped to contribute to these matters. Integration of single information systems into larger service entities is in the agenda of many Western countries for modernizing state government, but this kind of cross-governmental development work is complex and challenging task [24]. In addition, there also are many questions related, for example, to data protection and security that need to be addressed. It clearly is challenging to achieve extensive interoperability. Therefore, the structure of state government often impedes the success of EA work [25] [26].

3.3.3 Understanding the Influences of Technology and Information Systems

Interviewed top level decision makers see that knowledge of technology is deficient in some regard:

“...also managers should know about these issues about information systems, they are business processes and there is normal decision making power related to them and...operations which need to be equally evaluated as the same as when we renew some other work practice.”

Management’s ability to understand the influences of technology and information systems and their implementation is essential in order for them to make decisions concerning IT. This is a challenge. With EA it is possible to examine how to take best advantage of technology and its abilities in rationalizing [27].

4 Conclusions

This article discusses the challenges of national EA work in Finland perceived by the stakeholders who participated in the state’s Interoperability Programme in spring

2007. The results indicate that, according to the interviewed stakeholders of state EA work, essential challenges are, first, an implementation ability and governance. This is seen challenging in terms of shared understandings, implementation ability of EA, business and IT alignment as well as governance. Second, structure of the state government is forming challenges to EA work. Especially legislative boundaries and socially rooted structures in the form of professionalism are seen to hinder EA work. Third, advancement of interoperability within the whole state government is a challenge. Here the lack of shared IT infrastructure is one obstacle. Another challenge is seen in the opportunities to cross the administrative sectors, particularly by service processes. Finally, a challenge for the success of EA work is the insight into the impact of technology and information systems within state government.

The results reflect a similar need for creating an overall strategy for the state government that has arisen in different countries [28]. Methods for this are, for example, centralization and integration of services. The departments of state government are encountering the dynamic environment that increasingly demands efficiency [17]. This requires interoperability of business functions, information systems and technology. This challenge arises from the data. Business and IT alignment enables the organization to utilize its information resources in achieving business goals. In this kind of situation department's information systems support and they are supported by the department's strategy [17]. According to the stakeholders, information resources can be utilized in co-operation use in various ways but this requires investments in vocabularies and ontology services. EA is a practical tool for increasing and ensuring the interoperability of business, information systems and technology. In the data this is visible in cross-governmental electronic services which are possible via shared technology architecture, centralized registries and portals.

It seems that government EA work requires changes in work practices and investments in change management. This is a challenge but at the same time an opportunity. EA is one tool for public service modernization. The interviews show that EA work is weighted with great expectations which need to be answered in the future. On the basis of the data we recommend the following:

1. The governance level of EA needs to be leveraged. EA should form the ground for business driven development and decision making.
2. EA needs to be a tool for business driven development. This requires the involvement of general management and people who participate in the development of substance functions.

The level of governance needs to be suitable. If governance is insignificant, it diminishes the benefits that could be achieved in co-operation, better services and lower costs. Too strict governance may lead into diminishing of innovativeness and initiatives which may reduce modernization of public services and government's structures. One part of the governance is EA governance model. With it EA can be linked in the state government's business and financial processes. Governance model includes tools for EA governance and maintenance. The usage of these is needed for keeping the EA current and able to support the business functions. If EA work remains in the level of information management the maximum benefits are not reached. In that case, for example, integration of information systems is done without of holistic reorganization of service structure.

In general, various challenges of EA work are widely known; however, there are not yet many solutions. There is also a lack of empirical studies concentrating on how to successfully use EA especially in public sector reforms. In the future, a follow-up study concerning the stakeholders' views on state EA will be carried out. Then the topics emerging as essential in this first interview study will be elaborated. It is essential to further clarify the stakeholders' views in order to incorporate general management and people who participate in the development of substance functions to the EA work. In this way it is also possible to unveil the potential strategic knowledge capital that the stakeholders have regarding eGovernment.

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II

STAKEHOLDERS' VIEWS ON GOVERNMENT ENTERPRISE ARCHITECTURE: STRATEGIC GOALS AND NEW PUBLIC SERVICES

by

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Stakeholders' Views on Government Enterprise Architecture: Strategic Goals and New Public Services

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Abstract. This paper introduces different stakeholders' views on enterprise architecture development within the Finnish government. The data is gathered from 21 interviews accomplished during spring 2007 among participants of the Interoperability Programme. The interviewees represent different sectors and levels of the Finnish government and IT companies. On the basis of a qualitative data analysis we discuss the notions that different actors connect to EA work. The key conclusions are that the ongoing EA work is seen as technically oriented and more emphasis should be put to activities and contents. On the basis of the data, it seems easier to develop government EA and interoperability on the level of state administration and ministries than in the agency level.

Keywords: State Administration, Enterprise Architecture, Interview Research.

1 Introduction

At present, public administrations all over the world promote costly e-government programmes to provide electronic access to government services. However, e-government approaches have often not been able to solve organisations' concern how to utilise ICT to its fullest strategic extent. Difficulties have been encountered and many e-government initiatives are described as chaotic and unmanageable [1]. One solution has been to initiate an enterprise architecture (EA) programme. EA is seen as a comprehensive approach, for example: "*enterprise architecture is a coherent whole of principles, methods and models that are used in the design and realisation of an enterprise's organisational structure, business processes, information systems, and infrastructure.*" [2] Further, Enterprise architecture is used to describe how different elements in an organisation – systems, processes, organisations, and people – work together as a whole [3]. By identifying, structuring and categorizing these elements, EA can increase the potential for cross-public sector reuse and reduce duplication and hence reduce costs.

In taking EA into use as a holistic development tool for e-government, it is of utmost importance to take into account the views of the stakeholders involved. In particular, it is necessary to notice their views in order to guarantee acceptance of the

new information systems. From an information-legal basic rights viewpoint, the most pivotal issues of catering for the stakeholders' concern the right to receive information, the right to communicate, the right to free information, to exchange information freely, and the right to information sovereignty. Thus, when using EA as a tool for e-government, attention should be paid on the informativeness of the approach, and especially, how the stakeholders understand EA in the context of developing e-government. However, there is little research that discloses how the stakeholders actually understand EA as a tool for the development work of e-government.

In this paper, we introduce results from an empirical study concerning different stakeholders' views on government EA development initiated within the Interoperability Programme of the Finnish state administration. In the following, we first depict the research setting and method. Second, we present the results as stakeholders' views on government enterprise architecture. Third, the strategic goals of enterprise architecture work are described. Forth, we present interviewees ideas for new public services. Finally, we state the conclusions and topics for the future research.

2 Research Method

According to its aim to understand different stakeholders' views in particular organizational context, the study merges with the principles of interpretive research that is seen to produce deep insights into human thought and action [4]. An interpretive analysis was carried out with data from semi-structured, in-depth interviews. The interviewees were asked a written informed consent, and the questions were asked in a manner that excludes interviewer bias [5]. The method has been applied also in our prior study [6].

The interview themes and related questions were derived from an underlying theoretical EA framework developed for the Finnish state administration. The framework consists of four generally known EA viewpoints:

- Business (e.g., clients, organisation, stakeholders, services, processes)
- Information (e.g., strategic knowledge capital, vocabulary)
- Information systems (e.g., information system portfolio, systems' life-cycles)
- Technology (e.g., technology and standard policies, model architectures)

These issues are placed within three levels in the framework. The highest is the level of state administration, which is the top level of decision making. The second level is the level of administrative sector, which includes independent decision-making bodies under state administration level. The lowest level refers to civil service department level. This structure was implemented in this study by selecting interviewees from each level. The interview questions concerned the respondents' views of current and future condition of state EA. These levels form the basis for interconnections between the different sectors in that the level of state administration operates in a cross-sectional manner, and thus is able to delegate cross-sectional tasks to the lower levels.

In this way also the participants from the state administration level possess essential decision making power.

The data is collected from 21 interviews accomplished during the spring 2007 among participants of an Interoperability Programme of the Finnish state administration. At the time of the interviews, the Programme was just started, and was in its planning phase. The interviewees represent stakeholders from different levels and also sectors of Finnish government and IT companies. Their concern related to the development of EA varied according to their occupational position (Table 1). The selection of interviewees was based on purposeful sampling [7] in order to capture variation in the data in terms of both assumed information intensiveness and stakeholder population. The interviewees consisted of 11 state employees and 10 IT company employees. Six of them were female and 15 were male. Purposeful sampling together with the number of interviews is regarded to provide for saturated analysis of the information available [e.g. 8].

The transcribed interviews were analysed. During analysis an interpretation of the interviewees' utterances was carried out by iterating between the interdependent meaning of parts and the whole that they form [4]. In this way the whole data was the source of the results, which indicate the various meanings that the respondents assign to EA. In the following, the citations from data are selected on the basis of representativeness within data.

Table 1. Interviewees by organisational level, occupation, experience in EA, and number

Organisational level	Occupation	Experience in EA (yrs)	No
State administration	Administrative Counselor	25	1
	Chief Secretary	10	1
	Operations Manager	7	1
	Vice Director	30	1
Administrative sector	Senior Lawyer	1	1
	Information Specialist	7	1
	Senior Adviser	4	1
Civil service department	Data Administration Manager (city)	2	1
	Data Administration Manager	15-30	3
Management level of IT companies	Director	6	1
	Sales Director	10	1
	Consulting Manager	10-25	2
Consultants	Senior Consultant	8	1
	Management Consultant	0-9	2
	Consultant	10-16	3

Next we present results of the study. We have selected the business architecture as our viewpoint in this paper. The results depict interviewees' opinions on current and target business architecture of Finnish state government.

3 Views on Government Enterprise Architecture

The Finnish government enterprise architecture work is carried out by various different stakeholder groups. This was also reflected in the interviews. We categorized the representatives of the public administration in three organisational levels that are also present in the Finnish EA framework. These are state administration, administrative sector and civil service department. The interviewees were from different sectors of the government, such as the Ministry of Finance, Ministry of Defence, Ministry of Social Affairs and Health and, Ministry of Employment and the Economy. The representatives of the IT companies were categorized in two levels: management and consultants.

At the general level stakeholder group's views varied in relation to the organisational viewpoint. At the level of civil service department the interviewees discussed the EA work through the lens of the department or municipality they represented. Interviewees from administrative sector viewed EA through their own organisation or sector of administration. The interviewees from the state administration had the viewpoint of administrative sector or the state as a whole. One interviewee had the viewpoint of a municipality.

The interviewees from IT companies discussed the EA work solely from the viewpoint the whole government. They did not consider administrative sectors or civil service departments as separate wholes. One representative of an IT company discussed the viewpoint of municipalities.

We believe that these differences in EA views elicit an important notion for the government EA work. The government EA work is holistic and the results are aimed for the whole government. The somewhat narrow views of people participating in the EA work may lead to unexpected or unwanted outcomes. Representative of administrative sector delineates how he views EA:

"...from the viewpoint of my own organisation and then also from the holistic...at least should be viewed."

The view of a consultant:

"...we look the government as a whole and how the...organisation, the whole system, would work in the best possible way."

These different views on government enterprise architecture are visible throughout the data. They are reflected in the answers to other questions as well. Next we discuss the strategic goals of the government EA work.

4 Strategic Goals of Enterprise Architecture Work

The main goal of the Finnish Interoperability Programme is to create EA to be used as a tool for steering the development of operations and information systems (IS) at all levels of state administration. In addition, the goal is to create and introduce a governance model for EA maintenance and utilisation of EA descriptions in steering of development and IS projects. With the EA it is easier to take into account strategic goals in the development of public services. These goals are: customer orientation, sustainable development, enhancement of service production. Hence, EA is defined as

a tool for strategic management through which the operational development and use of IS are harmonised in the level of state administration. These strategic goals of EA work are very holistic and require substantial changes in the work practices within the government and in the customer interface.

From the interviewees presenting Finnish government, we asked what kind of strategic goals should their organisation or the government generally set for the EA work. At the civil service department level increasing interoperability was seen as the key strategic goal. Interoperability is defined as *an ability of information systems and of the business processes they support to share and exchange information* [9]. Interoperability was mentioned from the viewpoints of building shared services and facilitating information transfer. However, technical interoperability was often in the center of the discussions.

Interviewee from the administrative sector brought up that attention should be paid in interoperability of the operational processes at the organisational level. Interviewees representing state administration emphasized viewpoints of productivity and efficiency:

“It should be based on nationally centered systems, because we must remember that we have only 5,2 million citizens...In Finland the volume is extremely small...that is why...we must avoid building overlapping systems...”

Another interviewee emphasized the productivity viewpoint. In his opinion it accelerates the functioning of the administration, improves its quality and enhances the ability to service citizens.

From the interviewees representing IT companies, we asked what kind of strategic goals should be set to the government EA work. They brought up, for example, that guidelines and recommendations are needed in state administration but from the other hand there should also be freedom to do the core functions. IT professionals conceived the role of communications significant in order to achieving success in EA work. They felt that there is a need for a corporate strategy for the government as a whole. Currently such is lacking.

IT professionals highlighted improving interoperability as an important goal for rationalizing the administrative work but as well in a wider societal framework. This means the qualitative change brought up by aging of the population and as a need for new type of service production.

Representatives of IT companies underlined the importance of customer viewpoint which did not come up in the interviewees of administrative people. In sales directors words:

“Well in the end everything concludes in this customer viewpoint thus why the state exists and why the services are produced...therefore first the strategic goal needs to be...producing better services here for these customers.”

The stakeholders of the state administration emphasized interoperability as the main strategic goal for the enterprise architecture work. This was seen important from the viewpoint of using the common information resources and establishing coherent business processes in the state level. All stakeholders repeatedly elicit the need for rationalizing the operations as a strategic goal.

Next we present interviewees proposals for new public services.

5 New Public Services

New public services emerged as a significant goal for the government EA work. For many interviewees perceiving new type of services was troublesome. We asked: “What kind of new services public administration could produce” and the answers were general, when new public services were conceived solely as electronic services.

Representatives of civil service departments perceived electronic services as a substantial challenge and at the same time they saw a great development potential in them. As concrete development matter they brought up, for example, user identification. Currently in Finland, there is a lack of a reliable and widely used identification method. This was seen as an obstacle for the development of electronic public services.

At the administrative sector level the interviewees highlighted coherent service production and jointly development.

The transition into centralized solutions, particularly in financial and personnel administration, was seen important in the level of state administration. Centralized solutions would have substantial efficiency benefits. This does not mean merely cost savings; furthermore it would result in producing better services with available monetary resources. In addition, they perceived producing electronic services in a way that takes into account the important democratic principles:

“...legal protection and then requirements of democracy, transparency and all these are secured. The way we now work at paper is transformed into electronic...This is where the focus is. Certainly we can produce new services, but to keep public sector's costs together...then this adaptation and productivity require...making these as efficient as possible.”

The requirement for democracy and efficiency in new services comes up in other interviews also. Interviewee saw it problematic that during elections politicians promised new services and lower taxes and citizens do expect to get new welfare services. He stated:

“It might be that the public administration is condemned to cut down services instead of extending them.”

Representatives of IT companies had varying opinions. Consulting manager wished better services instead of new services:

“Well, I do not know, there are little that citizens would need. Most of these current, so called, services are such that no one ever asked for...I think it would be most important to get the existing services to function even better.”

Consultant disclosed the need for proactive service concept and one-stop shop services.

New services were essential for the interviewees. Representatives of administration defined services generally as electronic services without concrete examples or customer perspective. Developing electronic services is a major challenge which requires a lot of work from actors in public administration. Representatives of IT companies had concrete ideas for new services and ways of servicing.

6 Conclusions

Data analysis elicit different stakeholders' views in all the four EA viewpoints. In this article, we concentrated on the business architecture, because it is the fundamental function in transforming governmental traditional administrative processes into public services. Stakeholders' views varied in regard to the interviewees' background organisation.

The uttermost important strategic goal for the government EA work was interoperability. Interoperability was defined both technically and functionally. Representatives of IT companies brought up more strongly than administrative people the need for improving customer orientation and developing service production. All stakeholders emphasized the need for rationalisation.

Representatives of public administration perceived new electronic services as the most important type of services, but developing them was seen challenging and laborious. They also saw the possibility of reducing services. The improvement of existing services was found more important by the IT professionals than creating new services.

Differences in the interviewees background organisations were visible, for example, as follows. At the level of civil service departments the viewpoint was more narrow than the viewpoint in the level of state administration and IT companies. The views of people in state administration and IT companies were closer than of other groups. Based on the data promotion and development of government EA and interoperability is presumable easier in the state administration and administrative sector than in the civil service department level. In the civil service departments the focus is more in developing their own EA than participating in creating a government wide EA.

The interviewees saw the ongoing government EA work as technically oriented and more emphasis should be put to activities and contents. The need for productivity goals, concrete policies and common guidelines was recognised. Some interviewees were skeptical on the possibility of success in the EA work itself. According to the interviewees there are challenges in regards of marketing and communicating EA work, hence these are the requirements for advancement of the EA thinking.

This article focused on the business architecture viewpoint. In future research, the other three architectural viewpoints: information, information systems and, technology are covered. This is a requirement for constituting a more holistic picture on stakeholders' view on government enterprise architecture. In addition, follow up interviews would give important knowledge on development of stakeholders views.

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III

A FRAMEWORK FOR EVALUATING COMPLIANCE OF PUBLIC SERVICE DEVELOPMENT PROGRAMS WITH GOVERNMENT ENTERPRISE ARCHITECTURE

by

Katja Liimatainen, Jukka Heikkilä & Ville Seppänen, 2008

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A Framework for Evaluating Compliance of Public Service Development Programs with Government Enterprise Architecture

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Abstract: In the context of public government, enterprise architecture means a way for systematic description and planning of cross-sectional services. This is done by aligning existing resources with information and communication technology investments to ensure national and international interoperability. Governing interoperability across organisational domains requires that public agencies take into consideration other parts of the public sector and engage to courses of action that are commonly agreed upon. As many of the intra- and inter-sector information and communication technology initiatives seem to still end in trouble, the panacea considered is government enterprise architecture (GEA). GEA work is in the agenda of many governments. However, the successful implementation of such programs has been problematic.

In this paper, we describe the nature of public sector transformation with GEA. Based on the findings from the first round of the Finnish Interoperability Programme developing the GEA and our follow up research, we identify areas for improvement. After that we analyse the governance model for GEA compatible program initiatives. We propose a tentative framework for evaluating public service development programs' compliance with GEA. The framework is based on practical requirements that have emerged during the ongoing development of GEA in Finland. Framework describes how a program initiative needs to be handled in the GEA approach. The framework is guiding the procedure of implementing a program with quality assurance and monitoring measures. We also include an additional stage of business modelling, because of the observed problems of government agencies not being capable to look outside their box and innovate. The framework helps in evaluating the costs, benefits and beneficiaries of the expected outcomes of the program; the beneficiaries being as well government, citizens or private businesses, or any combination of these. The results of this study are of interest for both practitioners and academics in the field of enterprise architecture.

Keywords: Government enterprise architecture, electronic government, public service, development Project

1. Introduction

Archetypal public administration is hierarchically organised bureaucracy, where the responsibilities are clearly divided within the ministries' administrative subject fields. Initiatives are proposed to civil servants, who push the decisions higher on the organisational ladder by careful preparation on which democratic decisions are based. In addition, hierarchy is harnessed for delegating tasks and responsibilities along the line of command, indicated, for instance, by orders signed with stamps. In most Western societies the paper based processing has been replaced with information systems, wherein processes and decision rules have been hard coded. This trend has further reinforced the bureaucracy.

The digital era poses challenges to the public administration: The citizens are information and communication technology (ICT) literate, they are to growing extent having access to the public information at their fingertips. Yet, because the public administration, by definition, is for all, the civil servants are mediating the citizens' initiatives between the forms and decision makers within their silos. However, under growing cost pressures and the changing citizen capabilities, most governments attempt to modernise their operations, citizen interfaces and introducing self-service with the help of information and communication technology. We are finally seeing that the use of ICT tools and applications is leading to transformational shifts in public policy, processes and functions (UN 2008). This is not just automating processes or information gathering for decision making, but attempting to make fundamental changes to the processes at all levels (Mooney et al. 1996).

The calls for more efficient and streamlined public administration mean that more and more often the administrative burden to the citizens and other stakeholders, such as private service providers, count (Lau 2007). Against this backdrop, it becomes crucial to optimize the burden of administrative processes (they can be described as long administrative transactions) from different stakeholder's

viewpoint. Hence, this leads to redesign of the public sector as a whole (Mayer-Schönberger & Lazer 2007). In many nations, the governments seek to offer their citizens a seamless service delivery as part of the public sector modernisation plan (Liimatainen, Hoffmann & Heikkilä 2007).

Governments are simultaneously trying to improve the service delivery and efficacy of government functions. This requires rethinking the role of ICT, by increasingly looking towards e-government-as-a-whole concept. It refers to government agencies working across portfolio boundaries to achieve a shared goal and an integrated government response to particular issues. (UN 2008) Earlier political and managerial focus was on developing electronic services within each public organisation with limited consideration of cross-organisational coherency, the focus today has clearly shifted towards co-ordinated services offering one-stop shops to citizens and businesses (OECD 2007). One solution for intertwining disjointed e-government projects has been initiating a government enterprise architecture program. Enterprise architecture is a hierarchical approach for aligning business and ICT (Langenberg & Wegmann 2004) and it describes how the information systems, processes, organizational units and people in an organization function as a whole (Morganwalp & Sage 2004).

Some key prerequisites for the ideal seamless service delivery are free flowing information between authorities, power to change processes across administrative areas and new service concepts, which are implemented in an efficient way with the help of interoperable ICT systems. In spite of that, public sector ICT initiatives are mostly still developed in silos with too little attention to other actors in the government, or to the total administrative burden to the stakeholders. This new kind of service delivery requires interoperability. *Interoperability* is defined as an ability of information systems and of the business processes they support to share and exchange information (IDABC 2004). Policymakers initiate government enterprise architecture (GEA) programs to ensure interoperability, avoiding duplication efforts and enable government wide reuse (Janssen & Hjort-Madsen 2007). Hence, GEA programs face challenges related to integration and interoperability within and between public agencies (Hjort-Madsen & Burkard 2006). Overcoming these challenges is found out to be difficult (Isomäki & Liimatainen 2008). Government structures often impede GEA programs from succeeding (Hjort-Madsen & Gotze 2004).

The article is organized as follows. In the second chapter we describe the problems that GEA attempts to solve with illustrative cases. In the third chapter we argue the need for a framework for evaluating public service development programs' compliance with GEA and in the fourth chapter we will describe the framework for interoperable public service ICT development. The fourth chapter concludes the work.

2. Public sector transformation with GEA

In the business sector enterprise architecture (EA) is a tool for strategic management, supported with business and operating model mappings with ICT infrastructure. In other words, to our understanding an enterprise's mission, vision and strategy are reflected in the form of business model to different operating models and ICT infrastructure alignment. This development has been accelerated with the emerging promise of business modelling relying on modularised patterns and components instead of mere integration.

In governmental context, EA is mostly used as tool for integrating independent organisational and information and communication technology silos, as component based development is still rare. GEA is increasingly used to set the framework for developing public services and information systems in line with the administrative objectives. For example, by identifying, structuring and categorising organisational elements, GEA can increase the potential for cross-public sector reuse and reduce duplication and hence reduce costs. With GEA, the strategic goals of public sector service development and execution can, in principle, be better understood and accommodated.

In reality, the GEA initiatives in public sector have often ended up in trouble (Liimatainen et al. 2007): the prerequisites mentioned in the introductory chapter are not met, or it takes long time both to build capabilities to engage in to inarguably complex process of designing GEA and overcoming organisational and cultural barriers of thinking in terms of total administrative burden and customer processes across administrative boundaries. The complexity is due to the fact, that the variety of governmental services is vast: in modern societies they have grown to cover all aspects of life. For example, in the US Federal Government there are more than 10.000 applications, in the Finnish

government (serving population of 5.3 million) around 5.000, and in both countries the growth is accelerating despite countermeasures. Under these circumstances any approach gets burdensome, especially if you take into account the interoperability requirements stemming from the international and regional connections for the central government. However, implementation of a GEA program offers a way forward in integrating independent ICT silos across inter-organisational agencies. This integration is seen important by the most governments of Western countries (Janssen & Kuk 2006). As anticipated, interoperability and integration objectives are becoming increasingly important when governments implement and manage EA programs and governing interoperability across organisational domains requires co-operation between the agencies (Hjort-Madsen 2006).

Compared to e-government initiatives GEA programs are holistic approaches that intertwine and focus disjointed e-government projects. Governments usually have several independent e-government projects, which may have limited coherence and remain largely uncoordinated (Hjort-Madsen 2006). EA approach can serve as an umbrella for explaining the relationships among the projects and managing change. According to Christiansen and Gotze (2007) 67 percent of governments already have a GEA program and added to those the countries that are planning to have a program within one or two years the percentage will exceed 90.

The need for GEA can be understood in the light of the recent governmental project failures. In the UK, the originally 6 billion pound Connecting for Health programme faced a multitude of problems, several scope changes and give-ups by vendors and consultants, and continuous budget over-runs. The problems are deep-rooted in data conversion, legacy system upgrades, user training and meagre senior staff engagement into the design. (Meyer 2006). On the programme page, it is stated that the budget is now 12.4 billion pounds for next ten years, *"It is better to get the tasks right rather than sticking to a rigid timetable"*, and *"The National Programme for IT [=NHS Connecting for Health] is a platform that will ensure that all systems within the NHS (National Health Service) can work together"* (NHS 2008a). The latest estimate the new ICT systems in the NHS are to deliver better care and an estimated 1.14 billion pounds in savings by 2014 (NHS 2008b). It seems that after the first failures, the sheer size and complexity of the projects requires EA approach.

There are some governments that are forerunners in GEA work, for example, USA and Denmark. Even in these countries the implementation of GEA has not been without problems. The fast advances in GEA work in the USA's Federal Enterprise Architecture (FEA) are because of the use of legislation for certain governance aspects from the beginning. Most notable are the Government Performance Results Act of 1993 and the Clinger-Cohen Act of 1996. The former is to increase the transparency of government projects in terms of objectives, performance, effectiveness, and invested funds. The latter defines that acquisitions, planning and management of technology must be treated as a capital investment in co-operation with related authorities. The GEA includes a governance model, which includes the necessary activities to estimate, conduct and revise EA. It also defines the roles of different stakeholders and most importantly in Federal Transition Framework (FTF) the relationship of layers from performance evaluation and business/component modelling to data and technical reference models.

In practice, Hjort-Madsen's (2007) study showed that the federal agencies in the USA adopting EA planning are struggling to show how information systems planning can be a driver for administrative reforms and transformation in government. At the moment, the chief information officers (CIO's) rarely have control over IS budget and have problems while trying to get the IS planning into the management agenda (Hjort-Madsen 2007). Yet, Office of Management and Budget has estimated to reach 16-27 percent annual savings in infrastructure costs due to FEA. If we compare FEA to e.g. the Danish GEA, the latter is facing the risk of failure in the implementation phase, since the GEA is lacking a strong governance model (Janssen & Hjort-Madsen 2007).

Several countries have set increasing interoperability both between administrative branches and with suppliers a central goal. This requires cooperation across administrative branches, which is often a new and different kind of work practice for hierarchically organized administration. This causes certain kinds of challenges in the GEA implementation phase and particularly the role of governance models becomes salient. (Liimatainen et al. 2007) Architectures evolve over time and consequently governance structures and mechanisms are needed to guide and encourage desired development.

3. Demand for an evaluation framework

Governments are still today mostly unable to objectively quantify and show the benefits and returns of ICT investments and e-government efforts, although measuring has constantly gained momentum and attracted interest and efforts from policy makers, practitioners, industry and academic experts (OECD 2007). The prerequisite for measurement is that governments set quantitative and qualitative goals for their GEA programs and ICT projects. The achievement of these goals should be monitored through governance model and structures, the best example being the FEA.

The Finnish case shows the typical features. Government established Information Society Programme (2003-2007) that included regional projects, to promote local online public services. The National Audit Office of Finland (NAO) audited the programme and found serious shortcomings in the implementation and governance. According to NAO the programme had unrealistic and unclear objectives in relation to the timetable, available personnel resources, the governance model and allocated funds. The achieved results were fragmentary and modest compared with the original objectives. The implementation as small regional projects led to overlapping and fragmented online services. This was not expedient since the goal was to develop online services in the national-level. (NAO 2008) As a conclusion, The NAO stated that the governance of the projects should be centralised and managed at the national level. In the future the governance of cross-public sector programmes should be comprehensive and ongoing. The audit report concluded that the Information Society Program did not succeed in eliminating overlapping and competing projects. In fact, in some cases the results were reversed. (NAO 2008)

Since the 1990s, Finland has been a leader in exploiting ICT to renew its economy and to reform its public administration (OECD 2003). However, in the United Nations (UN) e-Government Readiness Index Finland ranked 9th in the year 2005 and relegated to the 15th place in the 2008 (UN 2008). According to OECD (2008) there are challenges in the Finnish economy. They are making public spending more cost effective with more competition between public and private providers of services and a level playing field ensured. This development has been foreseen some time ago before the latest UN and NAO reports, and corrective measures have been started in the Finnish government. The Council of State decided in June 2006 to create prerequisites for customer-oriented flexible services and strengthening the transparency of administration by revising the long term objectives for the government's ICT operations, development strategies of ICT functions, the common governance model, and the development programmes for the years 2006-2011. Among them the *Interoperability Programme* is to decrease overlap in information collection and maintenance as well as the overlap of ICT systems. The main goal is to increase flexibility by creating a common state ICT architecture (the Finnish GEA). It is the tool for guiding the development of processes and ICT systems at all levels of state administration. It includes a governance model for maintaining the architecture and utilising the descriptions of the architecture in the steering of projects and systems design. (Ministry of Finance 2006) The State IT Management Unit is responsible for the organisation of the programme and we have been following the progress of this programme from soon after its launch in 2006.

After the completion of the first round of the Interoperability Programme projects, we were able to summarise following issues hampering the achievement of objectives. These were picked out from the series of reports of the first stage of the programme and from our studies:

0. Management direction setting for programmes is mostly driven by internal efficiency improving logic instead of optimising administrative burden.
1. In many cases, (as stated in NAO's 2008 report), the objectives are unrealistic, too vague, and either not in relation to the everyday activities or aiming at too high a target without taking into account the resource limitations and the rule-based nature of the public administration.
2. The Finnish GEA method is demanding to implement and brings the cultural clash of functional administrators vs. process oriented reformers on the surface.
3. Data is not properly described, organised and maintained to facilitate secure and record-based retrieval and updates.
4. Tools to guide and draw up the GEA descriptions are not set. Therefore, different interpretations on the use of GEA may result in incompatible products and hinder interoperability.
5. Governance model lacks steering power and authority.

After a number of discussions with the problem owner, The State IT Management Unit and major ICT vendors, we have come to a following five points of issues to be dealt with the governance model, when designing a solution to an administrative service:

1. How to define the objective of the program in a concrete enough way? New programs should aim at innovative but feasible improvements instead of just saving costs. We believe that external views are needed for creative thinking. Along the development, the expert opinions from government are needed both in setting the objectives and insight of the practical implementation.
2. How to measure the performance of the improved system from administrative burden point of view? This calls for estimating the benefits and costs both from the responsible agencies and other stakeholders' points of view. The government should use its Balanced Scorecard variant (called Tulosprisma that consists of four type of indicators: Societal impact, Resources and finances, Processes and structures, Renewal and working ability).
3. How to measure, follow and evaluate the invested funds pay-off?
4. How to ensure interoperability from work processes and data compatibility viewpoints? Here the GEA compliance evaluation should play a major role.
5. How to ensure quality in all the above stages and in use of the GEA methodology? As pointed out by the NAO and other studies, monitoring and quality assurance must be built into the procedures.

Using the former questions we develop an evaluation framework.

4. Framework for evaluating public service development programs' Compliance with GEA

We propose a tentative framework for evaluating public service development programs' compliance with GEA. Framework is based on practical requirements that we derived above from the ongoing development of GEA in Finland. In our opinion, the key element in avoiding the previously mentioned problems, is to use a *standardised way to initiate new programs* for operations, service or ICT systems development in the government. The framework is guiding the procedure of implementing a program with quality assurance and monitoring measures. We also include a, not so common, additional stage of business modelling, because of the observed problems of agencies not being capable to look outside their box and innovate. The framework helps in evaluating the costs, benefits and beneficiaries of the expected outcomes of the program; the beneficiaries being as well government, citizens or private businesses, or any combination of these.

The framework (Figure 1) can be used by a government to evaluate whether to finance a program and to elicit if the program and individual projects are in compliance with the GEA. The framework is valuable in the countries that have complicated silo-based bureaucratic governmental structures. However, it is not as valuable for the countries that do not have as much administrative burden.

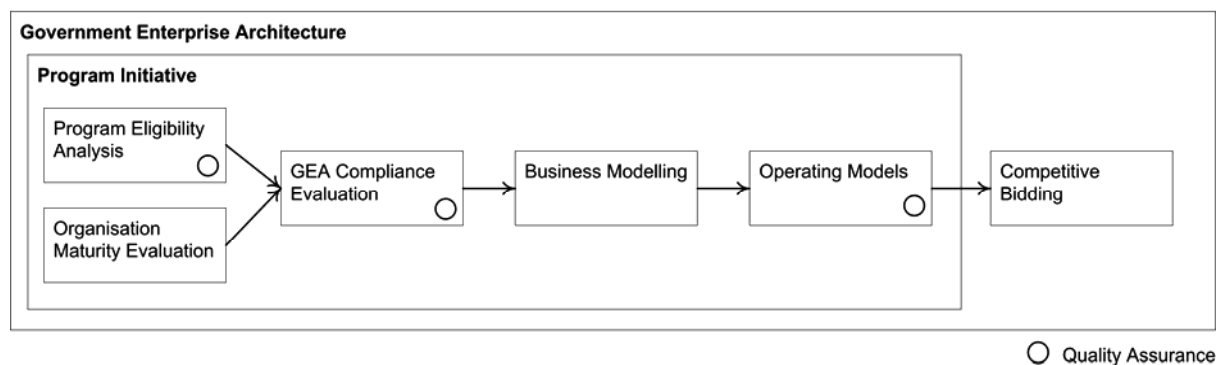


Figure 1: Framework for evaluating program initiative's compliance with GEA

An initiative for a new program can come from citizens, government programme or government organisations. Every new program is looked through the GEA. GEA covers the prerequisites set by the legislation, government programme etc. The government's strategy and goals for service delivery are included into the GEA. GEA serves as the operational environment and it describes the current and desired state and the road map to the desired state. Key attributes are, for example, clearly defined goals and government's service portfolio. Operations models, standards and system

components can be included into the GEA. GEA defines which kinds of programs and projects the public administration enforces and finances.

First, the analysis of *program eligibility* is ideally done by a number of stakeholders: the financial analysis is of special interest to government and agencies, whereas the long term government objectives evaluation is crucial to the citizens and companies. To achieve the best results quickly, it is important that most stakeholders are to participate. Here the administrative burden measures (such as the set of factors suggested by Lau 2007) can be used to achieve balance between financial and functional performance. The methods serve here as the vehicles for quality assurance, and at the eligibility analysis it is necessary to monitor key performance indicators by auditors. This should be tightly connected to the government programme and target setting to make the objectives realistic and aligned with the societal impacts.

Working in parallel, it is necessary to evaluate the capabilities and readiness of involved parties to guarantee sufficient premises for the program implementation. This includes mapping the *maturity* of processes, rules and regulations, and information systems for any cross-sectional requirements. This is also to find out what kind of resources are needed. It includes evaluation of the additional education that is needed for the personnel to be able to participate in the implementation of the programs results that are for example new services. Maturity evaluation is in the prime interest of the agencies management and experts.

Before moving ahead, the results of previous two tasks should be compared against the requirements set by the GEA to ensure the quality and the compliance with GEA. *GEA compliance evaluation* is the means a government can coerce national or sector standards, and utilise the existing infrastructure and shared services to their full potential before further investments. At this stage the EA descriptions are drawn. This task requires a holistic view from the top and detailed descriptions from related sectors and actors. This can be provided for example by mapping the services provided by different organisations into a government service portfolio.

At this stage, the objectives, existing resources, interoperability requirements and the capacity for changing the present system have been covered. Before rushing to the implementation, we suggest taking another look at the requirements in respect with the targets and performance indicators. A promising approach is *business modelling* (e.g., Gordijn 2003; Heikkilä et al. 2007), where the parties think through the ways to organise the activities and their roles in the most meaningful or profitable way. This is clearly in the interest of the involved agencies' management and experts, but it is most likely to require an outside view to innovate. Consultants, software vendors and research institutions may well serve for this purpose.

After the business model is designed it is time to choose from alternative *operating models*. With operating models we mean the set of resources to accomplish the desired targets. In addition to the agency personnel and information systems, these may include outsourced resources such as public-private partnerships. As operating models are typically constrained by present regulation and cost feedback from the earlier stages is required. This task is clearly within the authority of involved agencies' management, together with GEA experts (e.g. the CIO council). Quality assurance is necessary at this stage to ensure the necessary information for the next stage.

In addition, to the quality assurance mechanisms, the program initiative will be monitored and audited by independent authorities for quality and achievement of the expected outcomes. In our opinion, it is worthwhile to take the first audits of feasibility before the program initiative is moved to the planning stage. Additional audit points at the completion of program eligibility and maturity stages are needed for the assurance of continuous improvement. Finally, the operating model serving as a basis for competitive bidding and request for quotations is very important under the present legislation on public procurement (at least in Europe).

5. Conclusions

GEA work is in the agenda of many governments. However, the successful implementation of such programs has been problematic, as the experiences and evaluations from the UK *Connecting for Health* and the Finnish GEA illustrate. On the other hand, we have enough evidence to indicate that there is hardly any other way to go, but to increase national level monitoring and quality assurance

mechanisms to the programmes. In the contrast, governments that have less administrative burden do not need this kind of holistic approaches.

The simultaneous attempts to develop better public services and lessen the administrative burden to citizens and companies, increases the need for new ways of administering. The general belief is that with the help of modern distributed and component based information systems approach, substantial improvements can be achieved. For example, Estonia's standardised technological platform has enabled a fast and cost-efficient way of developing new services.

Based on the findings from the first round of Finnish GEA Interoperability Programme and our follow-up research, we identified five areas of improvement. Building on these areas, we depicted a framework for ensuring the compliance of public service development programs with GEA with sufficient quality assurance and audit mechanisms. In essence this means putting more emphasis on the participation, division of responsibilities and re-visiting the design for innovation before moving to actual implementation. With the help of the audits the agencies can improve their maturity for interoperable cross-sector services in a systematic manner.

Although, it is easy to see this will increase the activities, time and cost during the development program. Yet, we firmly believe that especially in the countries with thousands of application software installed and advanced legislation, this is going to be worth the effort. As the UK experience suggest, "It is better to get the tasks right rather than sticking to a rigid timetable." (NHS, 2008).

In the future we will do action research on the proposed framework: first by testing the idea with different stakeholders and then with a program initiative in Finland. Another pending need is to take advantage of a more interactive, participatory process of creating and introducing new services.

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IV

KEY ISSUES IN EA-IMPLEMENTATION: CASE STUDY OF TWO FINNISH GOVERNMENT AGENCIES

by

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Key Issues in EA-implementation: Case study of two Finnish government agencies

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Abstract

Enterprise Architecture (EA) is getting more common also in public sector as a means to ensure 'business' and IT alignment. This study reports a follow-up and theme interviews of the key actors/informants in two EA projects in public administration offices during and half year after the projects were completed. The early experience shows that the process of establishing a government EA is a tedious and complicated process and this study considers the root causes. Three set of factors are found hindering EA's potential to operate as a strategic alignment tool: lack of establishing proper EA governance, insufficient support for the development, and inadequate resources to do the former two.

1. Introduction

Understanding the partnership of information technology (IT) and business has become critical strategy enabler and success factor for any firm [1]. The successful alignment between business strategy and functional IT has been considered a key enabler in realizing value from IT investments in business for quite some time [2][3]. In addition, alignment provides direction and flexibility in probing new opportunities [4]. With the growth of complexity of IT in organizations, the alignment is growingly leaning on enterprise architecture (EA) to manage the interrelationships and growing demands on business agility. At present, EA can be seen as a central notion in aligning strategies, processes, information, systems, and technologies of an organization [5].

Recently, also *governments* around the world have initiated enterprise architecture programs to manage the vast number and complexity of information systems in running operations of public administrations for more responsive service to the citizens and

businesses. EA identifies the main components of the organization, such as business processes, information and systems, and the ways in which these components work together in order to achieve defined business objectives [6]. Accordingly, enterprise architecting is the set of processes, methods, tools, and structures necessary to implement an enterprise-wide coherent and consistent IT architecture for supporting the operations [6]. It helps in establishing a common language and offers standardized and repeatable processes to analyze, abstract, document, and communicate across the business-IT boundaries [7].

By aligning IT with 'business' objectives, national government EA (GEA) programs often pursue to increase the quality of public services, to improve the cost efficiency, and to reduce the number of overlapping systems and processes [8][9]. It is also common to aim at increasing interoperability of procedures and systems between the public offices and branches of administration.

Most of the current EA methodologies are rooted in the work of Zachman [10] architecting the enterprise information processing resources. Typically, EA frameworks feature the architectural viewpoints of business, data, applications, and technology. In addition, they commonly employ several levels of abstraction (e.g., conceptual, logical, and physical) to serve different decision-makers and stakeholders. Finally, EA serves as a blueprint describing the current ('as-is') and the desired ('to-be') state of an organization and, hence, as a basis of road mapping between these states [11].

As a part of the Finnish GEA program that was launched in autumn 2006, an EA-method loosely based on TOGAF 8 [12] was introduced, ultimately for 'planned change of government services' [13]. The method is aimed at the use of all levels of government organizations, and it includes a tentative governance model for EA [14]. At the time of writing it has been used in two pilot projects that developed agency-level

EAs, and its widespread use is about to start. As a part of the ongoing Finnish Enterprise Architecture Research project, the authors had the privilege to systematically observe these pilot projects that took place during the second half of 2007 and the early 2008. This study is primarily based on late 2008 semi-structured theme interviews. Key informants of the project were interviewed to discuss their experiences on the projects and to get the update on the situation of the EA development in the agencies.

This paper is to cast light on the issues of GEA introduction based on the experiences of actors on the two above-mentioned cases. Hence, it has practical implications for government organizations prior to launching the EA development. Three set of factors are found hindering EA's potential to operate as a strategic alignment tool: *lack of establishing proper EA governance, insufficient support for the development, and inadequate resources to do the former two*. Despite the noticeable differences in the execution and goals of the projects, these seemed to be similar as key issues in EA implementation in both cases. So we can confirm [6] that the challenges of successful EA development are often of political, project management, and organizational nature, and especially the lack of understanding of EA leads to inadequate resources and meager management support as symptoms of this misunderstanding.

The remainder of this paper is structured as follows: In the following chapters we describe our cases, the used data gathering and analysis, findings, and finally conclude with implications for further research.

2. Cases

This section summarizes the EA development projects carried out in Finnish Road Administration and State Treasury during the second half of 2007 and the early 2008. These were the first attempts to use the Finnish GEA method in developing EA in the government agencies. Both agencies are fairly large in size and run operations that require active cooperation and interactions with several external interest groups. Their operations rely heavily on extensive use of IT. Both agencies provide services for citizens as well as public and private organizations. However, there were also some considerable differences between the projects. For example, the goals, motivation, and the level of experience on EA in general were different in the agencies at the outset of the projects. In the remainder of this paper the agencies that executed the projects are referred to as RA and ST.

RA is generally considered as the forerunner in EA development in Finnish public administration. The

agency has been developing its architecture for a few years already. Before the project under study, however, the work had been done within different lines of business following a stovepipe mentality. The work could have benefit from more intensive inter-departmental coordination and from uniform EA method employed across the organization. The development has been driven by the IT department; the executives have shown positive, but arms-length commitment and involvement in it. However, the whole organisation of RA was becoming increasingly aware about the importance of EA as a strategic tool in responding the organizational restructuring and other challenges the agency was about to face in the near future. Therefore, it was willing to invest further in the coordinated development efforts. The goals set for the specific EA-project were to introduce a common means for EA development, to collect the existing dispersed development efforts under one umbrella, and to increase the involvement of business executives in the work. Another important goal was to adapt and subsequently employ the Finnish GEA governance model. The project in RA was mainly devised by utilizing the guidelines of top-down approach. It had a wide scope and originated in the organization's strategic goals.

The starting point for the project in ST was quite different. The project was the initial step that the agency took in developing EA. Just a few of the project group members had prior experiences on working with EA, and awareness in EA and its potential had only recently started to emerge in the organization as a whole. One of the interviewees commented that it would not have been possible to start such a development project in the agency one year earlier. The primary goal of the project was actually not on creating an EA but rather to design a common, interoperable architecture for the agency's electronic services platform. The Finnish GEA program was simultaneously looking for projects to pilot the newly established GEA method. The project at ST was considered a good candidate, and on that account the agency applied for the piloting project position. In the pilot the current state of the office's EA was drafted and the target state for electronic services architecture was designed to serve as a basis for detailed requirements specification of the new services platform. In parallel with this, the project was to establish the foundations for the forthcoming more architecture driven model of operations for the agency. The approach that ST took to EA development was bottom-up and primarily technical. Bottom-up approach appears more concrete and usually is seen to generate results quicker than top-down approach. Quick, positive feedback was hoped to encourage the

organization to take further steps in developing its EA. How these projects turned out in retrospect, is explained in later chapters.

3. Research method

We gathered our data by theme interviewing the key informants of the both EA projects in retrospect, i.e. after the projects were accomplished in the spring of 2008. The interviewer was familiar with the projects, because our research team has been following up their progress since the beginning. We interviewed 5 informants from both projects, about half years after the projects' completion. The themes covered different topics of the GEA ranging from project initiation to the experiences and lessons learned. The interviews were recorded and transcribed, sent to the interviewees for checking to improve reliability.

We also used ancillary data for getting the context right. The data was primarily the minutes from earlier stages of the projects workgroup meetings and workshops that were participated by the researchers. The project deliverables and documentation from the early stages were also at our disposal to improve the validity of direct observations by the researchers [15][16][17][18][19].

4. Findings

This section discusses and illustrates the significance of the three topics we found the most important in establishing EA: the governance model, support for the development project in the organization, and sufficient resources for both. In our view, these seem to be critical key issues to the overall success and especially in creating the basis for EA driven development of organization's operations and business-IT alignment. They are also closely related to each other, as they all seem to be necessary conditions to achieve success with the others. We have translated the transcribed citations from the interviews from Finnish to English.

4.1. EA Governance

Effective EA requires investments not only on technical, but also organizational and cultural infrastructures [6]. Yet, EA frameworks do not sufficiently emphasize the role of institutions and capabilities critical to enabling the governance, adoption, and diffusion [20]. Organizations that are after quick cost savings tend to focus excessively on standardization and centralization by primarily mandating compliance with the technical standards.

Also [21] criticizes EA for being often limited to technological issues. However, according to [6], the challenges of EA development are seldom technical. More often they arise from political, project management, and organizational issues. One interviewee addressed the problem by arguing that current EA methods and frameworks are not capable of taking organizational concerns adequately into account:

“The EA frameworks by design become marked as IT governance models instead of being generic [governance] models capable of taking into account different organizational structures and factors of production.”

The potential success of any EA program lies in the operation of governance model and its guidance for EA driven organizational transformation. Implementing an EA requires strong program and project management expertise along with an IT portfolio management process. Maintaining the architecture requires a refined change management process and procedures [6]. In addition, creating a strategic IT architecture competency involves ongoing negotiations about the organization's business strategy and how IT responds and shapes that strategy [21]. Developing an EA is undeniably a long-time process and it requires establishing robust governance structures and processes. The governance pursues better manageability and control, and, according to [20], architecture governance determines the adoption and diffusion of GEA. The need for governance is especially true for GEA, because architectural decisions must be made, coordinated and overseen on several interrelated levels (e.g., those of agencies, administrative branches, and governments in international settings).

At the time the pilot projects were conducted, the Finnish EA governance model was only in the process of being developed. It was limited foremost to the 1) development of the architecture itself and 2) the guidelines for implementing the TOGAF variant for current and target state descriptions. These two management objectives of the model is a subset of architecture governance as we see it. Because of little guidance and architectural directions coming from the ministries or government, many of the decisions were left to agencies' discretion. This degree of freedom did not receive much appreciation by interviewees. Instead, both agencies longed for more control over the EA development. This was especially manifested as the need for government-wide architectural policies and governance structures.

The preliminary governance model covers the areas of maturity evaluation, architecture development processes, change management, and communication [14]. According to the interviewees, both agencies found the adoption of the proposed model challenging. The major concern was that the proposed governance model expected the agencies to adapt to it rather than being adapted by the agencies. The model requires the organization to establish certain governance processes as well as related roles and responsibilities that may not be consistent with the existing operations. As one of the interviewees commented the Finnish GEA governance model:

“Adopting the governance model would require that we should need to change our existing working procedures.”

Interviewees in both agencies agreed in that the establishment of the governance model is the most important task of enterprise architecting. At the same time, it is also the most challenging task.

“Many are able to re-design processes and draw those flow charts but to design the processes so that they meaningfully and efficiently cross the boundaries of business domains... The challenge is to make it the enterprise architecture – not another disconnected entity specific to a single domain or line of business only.”

Neither one of the agencies fully succeeded in establishing the EA governance during the project durations of 7 and 10 months in RA and ST, respectively. Interviewees in both agencies strongly recommended that preparations for creating the requisite governance structures and the adoption of the governance model should be started immediately once the organization decides to initiate EA development. Preferably this should take place well before the actual EA project begins.

During the project, ST found the implementation of the governance model to be more laborious task than expected. As a consequence, acknowledging the vital role of the governance model, it was decided to reprioritize project’s assignments and put more resources in initiating it. After the project ended, the responsibility on finalizing the governance model was assigned to the recently established architecture team. RA found the Finnish GEA governance model insufficient in the level of detail and therefore had to specify several aspects of it before starting its adoption.

One interviewee raised a notion about that the EA governance should not create yet another self-sufficient silo into the organization. On the contrary, it must be

aligned with existing governance structures and management strategies

We conclude that the despite of the desires of the agencies, a governance model is not something that can be handed over to an organization from outside. A one size fits all governance model is simply not feasible according to our observations. It should be made flexible to be adaptable, but at the same time it must be generic and authoritative enough to ensure that all the required architectural principles will be enforced to meet the interoperability requirements.

4.2. Insufficient support for the EA development

Commitment by the architecture stakeholders is critical in bringing the architecture up to speed and making it successful. Business and IT managers are primarily responsible for creating a favorable atmosphere that is required in ensuring that the architectural process is granted enough time, money and other resources. [22]

Involvement from the senior management is of uttermost importance for any successful EA undertaking [7]. This is well recognized also in GEA context; for example, in the U.S. Federal Enterprise Architecture (FEA). The first step in the FEA process is to obtain the executive buy-in and support [23]. This step precedes the establishment of management and control structures and definition of architecture process and approach. The interviewees in RA and ST saw this as *the* topic to be considered prior to initiating an EA project. It is, basically, the premise of the GEA governance model. According to the interviewees, should this fail, the effectiveness of EA will be greatly hampered and it is unsure whether the project deliverables will be aligned with strategy.

A remedy to this threat is tighter control over the EA work, which must be exercised from a top-down business viewpoint [22]. It is also suggested to establish an enterprise-wide group at the executive level to provide on-going direction, oversight, or decision-making [7] to ensure the strategic connection.

Van den Berg and van Steenbergen discuss the concept of architectural thinking [22]. The maturity of architectural thinking is indicated by the degree to which the upper strata of business and IT domains share an architectural vision and how high they value the importance of architectural practices. The relationships between architecture and business goals must be clear and the architectural content should be geared to the business strategy. This means well-defined processes for architectural development not being limited only to the IT department. [22]

The project in RA was launched in the kind of situation above: the organization had taken several architectural initiatives under the lead of IT, but these have been fragmented and isolated within particular departments. Strengthening the architectural thinking and implementing the EA governance was seen as the remedy.

During the interviews it became apparent that in both agencies it would have been advantageous to take more preparing actions before launching the EA development project. An executive-level interviewee in RA pointed out that for their organization it has taken years to really get the grasp of what EA is about and what it means for developing the organization's operations. Several interviewees raised up the importance of architectural thinking. With this understanding it would be easier to set goals for the development.

In defining the important characteristics of EA development, several interviewees emphasized that it must not be seen as an IT project:

“The EA project must start from business needs. It is not an undertaking of the IT division. IT is merely an enabler.”

Despite of that, EA is commonly stigmatized being characteristically IT related effort. Admittedly, the roots of EA lie in computer science [10]. Its approaches and methods still carry that tradition and EA development is commonly driven by IT divisions for that their personnel is the most familiar with the semi-formal models and architecture descriptions that are usually used in the work. The project groups in RA and ST were also comprised of IT staff only, where as they should have engaged all involved stakeholders, including those on managerial levels, with sufficient understanding of EA's goals, methods, strategies, and the EA thinking in general. The lack of commitment and support stirred up some discussion, as it threatened to water down the advertised idea of EA being able to align the strategy with IT-supported operations. Therefore, both projects responded by organizing several workshops into which the business personnel were invited.

To sum up, it seems necessary to position the project in the organization so that it will not be perceived as an IT project. The need, objectives, and mandate for the work must come from the general management. This, however, necessitates that the managers understand the purpose of EA and commit themselves to it. Embarking from the IT divisions and heavily utilizing the traditional methods of systems engineering EA will face difficulties in soliciting the approval of business managers.

However, it was also noted that if marketed as a managerial tool EA may encounter insuperable competition:

“We already have enough 'isms. We have management by results, we have total quality management, and we have what-not-management. Being something rooted in the traditions of IT this whole idea of steering the organization by architectural models is a bit foreign concept for the general management.”

It may be helpful to differentiate EA both from the IT tradition as well as from the managerial paradigms. EA is not merely an application of a systems theory and neither is it a managerial strategy. Rather, it is seated in between these two as a framework that can parse and classify the information assets and help in evaluating, confining and guiding the strategic alignment, as indicate by one of our interviewees:

“The balanced scorecard won't give us any specific instruments to achieve goals we've set. It won't tell us what it takes to implement the chosen strategies or how the operations must be changed to reach the vision we have set.”

How EA should be sold for the executives? Since the concept is not intuitively understood outside the CIO community, a marketing strategy to communicate the strategic and tactical value of EA is suggested [23]. Both our cases organized training sessions for the stakeholders, including brief overview and the basics of Finnish GEA method and its tentative governance model. The interviewees were united on the need for more specific training on the subject matter as the needs, capabilities and areas of interests of the stakeholders vary. The importance of this task is only emphasized as there are no obligations for the state agencies to implement EA in Finland.

4.3. Insufficient resources

Referring to the earlier issues, it is evident that with lacking management support and without proper governance model it is very hard to roll out results that would show the benefits of EA development and thereby help in securing continuous and sufficient funding. Another critical problem for EA implementation is the short timeframe for learning and getting acquainted with the frameworks and governance model within the project. The interviewees uttered the resources related problems that EA implementation is not a project, but a constant, long-termed and on-going development of the activities.

In addition to financial and time resources, equally important is the sufficient allocation of the human capital. Modeling extensive and accurate 'as-is' architecture requires that the involved personnel is well acquainted with the business processes, information systems and services, and data resources of the organization. Both pilot projects struggled with the lack of current information. In addition, new unforeseeable sources of information did appear at the times the workgroup thought it had completed the task in hand and was ready to move on. Despite of these challenges, creating the current-state architecture can be seen as a relatively straightforward task of data collection and classification.

Drafting the 'to-be' architecture, however, takes the challenge to another level as it is needed to specify the new EA components and the strategic initiatives that the organization should take to maintain or improve its performance [24]. Creating the target-state architecture delayed the ST project and led to that the project schedule was extended by 1,5 months. The 'to-be' architecture is closely related to organization's vision and strategic goals. Therefore, formulating the target state must include the input from liable authorities to create essential link between the architecture and business objectives alignment.

Finally, competent architects are on high demand. The interviewees suggested that a pool of architects aware of more than their own field of administration could be established to overcome the shortage of resources and to learn from best practices.

5. Conclusions and further research

We identified three major sets of interrelated factors of key importance to the implementation of EA in public administration:

- *the lack of establishing proper EA governance,*
- *insufficient support for the development, and*
- *inadequate resources to do the former two.*

Without functioning EA governance it cannot be guaranteed that the results are aligned with organization's business goals. In essence, as confirmed by our interviewees and the literature [6], creating an EA is not a technical challenge. As Bussells notice, anyone can write a document, but that will not put the document into practice [7]. Lapkin mentions letting the EA to become a shelfware as one of the fatal EA mistakes an organization can make [25]. If the architecture is created from the bottom up and no control is being exercised from a business viewpoint, it may be difficult to justify the made architectural

choices, hard to get time, capacity and funding for implementing it in reality, and especially in alignment with the business or administrative objectives. In such a case, the architecture is at the risk of getting stuck on continuously improving efficiency without improving effectiveness [22]. The governance model aligning EA development with actual and correct business goals will help in avoiding these problems, and it also provides the means to follow-up the effectiveness of EA.

Establishing the EA governance commits to organizational structures and operations as well as staff responsibilities and roles. It is a continuous, long-term task, which in many cases will touch sensitive issues like leadership, politics, and organizational culture. Therefore, it is something needing the decisive authority that can only be gained with managerial buy-in and commitment in EA. The governance model can help in articulating of the strategic objectives and on the other hand bring concrete enough description of the existing and desired resources and operations.

The findings here indicate concerns that we have identified as key issues in EA implementation. They partly converge with the existing literature, but at the same time provide more fine-grained initial understanding and policy implications for the government organizations to improve their chances for implementing GEA for real benefits.

However, our data set is rather limited emphasizing more the phenomenon, its driving and hindering set of factors than generalizability. Therefore, the most obvious way to enhance our understanding is to confirm our findings with a similar set of questions applied in a context during and after EA implementation project.

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V

**KEY ISSUES IN ENTERPRISE ARCHITECTURE ADOPTION
IN THE PUBLIC SECTOR**

by

Ville Seppänen, Katja Penttinen & Mirja Pulkkinen, 2018

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Key Issues in Enterprise Architecture Adoption in the Public Sector

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Abstract: This paper examines the challenges of enterprise architecture (EA) adoption in public sector organisations. So far, demonstrating the benefits of EA has appeared difficult in this context, and the results in transforming public sector remain modest: Both the penetration and the maturity of EA appear rather low. In the academia, however, the adoption of EA has gained less interest than the EA development and methodologies. Hence, there is a need for research on what are the challenges of EA adoption, and how to overcome them. This paper presents the results of an expert survey on the challenges of EA adoption in the Finnish public sector. The analysis of quantitative data, supported with a qualitative data, reveals three interrelated factors: *Resistance towards EA*, *Relevant EA goals*, and the *EA practices in use*. Managing the identified key issues classified in these three broad concepts would be the prerequisite for institutionalising EA and making it a legitimate practice. The findings extend the current knowledge of the public sector EA with practicable ideas how to increase the level of penetration and maturity.

Keywords: enterprise architecture (EA), adoption, organisational change, resistance towards EA, relevant EA goals, EA practices in use, survey research

1. Introduction

Few question the benefits, such as improved alignment, informed decision-making, and reduced costs, attributed to well-planned and methodical management of enterprise architecture (EA). However, organisations, especially in the public sector, are struggling to adopt EA and related enterprise architecture management (EAM) practices. Lack of properly managed EA leads into problems in interoperability and holistic development that are the requirements for a fluid digital transformation of governments. This study aims at uncovering the reasons for the moderate success in introducing EA to public organisations, and suggest improvements in the EA adoption stage.

EA can be used as a business management tool, that supports especially communication and change management within and between the organisational entities. EA identifies the main components of the organisation, including its information systems, and the ways in which these components act as a whole to achieve defined business objectives (Kaisler, Armour and Valivullah, 2005). However, the consensus regarding the key constituents and practices of EA is lacking (e.g., Schöenherr, 2009; Zink, 2009; Lemmetti and Pekkola, 2012; Lucke et al., 2012; Rahimi, Götze and Møller, 2017) and, therefore, each organisation adopting EA can be advised to define the purpose and scope for the work based on their individual needs. The definition of EA in any particular instance emerges from the purpose and scope (Hope, 2015). Thus, the first step in building a relevant EA program is to understand and embrace the most appropriate implementation approach for the organisation (Bui, 2015). For example, Hjort-Madsen and Pries-Heje (2009) identified two types of EA programs in the public sector. One type is a stable element of information technology architecture, and the other is a fashion-driven business architecture element. Even if used in parallel, these types of EA differ substantially in focus, approach, and produced artefacts. For these reasons, in this paper we avoid committing to a single definition of EA, but examine the adoption of EA as a practice, rooted in current theory.

In the public sector, EA programs often set goals to increase the quality of public services, to improve the cost-efficiency, and to reduce the number of overlapping systems and processes (Christiansen and Götze, 2007; Saha 2009). Recently, EA has gained significance in managing the digital transformation (e.g., Aier and Schelp 2010; Schmidt et al., 2015; Zimmermann et al., 2015). However, demonstrating the benefits of EA is difficult (Morganwalp and Sage, 2004; Niemi and Pekkola, 2016), because many of the expected benefits are indirect and intangible (Niemi, 2006). EAM is a challenging task (Kaisler, Armour and Valivullah, 2005; Zink, 2009; Lucke et al., 2012; Hauder et al., 2013) and pessimistic opinions about the researchers' ability to overcome the challenges have been presented recently (Kaisler and Armour, 2017).

Many government organisations have performed poorly in their EA efforts and EA programs have failed to meet the expectations (Saha 2009; Foorthuis et al., 2015; Hope, Chew and Sharma, 2017). Currently, the research on EA success factors is mostly conducted as literature reviews (Jusuf and Kurnia, 2017) and the public sector EA adoption has gained less interest in empirical research than EA development (Dang and Pekkola, 2017). This motivates our empirical research on the adoption stage of EA. The research question is:

What are the key challenges and issues in EA adoption in the public sector?

To answer this question, we first search the EA literature for the reported challenges and critical issues. We turn them into a survey questionnaire, targeting EA experts in the Finnish public sector. Since the adoption of EA requires an organisational change, the survey is structured according to a generic pattern of supported organisational change, derived from good practices for organisational change management. Our study aims at revealing what are the specifics in the EA adoption case, and the reasons behind the moderate success in public administration. The study indicates the existence of three factors, namely *resistance towards EA*, *relevant EA goals*, and *EA practices in use*. The detailed results reveal the key issues in adopting EA in the public sector.

The remainder of the paper is organised as follows. First, we present the background literature and a generic structure for EA adoption process. Then, we describe the research method, present the results of data analysis and construct the key issues of EA adoption. Finally, we discuss our findings, consider their implications, and make suggestions for future research.

2. Background

2.1 Enterprise architecture in the public sector

Dang and Pekkola (2017) provide a systematic literature review on EA in public sector that we found to give a very good coverage for this area. What is significant for EA, public administration generally is a collection of heterogeneous organisations with different business processes and information systems. Consequently, public sector EA has a wide variety of stakeholders, domains and organisations, resulting in considerable complexity. This is a key difference compared to the private sector, where EA is often used within a single organisation. (Janssen, Flak and Sæbø, 2013). The focus of EA in the public sector varies from the whole-of-government to specific domain architectures, such as e-healthcare (Kaushik and Raman, 2015), online public service provision (Tambouris et al., 2014), federated identity management (Baldoni, 2012) and bureaus (Gregor et al., 2007). Whole-of-government approach has been of interest in the developed countries, such as Canada, Denmark, Japan, Netherlands, New Zealand and Norway (Christiansen and Gøtze, 2007; Janssen and Hjort-Madsen, 2007; Agesen et al., 2011), and more recently also in developing countries (Dang and Pekkola, 2017), for instance, in Namibia (Shaanika and Iyamu, 2014) and Vietnam (Dang and Pekkola, 2016). On the other hand, some countries with high level of local autonomy, such as Sweden (Janssen, 2012), have deemed EA unsuitable for the whole-of-government.

Policymakers initiate public sector EA programs to enhance interoperability, productivity and the standard of service systems (Hjort-Madsen, 2006; Janssen et al., 2012; Janssen et al., 2013; Hiekkänen et al., 2013; Lemmetti and Pekkola, 2014). Participation in the programs is usually voluntary, although the United States and Finland have mandated the use of EA by legislation. In Finland, the government EA was introduced in 2006. The Finnish Act on Information Management Governance in Public Administration was passed in 2011, making the use of EA mandatory, for example, in central government offices, courts of law, and local government agencies conducting tasks assigned to them by law. Similarly, in the United States, EA is controlled at the federal government level through legal regulation (for example, the Clinger-Cohen Act of 1996). The legislation and encouragement by the National Association of State Chief Information Officers have lead the U.S. state governments to invest in EA adoption. 24 out of the 50 U.S. state governments have implemented EA (Bui, Markus and Newell, 2015), however, with challenges encountered in adoption (Saha, 2009). Currently, Finland shows similar adoption rates at the level of state government, but lower in municipalities and local government organisations.

EA programs face challenges difficult to overcome, as related to the integration and interoperability within and between public agencies (Hjort-Madsen and Burkard 2006) since government structures often impede EA programs (Hjort-Madsen and Gotze 2004; Bui and Levy 2017). EA adoption cannot transform the government by itself; a transformation will happen only if institutional forces promote it (Hjort-Madsen and Pries-Heje,

2009). Overall, it seems that both the penetration and the maturity of EA remain low, even among organisations that have taken EA into use.

2.2 Enterprise architecture adoption

Hjort-Madsen (2006) describes EA adoption in government as “emergent, evolving, embedded, fragmented and provisional social production that is shaped as much by cultural and structural forces in the organisational context in which they are implemented as rational technical and economic ones.” Introducing EA can be characterised as a process during which these practices are first initiated, then deployed, with the goal to institutionalise them in an organisation. To have EA as part of the organisational routines, EA management is needed. EAM is a management approach that helps organisations to plan, develop, and control their EA. EAM provides a holistic understanding of the EA (Rahimi, Gøtze and Møller, 2017). EAM influences the decision making at the level of IT/IS planning and design, and is intertwined with the strategy process of the organisation, with EA becoming a tool in strategy deployment. The practices typically include the deployment of an EA method and a governance model, as well as at least the introduction of the processes and structures for EA planning, design, and development. As an adoption of a novel set of methods, an organisational change process is required, with alterations in the current *modus operandi*.

Regarding EA development models, besides the Architecture Development Method (ADM) included in the evolving standard, TOGAF (current version 9.1), there have been also research accounts on generic EA development process models (e.g., Pulkkinen, 2006; Aier and Gleichauf, 2010). These models implicitly assume that an adoption phase has been completed, and the EA development is an established practice, supported by an executive mandate. However, our focus lies on the adoption phase, initiating the EA management process in an organisation.

The EA adoption will require changes in current operating models, regarding IT/IS planning and implementation, project and program management, and IT management. It also should change the business management practices. Implementing any novel practice, or a change in existing practices, follows a pattern of organisational change process (e.g., Kolb and Frohman, 1970; Keen, 1981; Slevin and Pinto, 1987; Kotter, 1995; Schein, 1996; see also Figure 1). A variety of explaining models exist emphasizing different viewpoints and variation in granularity. More recent literature has taken distance from these basic models, seeing them as too monolithic or too much top-down, or managerial (e.g. Smets, Morris and Greenwood, 2012). However, if a public organisation implements a regulatory change which often comes with a set time for adoption, a managed and holistic change is needed.

We compared the characteristics of the models of managed organisational change. Consequently, we chose the process of planned change (Kolb and Frohman, 1970) as a base for our study due to the following reasons. First, it incorporates the customary activities to organisational development and change management yet presents these at the level of granularity feasible for an EA adoption initiative in a public organisation setting. This allows us to explore the issues stage by stage in fine detail. Second, the model includes feedback loops to capture the iterative nature of the adoption process. Third, the context of the model and its typical use cases pay attention to the relationship between a client organisation and external consultants facilitating the organisational change. This suits our purposes, as the EA adoption projects in public organisations are commonly supported by the EA consultants. Further, we acknowledge that the different models only bring different aspects of the organisational change to the fore, and they are not as such competing or contradicting. We take all of them (Figure 1) to support the presented ideas.

The Kolb and Frohman (1970) process model, has seven stages, which may occur sequentially, or some of them simultaneously. Two feedback loops emphasize the need for continuing renegotiation or refinement during the process, and the use of evaluations of previous actions to modify the activities (Kolb and Frohman, 1970). In the case of adopting a new policy, or methodology, this reflects the needed learning in the adopting organisation. Hirvonen and Pulkkinen (2005) have been examining the client and consultant roles in EA projects, reflected on the organisational change frame. According to them, the main lesson to learn are the responsibilities of the client organisation itself for a successful change effort at its different stages.

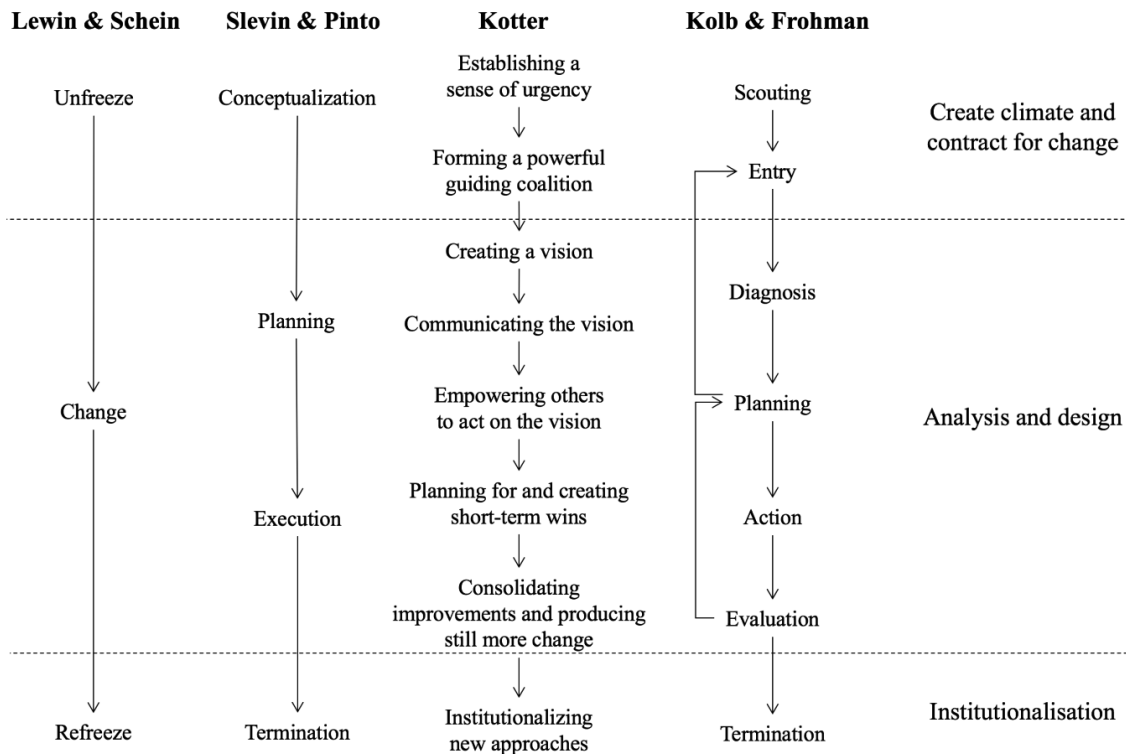


Figure 1: Change process frameworks

The *Scouting stage* precedes the launch of the adoption project. During this stage, Kolb and Frohman (1970) advise to evaluate the organisation’s resources and limitations, major subsystems (such as departments, divisions, and subsidiaries), attitudes toward change, motivation of the organisation to improve itself, and its social and cultural norms and values. In the *Entry stage*, that follows next, the key is to find an entry representative (“a project champion”), through whom the contract (i.e., how the succeeding stages of the adoption process will be implemented) can be negotiated. This stage begins with developing the initial statement of the project goals and by examining the contributions that are required from different stakeholders. The executive sponsorship for the project should be established during this stage as well. Finally, the project is positioned within the organisation, and a project team with the capabilities to perform up to the initial goals is set up.

The third stage, *Diagnosis*, focuses on refining the initial project goals. The *Planning* stage covers two parallel branches of activities. The first branch contains the tasks that contribute to planning the project implementation and operationalization. The second focuses on preparing in our case of, in introducing EA, the governance model implementation, introducing EAM to the organisation. Without EAM, EA may remain a tool only used within a single IT project. The stage ends with the creation of a formal project plan and by establishing a communication strategy that addresses all relevant stakeholders. The feedback loop from Planning to Entry emphasizes the need for continuing renegotiation in the organisation by reflecting the results of Diagnosis and Planning.

The *Action stage* can be divided into three intertwining parts: modelling the current state architecture, modelling the target state architecture, and planning the transition roadmap. The final stages are *Evaluation* and *Termination*. Evaluation involves the tasks such as evaluating the project’s results and contributions, and the overall change that has taken place. The second feedback loop, from Evaluation to Planning, enables the re-evaluation of the previous actions and, if necessary, allows to modify planning activities (Kolb and Frohman, 1970). The results of Evaluation define whether the project can move forward to Termination stage, should return to Planning stage to make a new action plan, or even reverse back to Entry stage to renegotiate the EA adoption project. It is noteworthy, that the Termination is emphasized in consultancy led projects for the practical reason that the client and the consultancy agree on the completion of the assignment and the results.

However, within the adopting organisation, the Termination stage ends the only the change process, and should flow into an organisational 'refreeze' leading to institutionalisation of the new practice.

As the adoption of EA is only the initial step in the continuous process of EAM, Termination needs to focus on confirming new behaviour patterns, transferring the responsibilities and ensuring their continuity. In contrast to a typical development project with the definitive end, an EA adoption project is only the first phase of what must transform into the continuing processes of EA planning, development, and management. These are usually undertaken as follow-up activities (Pulkkinen and Hirvonen, 2005). Therefore, during the Termination stage, it is important to ensure the continuity of the work that has been started. The institutionalisation of EAM (c.f., Hjort-Madsen, 2006; Iyamu, 2009; Weiss et al., 2013), however, is beyond the scope of this paper.

3. Research method and data collection

The majority of the previous research on the problems and success factors of EA is conducted in the forms of literature review, or interpretation of qualitative data. While our research builds on these findings, we chose the quantitative approach to allow the assessment of the commonness of problems and to explore, what are the key issues. For the data analysis, we used Principal Axis Factoring accompanied with qualitative data in a triangulation setting.

To evaluate the commonness and criticality of the issues found to hamper EA adoption and use in public organisations, and to find more insights into the challenges, a survey questionnaire based on a literature review on EA-related problems was set up online. The literature was searched with Google Scholar with keywords such as "enterprise architecture" and "problem", "challenge", "issue", to find reported problems. Over 80 issues have been reported as problematic. In a critical consideration, the relevance of the issues raised, and their possible overlaps (different interpretations of the same phenomena) were evaluated. As a result, the number of different items to include into the survey questionnaire was reduced to 28. Given the space limitations, a comprehensive list of EA-related issues and the survey items are not presented here, and are provided upon request by the first author.

For each item, we asked whether the respondents had encountered similar problems, and to evaluate the criticality of each problem on a scale from 1 to 3 (*Not challenging, Fairly challenging, Highly challenging*) regarding their impact on the success of EA adoption. In addition, the respondents could leave open comments on every topic covered in the survey. This option was eagerly used, providing additional qualitative material and enhancing the reliability, as the open-ended answers were also analysed to contribute to the overall result. The structure of the survey instrument was inspired by the process of planned change (Kolb and Frohman, 1970), discussed in the previous section, and we will reflect our findings toward it in the next section.

The selection of survey respondents was based on purposeful sampling (e.g., Patton, 1990; Onwuegbuzie and Leech, 2007) in order to capture variation to represent the expertise in the Finnish public sector EA. Over half of the respondents assessed their expertise on the matter to be at the highest level (on a scale of *Weak expertise, Intermediate expertise, Good expertise*). Approximately 50% of the respondents represented central government organisations or municipalities, 25% of the respondents were actively involved in the EA development in higher education organisations that represent public sector in Finland, and another 25% came from private IT companies with experience in public sector EA consulting. 85% of the organisations represented by the respondents or their clients', in the case of consultants, had started a systematic adoption of EA, yet only 17% had completed it by the time they took the survey. The survey was created 2013, a few years after the Finnish Act on Information Management Governance in Public Administration was passed. After an analysis of the initial results in 2015 we were prepared to refine the instrument. However, no need for major revision of the topical issues was found, and we recruited more respondents to acquire sufficient data for our quantitative analysis. The survey was completed by the end of 2016 by altogether 54 respondents. By the end of the data collection period, the EA adoption rates and maturity were still low in the central government and even lower in the local government organisations. Approximately, only 20% of the local government organisations have started the EA adoption. The final sample, after removing the incomplete responses, consisted of 50 respondents.

4. Results

Descriptive statistics of the data show that the items related to poor understanding of the purpose and goals of EA were most commonly identified by the respondents, and were considered as the most challenging. Adoption entails both individual and organisational learning for changed behaviour. On the other hand, the respondents were quite satisfied with the EA methods they were using, as well as the benefits the EA can provide to their organisations. The least significant item in the survey addressed the inflexibility and unsuitability of the EA method, a result that could be seen somewhat surprising. Such issues were encountered by 24% of the respondents and mere 3% regarded the EA methods to pose a high challenge to successful EA adoption.

We conducted an exploratory Principal Axis Factoring to identify underlying themes in our data. To improve the factorability, two items were removed, based on the examination of Anti-image correlation matrix. The removed items also appeared to be rather insignificant issues according to the preliminary descriptive analysis. We used Varimax with Kaiser Normalization as a rotation method and suppressed the item loadings less than .5. Kaiser-Meyer-Olkin measure of sampling adequacy was .658, which indicates that the sample's factorability was mediocre. Bartlett's test of sphericity was significant ($\chi^2(325) = 559.186, p < .001$). It is noteworthy that the survey was specifically targeted to experts in the public sector EA domain. Therefore, the respondents represent a reasonable sample of the total population (EA experts working within the Finnish public sector, or representing IT providers serving it). The analysis resulted in the three-factor solution that explained 44.47% of the total variance.

4.1 The key issues in EA adoption process

The analysis revealed an underlying three-factor solution from our data. We consider these factors to represent the key issues of an EA adoption. The factors *Resistance towards EA*, *Relevant EA goals*, and *EA practices in use* can be mapped into the stages of the process of planned change as shown below. Figure 2 also presents the Eigenvalue and explanatory power of each factor, as well as the item loadings and communalities (borderline values underlined). We follow this order in the discussion following in the next sections.

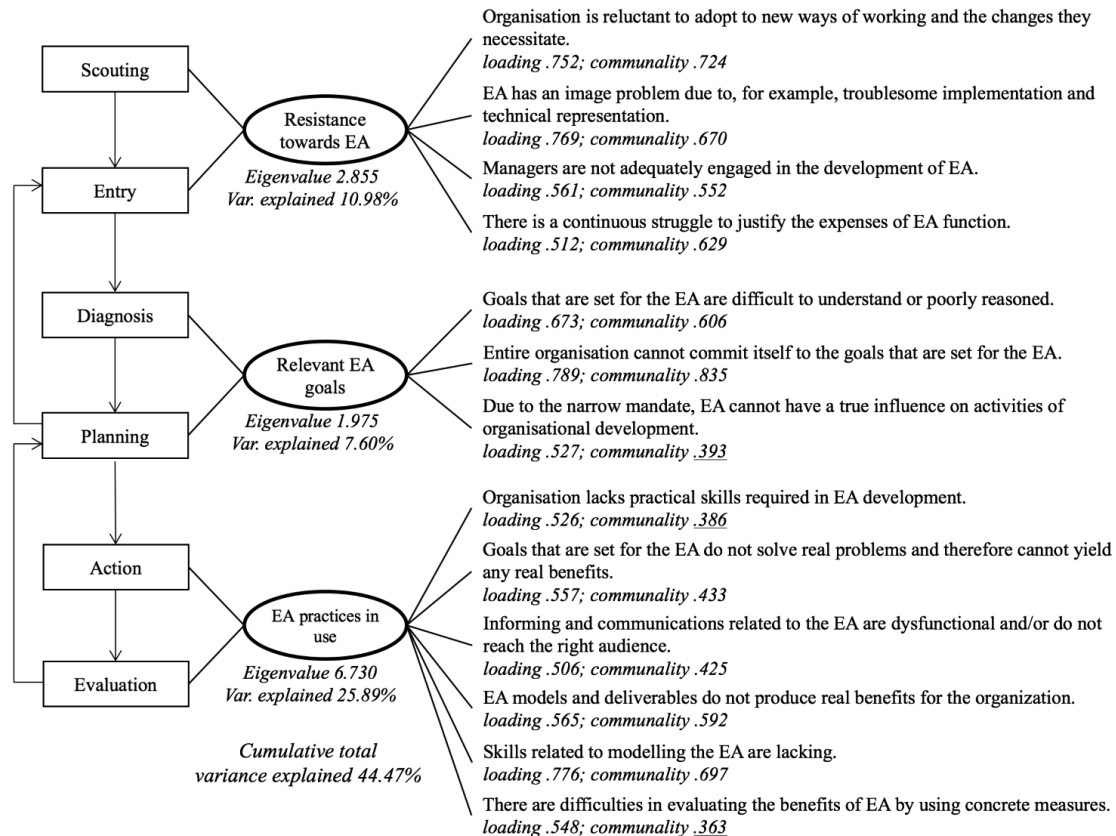


Figure 2: The three-factor solution mapped into the stages of planned change process

4.1.1 *Resistance towards EA*

The first factor was loaded with four items and labelled as *Resistance towards EA*, since all the items concern the organisational change resistance, either as its cause, or an effect. In the context of this study, this factor represents specifically resistance towards the adoption of EAM as a policy in the public sector. The key issue is the organisational capability to undertake the change effort, the adoption project, which should appear in terms of the readiness and the willingness to change the status quo. This involves commitment at all levels, and the allocation of sufficient resources to implement the change.

Our respondents commented that EA appears heavily IT-oriented and therefore fails to reach all the relevant stakeholders.

“The enterprise architecting is still seen as something that only propeller heads would be interested in. The core business is not willing to participate and cannot see the benefits it could provide.”

Due to the IT-orientation, EA often suffers from a narrow mandate, which limits the viable area of its influence and impact.

“EA is considered as IT busywork and its mandate is too narrow.”

“Although our EA team consists of representatives of the entire organisation, they still see this work irrelevant and thereby are often ‘not able to participate’ the EA planning meetings.”

The lack of commitment manifests itself also in insufficient allocation of resources, which incurred several direct responses from our respondents.

“For us, it is not about the lack of EA skills, it is rather about the shortage of resources. And this is because of the management’s poor understanding about what we could achieve with EA.”

Interestingly, some respondents commented that their organisation acknowledges the need for systematic EA planning and management, yet they still fail to connect the dots.

“In our IT department, the EA work is desperately needed, and they understand it. In the business units, the EA is needed at least as much, but they haven’t realized it. Between the lines you can read their need for the holistic long-term planning, the architecture documentation, connecting the target-state with the strategy, and so on.”

4.1.2 *Relevant EA Goals*

Three items loaded onto the factor labelled as *Relevant EA goals*. This is related to the EA benefits, and the factor captures that organisations are often unable to recognize beneficial use cases for the EA and problems it could help to solve. Our study, however, cannot reveal whether the root cause is the missing mandate, the inability to agree on shared strategic directions, the lack of skills needed in their operationalization, or something else. The data gives hints toward all of these directions. Kolb and Frohman (1970) call for recognizing the desired state toward which the organisation is striving and then defining the operational goals, which can be placed in the context of organisation’s total development to give a direction to a meaningful solution. Also, the goals should be set acknowledging the different subsystems of an organisation, which may have different priorities or even conflicting objectives. If the goals are poorly set, e.g., they would not lead into the desired objectives, there is a need to return to adjust them. Our respondents argued that their EA efforts, overall, are lacking clear, relevant, and measurable objectives.

“It would be very important to have relevant goals accompanied with some kind of indicators that would help us to visualize the achieved progress to management as well as employees. This would greatly help the overall commitment to EA.”

It was noted that the objectives should be divided into manageable sizes.

“Problems can be avoided by dividing the objectives into smaller pieces that are easier to cope with. I mean sub-goals. It is also important to learn to tolerate the incompleteness.”

Furthermore, it was argued that the objectives should be tightly aligned with the existing practices of project portfolio management.

“I think that the architectural requirements must be aligned with the project management models. This would make it possible for the EA to oversee, and especially to help, the development projects so that they could understand the architecture requirements and perform accordingly.”

According to respondents, there are also problems in the strategic organisation management.

“The problem of defining the target-state is not due to difficulties of finding the relevant information. Rather, the problem is that our organisation as a whole cannot agree the direction we should be heading to.”

4.1.3 EA Practices in Use

Six items loaded onto the factor we labelled as the *EA practices in use*. First, this factor characterises the lack of skills that are required in modelling and designing organisation’s architectural structures. The factor emphasizes the importance of that the enterprise architects must have not only methodological but also social skills. The practices centering around blueprints and other artefacts cannot guarantee the success, if these are not useful for the dedicated purposes: informing and negotiating on architecture solutions, evaluating them, making decisions on, and further designing and developing solutions. Continuous evaluation enables defining if there is a need to return to adjusting the action plan. The obstacles in adoption are related to both individual and organisational learning – the communication and negotiation skills mean facilitation of the learning to diffuse the information and support the reception of it.

Our respondents noted that EAM at an organisation-wide level is by no means a trivial task. The existing professional skills may not translate into the specific purposes of EAM.

“[...] it is still challenging to step outside of our own silos and to transfer these skills into the context of EA.”

The respondents were generally satisfied with the EA methods and tools they are using. However, they identified the need to improve the presentation of EA artefacts to make them usable for wider audiences.

“Methods and modelling languages are flexible enough and offer decent tools for planning and modelling. But they are not commonly readable and understandable, and therefore require vernacular translations before the full benefits can be reaped.”

Our respondents noted that the methods and tools have to conform with the domain specific requirements and the modelling must be prudent.

“Methods and tools must be adjusted to fit the need. It makes no sense to model the whole world.”

Respondents also considered the realization of benefits to be challenging.

“Making plans is quite easy but it gets difficult when you try to operationalise those plans. It requires real work and that the organisation is willing to change.”

This may be due to that the EA benefits realization is a complex phenomenon that involves several interrelated concepts, which include also the social environments. Verification and measuring of benefits was also addressed by our respondents.

“Overall, it is difficult to measure the operations development. Indicators are fabricated afterwards, and they are vague.”

Some respondents argued that the vocabulary used by the enterprise architects and EA consultants is filled with technical jargon, which causes problems in communications between the stakeholders.

“Directing the communications to different stakeholder groups is challenging. The enterprise architects should be able to speak fluently both business language and the IT jargon.”

Finally, in addition to that the EA-specific terminology and artefacts fail to communicate with the relevant stakeholder groups, the overall understanding about the purpose of EA seems to be lacking.

“General managers [...] don’t understand what the term enterprise architecture means.”

5 Discussion

In this study, we present results based of a survey among experts on the challenges of EA adoption in the public sector in Finland. Represented under the 54 respondents were a number of different public sector organisations, as well as IT providers working with the public sector. Based on the analysis of the survey study, aligned with the stages of the generic model of planned change in organisations, we propose three key issues in the adoption of EA in the public sector.

For the most parts, our results comply with previous studies. However, compared to studies on private companies, it appears that the resistance towards change plays a more considerable role in the public sector, characterised by inertia likely caused by issues typical of the public sector, as bureaucracy. For example, in Finland EA is mandated by law; nevertheless only in 17% of the organisations represented the adoption was completed. It is important to get the management to commit to the EA and to ensure fluent communication between the stakeholders. This is reflected in the previous research (Lucke, Krell and Lehner, 2010; Lucke et al., 2012; Jusuf and Kurnia, 2017). Janssen and Klievink (2012) also note that the starting points of a project are crucial and inability to solve the failure factors at the beginning will likely result in a failure at the end. First, their results emphasize the importance of knowing the potential issues in advance. Our study contributes to the practitioner community by identifying such issues. Second, the results of Janssen and Klievink (2012) are in accordance with the analysis we present.

If examined per item, our data indicates that the most commonly encountered and the most challenging problems appear during the early stages of an EAM adoption process. We were able to find only one study on the public sector EA that specifically suggests factors that influence the adoption phase. In their case study, Dang and Pekkola (2016) identified five major problem areas, namely responsibility and credibility, objectives, readiness and awareness, EA work and output, and stakeholders’ different views. Although they applied slightly different perspectives in the conceptualisation, our results are in line with theirs. Table 1 summarises notable observations from the previous studies in relation to the key issues constructed from our data.

Table 1: The key issues in relation to the previous research findings

Key issue	Observations from literature
Resistance towards EA	EA often lacks the top-level sponsorship, or the entry representative. This compromises the mandate that is necessary for the successful adoption and for the benefits realization. (Armour and Kaisler, 2001; Dreyfus, 2007; Lucke et al., 2012; Roth et al., 2013; Kaisler and Armour, 2017)
	EA’s IT-orientation causes resistance in other stakeholder groups (Isomäki and Liimatainen, 2008; Seppänen, Heikkilä and Liimatainen, 2009; Asfaw, Bada and Allario, 2009; Penttinen and Isomäki, 2010; Poutanen, 2012).
	Public organisations are often characterised by inertia in the sense that institutional structures and professionalism constrain and channel new arrangements (c.f., Scott, 2005; Isomäki and Liimatainen, 2008).
Relevant EA goals	The EAM should be driven and guided by the organisation’s strategic objectives (Dang and Pekkola, 2016; Rahimi, Gøtze and Møller, 2017).
	The failure in setting goals may lead to local optimization with global ramifications (Dreyfus, 2007).
	EA development should be organised with manageable sized objectives that enable 'quick wins' (c.f., Niemi, 2006; Hopkins and Jenkins, 2008).
EA practices in use	EA should be aligned with the practices of project portfolio management (Aier and Schelp, 2010).
	Specialized skills and capabilities are required to discern and manage large and complex structures (James, 2002; Strano and Rehmani, 2007; Hauder et al., 2013; Dang and Pekkola, 2016).
	Practice of EA requires a combination of both hard and soft skillsets (e.g., Strano and Rahmani, 2007; Hope, Chew and Sharma, 2017; Banaeianjahromi and Smolander, 2017).
	Stakeholder groups outside the IT domain fail to utilize EA artefacts (e.g., Lucke, Krell and Lechner, 2010).
	The majority of potential benefits of EA are either strategic, indirect or intangible, and therefore difficult to measure and even attribute as the results of EA (Niemi, 2008).
There is a lack of shared vocabulary (Lapalme, 2012) and confusion regarding the understanding of EA and its concepts (Lemmetti and Pekkola, 2012).	

To summarize, our study aims at drawing a more consistent and aligned picture of the problem area than could be found in the literature on the obstacles encountered in adoption of EAM practices in public sector

organisations. Firstly, starting out with the existing body of knowledge, earlier findings were tested and mainly confirmed (see Table 1), but also extended theoretically, with the organisational change process. Prior studies largely rely on small scale or qualitative data, as case studies. Testing the findings in a quantitative study provides in our view a confirmed baseline for the whole area of research and practice. This is helpful for the future developments in both research and practitioner fields, in finding solutions for the known problems.

Secondly, in our quantitative study, we draw together the individual items to three main clusters and align them with the generic organisational change process. This gives in our view a fitting theoretical frame for a more consistent theoretical base for future research. Additionally, it is important to clarify the setting from a theoretical point of view. As one of the benefits of EA, support for organisational change does get mentions. However, to be able to support organisational change, practices related to EA must be introduced and adopted in an organisation in due course. This is a stage prone to the numerous problems as discussed in this study. It appears that EA is often perceived solely as an IT artefact and as such, it evokes similar reactions as information technology induced changes.

Further, the individual items confirmed in the survey, and their relative importance can be translated to action points in organizations, both in new adoptions and in organizations with adoption stage behind but still experiencing problems. Here, maybe the most prominent overall result is the importance of issues other than tools and techniques, but related to the footing of the necessary changes in the organizational practices. This supports the views of recent literature on EA management that stresses the involvement of the organization business management.

5.1 Reliability and validity

In regard to the reliability of this study, an obvious limitation is the sample size. However, the recruited respondents were carefully chosen experts who not only show merits in practice of our research topic, but also represent a notable portion of experts in the Finnish government EA scene at the time of the data collection. In addition, the respondents came from tens of different organisations, giving the data quite diversified sources. The qualitative data we have previously collected as participant observers in EA adoption projects (Seppänen, Heikkilä and Liimatainen, 2009) also supports the identified factor solution.

The survey instrument was built on the issues that were found in the published research literature. Condensing the 80 issues mentioned to the 28 in our survey instrument, involves some subjective judgment. However, the open-ended questions gave an opportunity also to test the validity of the set of issues used in the survey. The survey instrument used a three-point scale to allow the evaluation of EA problems' criticality. While we believe that this scale was suited for the purposes of this study and did not result in significant decrement in reliability or validity (c.f., Jacoby and Matell, 1971) it may not always allow optimal differentiation between the respondents' opinions.

To evaluate the generalizability of our results, and to further broaden the understanding on the problems of EA adoption, additional research cases and data, preferably from other countries, would be needed.

5.2 Implications for research and practice

The current research seldom attempts to make the distinction between public and private organizations explicit. Concentrating on the public only, we found that there are differences. hence, further research on differences and commonalities would be an interesting research avenue. The use of EA has longer tradition and is more tightly rooted in the private sector, giving deeper insights, from which again government organisations could profit. Also, our study focused on the adoption phase, which, in our terminology, adherent to that of Goodman et al. (1979), may or may not lead to the actual institutionalisation. Therefore, follow-up studies on the success of institutionalisation, i.e., positioning EA as a practical and even social norm in the organisational development activities, that can be observed only through time (Barley and Tolberg, 1997), would be interesting. Further, the success factors, as the other side of the coin, could be reflected on the problematic issues.

Due to the continuous pressure to save on administrative costs, to improve the quality of public electronic services, and to reap the benefits of digital transformation, the EA adoption is currently on the agenda of many public organisations and more so in the future. Our results can be used to improve the preparedness to cope with problems that are likely to be encountered and the readiness for related organizational change, adopting

EA and supported by it, continue the organizational transformation in desired areas. Therefore, this study is of interest to the IT professionals and enterprise architects serving in public organisations as well as the consultants who participate in government EA projects.

6 Conclusions

We suggest that the three key areas, namely *Resistance towards EA*, *Relevant EA goals*, and *EA practices in use* proposed in this paper, should be in the focus in any EA adoption project. The organisation and the relevant stakeholders should establish a common understanding and will to commit themselves to the process of change that the adoption and utilisation of EA and adoption of EAM practices require, to find the agreement on the goals, and to develop a capability to implement.

We argue that the present understanding shows that there is no need to get stuck in the details, such as versioning and fine-tuning the EA methods, as these are the areas that thirty years of accumulated practical experience and research have already covered. Rather, we should focus on establishing ‘architectural thinking’ (c.f., Winter, 2016) and while the benefits of EA are unquestionable, they cannot be realised without moving from words to deeds.

As also ample methodical support exists for organizational change, the alignment of the EA adoption problems to the organizational change process supports in our view the practitioners, where seeking to avoid problems and mitigate risks in the adoption efforts. Beyond the EA practice, our study is a message to the organization management interested in the benefits from a managed EA, and leading the change efforts.

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VI

REVISITING AND REVISING THE GRAND CHALLENGES OF PUBLIC SECTOR ENTERPRISE ARCHITECTURE

by

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Revisiting and Revising the Grand Challenges of Public Sector Enterprise Architecture

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Manuscript Type:	Empirical Research
Keywords:	enterprise architecture, public sector, grand challenge, context, content, and process (CCP) model, qualitative longitudinal research
Abstract:	<p>Ten years ago, enterprise architecture (EA) was regarded as a promising tool for the transformation and digitalisation of government. In reality, EA adoption in the public sector has been slow and problematic. In this paper, we study the grand challenges of EA implementation in Finland, where the use of EA is mandated by law. We interview multiple stakeholders from different levels of public administration and companies and find out, from a qualitative longitudinal research, that the challenges from ten years ago still exist and that new challenges have emerged. The grand challenges are presented with the context, content and process model of organisational change. We argue that the structures of government impede the implementation ability, governance and advancement of interoperability. These challenges from previous research are now accompanied with new grand challenges: practising EA and needing to reconceptualise EA. Finally, we discuss the future role of public sector EA and recommend solutions to overcome the grand challenges.</p>

Revisiting and Revising the Grand Challenges of Public Sector Enterprise Architecture

Ten years ago, enterprise architecture (EA) was regarded as a promising tool for the transformation and digitalisation of government. In reality, EA adoption in the public sector has been slow and problematic. In this paper, we study the grand challenges of EA implementation in Finland, where the use of EA is mandated by law. We interview multiple stakeholders from different levels of public administration and companies and find out, from a qualitative longitudinal research, that the challenges from ten years ago still exist and that new challenges have emerged. The grand challenges are presented with the context, content and process model of organisational change. We argue that the structures of government impede the implementation ability, governance and advancement of interoperability. These challenges from previous research are now accompanied with new grand challenges: practising EA and needing to reconceptualise EA. Finally, we discuss the future role of public sector EA and recommend solutions to overcome the grand challenges.

Keywords: enterprise architecture; public sector; grand challenge; context, content, and process (CCP) model; qualitative longitudinal research

Introduction

Today's governments function in a complex and uncertain world. The public sector is facing a systemic change, which means a coincident change in operations models, structures and their interaction to create the prerequisites for well-being and sustainable development in the future. Digital transformation requires many different policy areas to be considered simultaneously in an integrated approach (Tan & Pan, 2003; Janowski, 2015). The need for an integrated approach forces governments to overcome silo-based structure and to promote cooperation at the different levels of government to develop a whole-of-government strategy (OECD, 2017a). The significance of information systems

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2
3 and technology is increasing, and at the same time, the need for alignment between
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5 business and information technology remains a major challenge, especially in the public
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7 sector (Rusu & Jonathan, 2017). Currently, there is an ongoing transformation towards
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9 human-centred digitalisation (Haukipuro et al., 2014; Opromolla et al., 2017) as a new
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11 way of seeing governance as a service (UN, 2016). To lead the transformation in the
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13 desired direction, governments need holistic information. This kind of information can
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15 be achieved by the appropriate use of enterprise architecture (EA).
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18 EA is an incoherent field of study in which the concepts are not well-defined
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20 (see e.g. Saint-Louis & Lapalme, 2016). Different perceptions of the focus of EA
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22 research are visible in the varying definitions of the term EA (e.g. Schöenherr, 2009;
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24 Lapalme, 2012; Löhe & Legner, 2013; Simon et al., 2013; Rahimi et al., 2017; Saint-
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26 Louis et al., 2017). It is argued that EA should be defined by each organisation in
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28 regards to the purpose and scope of the work (Schekkerman, 2009; Shaanika & Iyamu,
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30 2014). Since there is not one scientifically accepted definition and our research context
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32 is EA implementation in Finland, we use the definition from the Finnish national EA
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34 (FINEA): EA is a systematic way to analyse, develop and manage organisations'
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36 functions and structures, and it describes how organisations' business, information and
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38 systems function as a whole. EA offers systematic ways to make the whole visible,
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40 manageable and understandable. (FINEA, 2017) This definition has similarities with
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42 many EA definitions in Information Systems (IS) studies (Kaisler et al., 2005; Gregor,
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44 Hart & Martin, 2007; Lankhorst, 2009; Rahimi et al., 2017).
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49 In the public sector, policymakers initiate EA programs often to improve
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51 interoperability, enhance productivity and improve the standard of service systems
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53 (Hjort-Madsen, 2006; Hiekkänen et al., 2013; Janssen et al., 2013; Lemmetti &
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55 Pekkola, 2014). The main goal of EA is generally interoperability (Janssen, 2012). In
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3 accordance, FINEA aims at improving the interoperability of public organisations'
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5 operations and services. Although the use of EA is usually voluntary for public
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7 authorities, the United States and Finland require its use by law.
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9 As a socio-technical artifact, EA has many stakeholders. Lange, Mendling and
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11 Recker (2016) provided a summary of what they considered to be the key empirical
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13 studies in EA management research. Their analysis of current research on EA shows
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15 that most studies have chosen only one stakeholder perspective, such as the perspective
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17 of architects or members of the EA management function. Nevertheless, some empirical
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19 research on public sector EA have included the perspectives of various stakeholders
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21 (Hjort-Madsen, 2007; Janssen & Kuk, 2006; Hjort-Madsen & Pries-Heje, 2009; Scholl,
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23 Kubicek & Cimander, 2011; Janssen, 2012; Hiekkanen et al., 2013; Kaushik & Raman,
24
25 2015; Shaanika & Iyamu, 2015). To the best of our knowledge, however, no previous
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27 studies have covered more diverse stakeholders from different levels of the public and
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29 private sectors than ours.
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32 A growing body of IS research examines the formation of initial beliefs and
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34 attitudes; hence, little research is directed at explicating why and how beliefs and
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36 attitudes change over time (Bhattacharjee & Premkumar, 2004). According to
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38 Orlikowski and Baroudi (1991), nearly 90 percent of IS research represented a single-
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40 snapshot data collection method (see also Avital, 2000; Pollock & Williams, 2009).
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42 Similarly, longitudinal research is rare in EA studies. For instance, out of 71 studies
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44 included in a recent systematic literature review on public sector EA (Dang & Pekkola,
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46 2017a), there is only one longitudinal study. Ask and Hedström (2011) present a
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48 longitudinal case study on the problems during the development and implementation of
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50 an eGovernment initiative in Sweden. Additionally, we found two longitudinal case
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52 studies of EA in railroad companies in Switzerland (Aier et al., 2016) and the United
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3 States (Thummadi & Ocker, 2017). In contrast to previous studies, our goal is to create
4
5 a holistic view by involving multiple stakeholders' of FINEA implementation in a
6
7 qualitative longitudinal study.
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10 Our research is motivated by the poor performance of governments in their EA
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12 efforts and by the failed expectations of EA programs (Saha, 2009; Ojo, Janowski &
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14 Estevez, 2012; Foorthuis et al., 2016; Hope, Chew & Sharma, 2017). Currently, the
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16 research on EA success factors is mostly conducted as literature reviews (Jusuf &
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18 Kurnia, 2017), and public sector EA adoption is of less interest in empirical research
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20 than EA development (Dang & Pekkola, 2017a). Our goal is to create a holistic view by
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22 involving multiple stakeholders of FINEA and to understand their perceptions of the
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24 challenges of EA over a ten-year period, lasting from 2007 to 2017. To get a
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26 comprehensive picture, we interview, in a qualitative longitudinal study, stakeholders
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28 from various levels and organisations of government and IT companies that consult the
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30 public sector. Our goal is to identify the grand challenges of public sector EA that cause
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32 the slow progress in the penetration and maturity of EA. Accordingly, the research
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34 question asks, *What are the grand challenges of EA in the public sector, and how have*
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36 *they evolved through time?* In recent studies, the need for EA to reinvent itself has been
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38 discussed (Janssen, 2012; Lapalme et al., 2016). Our paper addresses this by presenting
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40 insights on the possibilities and challenges of EA in public sector over a ten-year period
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42 and on how the field has and should mature to fulfil its potential in the future.
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47 The remainder of the paper is organised as follows. First, we present the
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49 background literature. Then, we describe the research method and context. Next, we
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51 present the results by applying the context, content and process (CCP) model to the
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53 challenges of EA that we have found. Finally, we discuss the findings, consider their
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55 implications and make suggestions for future research.
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Research approach

Our research explores how EA is implemented in the Finnish public sector and what the challenges of EA work are. We aim to understand different stakeholders' views of EA challenges. Implementation of EA requires changes in organisation – for example, in operation models, project and program management and IT management – and, on the other hand, EA is an instrument of change. In our view, EA is a socio-technical artifact (Mumford & Weir, 1979; Drechsler, 2015) which intersects both social and technical aspects in an organisation, and successful implementation is a process of change that requires responding to social interdependencies (Janssen 2012) and avoidance of being perceived merely as an IT project (Seppänen et al., 2009; Penttinen & Isomäki, 2010). EA should be implemented as part of the organisation's planning processes, and there is a need for organisational and executive support and funding (Kaisler et al., 2005). One reason for failure is an organisation's lack of readiness for change (Donaldson, Blackburn, Blessner & Olson, 2015). The success of EA adoption depends on stakeholder acceptance and appropriate architectural governance (Mondorf & Wimmer, 2017). The involvement of many (often quite autonomous) stakeholders and influences of public values, political climate and intersecting organisational objectives make EA more complex in the public sector than the private sector (Bouwman, Janssen & Versteeg, 2011). Some researchers see establishing EA in the public sector as being inappropriate and problematic, since EA represents governance structures from the private sector (Scholl, Kubicek & Cimander, 2011).

We chose to adopt the CCP model because it was originally developed by Pettigrew (1985) for researching organisational change. The framework is suited to our purpose to understand the socio-political context of public sector EA and the perceptions of the different stakeholders. This demands an interpretive approach for deepening understanding (Stockdale et al., 2008). In the framework, the context is the

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3 environment in which the change takes place, and at the same, it represents the reasons
4 that drive the change (i.e. 'why' there is a need for change). It constitutes inner and
5 outer contexts. The inner context is the organisational culture and structures, and the
6 outer context is the social, economic and political environment. The content is the area
7 in which the transformation should happen; it's the purpose, objective and goals of
8 change (i.e. 'what' is pursued). The process of change consists of the actions, reactions
9 and interactions of stakeholders and the methods that are used to implement the change
10 (i.e. 'how' the change is pursued) (Pettigrew, 1987). Consequently, to understand and
11 evaluate the change requires a thorough understanding of each of these concepts, as
12 well as how they interact and affect each other. Three concepts of CCP are broad
13 enough for different kinds of arguments and ideas and provide parameters for reviewing
14 them (Stockdale & Standing, 2006). In this way, the model sufficiently guides the
15 process of data-driven analysis and gives interpretative space for researchers' views.

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The CCP model was first introduced to IS research by Symons (1991) to
investigate and analyse important elements in IS evaluation. The framework is used in
various studies in IS (Avgerou, 1995; Huerta & Sanchez, 1999; Lyytinen, Newman &
Al-Muharfi, 2009; Song & Letch, 2012, Bernroider, Koch & Stix, 2013, Venable, Pries-
Heje & Baskerville, 2016; Mondorf & Wimmer, 2017). Additionally, the framework is
useful because it can be tailored to fit into different research settings, depending on the
environment, the research context, what is researched and the inclusion of stakeholders.

Research method

Qualitative longitudinal research (QLR) is driven by the need to understand what
changes and how and why change happens in the sociocultural context (Holland,
Thomson & Henderson, 2006). Our research is QLR and constitutes of two rounds of
semi-structured, in-depth interviews. The interviewees were asked to sign a written

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2
3 informed consent, and the questions were presented in a manner that excludes
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5 interviewer bias (Kvale, 1989). Our aim is to accomplish a nuanced understanding of
6
7 different stakeholders' views and the process of change in the FINEA implementation.
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9 The study merges with the principles of interpretive research, which are considered to
10
11 produce deep insights into human thought and action (Klein & Myers, 1999).
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14 According to McLeod and Thomson (2009), longitudinal research shares
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16 characteristics with follow-up studies. They, for example, generate comparison between
17
18 different times. The key difference is that follow-up studies may not have been set up
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20 originally to be longitudinal and that the points of return are fewer, as well as that the
21
22 observed changes between the research phases might be more dramatic. There are
23
24 different types of follow-up studies. The original researchers a) review a previously
25
26 completed study through a different temporal and conceptual lens, b) extend the original
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28 study with another wave of research and c) subsequently return to a research site or
29
30 follow-up with participants. (McLeod & Thomson, 2009) Our research combines the
31
32 former two and was originally planned to be QLR, and it consists of two rounds of data
33
34 collection using semi-structured interviews; therefore, we do not consider it to be
35
36 merely a follow-up study. In our research, temporality is designed into the research
37
38 process and change is the central focus of our analysis. These are the distinguishing
39
40 features of QLR (Thomson, Plumridge & Holland, 2003).
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44

45 ***Data collection***

46
47 Longitudinal research offers insights into process, change and continuity over time in
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49 phenomena ranging from individuals and institutions to societies (Marsh & Elliot,
50
51 2008). It helps map the social world temporally, enabling the ability to make sense of
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53 changes. QLR's major advantage is flexibility, which has the potential for development
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55 and innovation throughout the entire research process. Research samples and sampling
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3 can change in the process; this is even more likely in the long-term QLR (Elliot,
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5 Holland & Thomson, 2008). We used purposeful sampling (Patton, 1990) to capture
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7 variations in the data in terms of both assumed information intensiveness and
8
9 stakeholder population. Since the research was carried out over a long period, there
10
11 were changes in the sample. We faced attrition and brought in new interviewees to keep
12
13 the representativeness similar in each stakeholder group. According to Elliot, Holland
14
15 and Thomson (2008), attrition is normal and not as important a concern, since our unit
16
17 of analysis is a stakeholder group representing a certain organisational level.
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19

20 The original plan was to do the second-round interviews after one year, but due
21
22 to the slow progress in FINEA implementation, the interviews were postponed ten
23
24 years. The first round of data collection was aimed at descriptive ex ante evaluation
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26 (Venable, Pries-Heje & Baskerville, 2016). We provided information for the
27
28 development of the first FINEA method about the challenges perceived by different
29
30 stakeholders. The second round of data collection was done ex post (Venable, Pries-
31
32 Heje & Baskerville, 2016) and aimed at reviewing the challenges and changes in the
33
34 perceptions of the stakeholders.
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37 The first round of data was collected from 21 interviews conducted during
38
39 spring 2007. At the time, the development of FINEA method had just started and was in
40
41 its planning phase. The interviewees represented stakeholders from different levels and
42
43 sectors of the Finnish public sector and IT companies. Their concerns related to the
44
45 development of EA varied according to their occupational positions. The first-round
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47 interviews are described in detail in previous studies (Isomäki & Liimatainen, 2008;
48
49 Penttinen & Isomäki, 2010).
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52 The second round of data was collected using 26 interviews during summer
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54 2017. In one interview, there were two representatives of one city. Due to scheduling
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3 reasons, we interviewed seven previously interviewed people over the phone. The
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5 interviews lasted from 36 to 100 minutes, the average being 63 minutes. The interviews
6
7 were transcribed and analysed using the ATLAS.ti software. There was some attrition in
8
9 the sample, reasons for which were death, leave of absence, moving from Finland,
10
11 retirement and no longer working with EA-related things. If we could find contact
12
13 information, we tried to reach interviewees, and if we connected, we asked for a
14
15 recommendation for a replacement interviewee. We also asked for recommendations
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17 from the people we interviewed. New interviewees came from the result of snowballing
18
19 and were selected through purposeful sampling. For the second round, we included
20
21 more representatives from municipalities, since they mostly started their EA work
22
23 during the ten-year span. We selected two cities that can be considered advanced in EA
24
25 and two cities in the EA adoption phase. Interviewees' concerns related to the FINEA
26
27 varied according to their occupational positions (Table 1).
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34 Table 1. Interviewees by organisational level, title, experience in EA and number
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38 In the second round, interview themes and related questions were derived from
39
40 the results of previous studies. This is in line with QLR's data generation, which is
41
42 iterative and draws from what has been learned previously to understand change and tell
43
44 a story over time (Mcleod & Thomson, 2009). The interview questions were divided
45
46 into four parts: questions of 1) background information of interviewees, 2) previous
47
48 situations 3) current situation and 4) future of EA. The questions covered macro- and
49
50 micro-level issues. Past- and future-related questions covered issues of FINEA and
51
52 interviewees' perceptions of how it has affected their own work. Current situation
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54 questions were different for the interviewees from the public and private sectors.
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3 Interviewees from the public sector we asked questions about EA in the organisations
4 they represented, and interviewees from the private sector we asked questions about
5 their public sector client organisations.
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10 *Data analysis*

11 Analysis in QLR usually focuses on meaning and must engage with and capture time,
12 process and change. The analysis process can involve cross-sectional analysis (looking
13 at a moment in time across the sample), repeat cross-sectional analysis (looking for
14 change) and longitudinal analysis (narrative analyses of each case) (Holland et al.,
15 2004). In our research, we combine the former two. Working in two temporal
16 dimensions and articulating them as an integrative dimension is recognised as being
17 crucial for analysing change through time (Saldana, 2003).
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27 During analysis, an interpretation of the interviewees' utterances was carried out
28 by iterating between the interdependent meaning of parts and the whole that they form
29 (Klein & Myers, 1990). In this way, the entire data set represented the source of the
30 results, which indicate the various meanings that the respondents assign to EA. Our
31 research has the three core elements (proposed by Vallance, 2005) of longitudinal
32 qualitative analysis: a longitudinal research question, a sample that includes data
33 collection over time and an analysis that explicitly addresses change over time. The
34 first-round interview data was combined to the second by generating the coding
35 framework for an analysis of the second interviews from the categories developed from
36 the first-round interview results. The three categories are the 1. implementation ability
37 and governance, 2. structures of government and 3. advancement of interoperability. In
38 the following, the citations from data are selected based on representativeness within
39 data and are translated from Finnish to English.
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Research context

In Finland, government EA work started 2006 by customising the EA framework, method and governance model. Most governments use customised frameworks and applications that fit the country's administrative structure (Janssen & Hjort-Madsen, 2007). The Finnish Act on Information Management Governance in Public Administration was passed in 2011 (Finlex, 2011). It makes the use of EA mandatory, for example, in central government offices, courts of law and local government agencies when they conduct tasks laid down for them by law. Regardless, few public organisations have undergone an EA adoption project, and the penetration and maturity of EA are still low.

In comparison, EA work in the United States at the federal level is controlled through mandatory regulations (e.g. the Clinger-Cohen Act of 1996). A total of 24 states (out of the 50 U.S. state governments) have adopted and implemented EA (Bui et al., 2015). In practice, the federal agencies adopting EA have struggled to show how IS planning can be a driver for administrative reforms and transformation in government (Hjort-Madsen, 2007). U.S. state governments are not obligated to perform EA work, and they can choose an EA vendor that promotes at least three different EA designs (technical, operational and strategic). The states themselves adopt and adapt the designs. (Bui et al., 2015) In Finland, public sector organisations should use the FINEA method and its guidelines in EA planning and management. In Table 2, we present the timeline of FINEA and the services supporting the implementation.

Table 2. Timeline of FINEA implementation

The Finnish public sector is strong in building platform solutions, such as Suomi.fi, to legacy environment. Finland has been among the top ten countries in e-

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2
3 government readiness and currently holds fifth place (UN 2016). The challenge has
4
5 been in changing the structures and developing operations and governance. These
6
7 challenges are often brought up in the reports by the National Audit Office. The
8
9 recession and disruptive change that started in 2009 weighed on the economy,
10
11 productivity growth and international competitiveness. This has affected the innovation
12
13 policy, and there have been cut backs in investments in research and development. To
14
15 be successful in the future, Finland needs better co-ordination and cooperation among
16
17 policy actors and national and regional levels, as well as further internationalisation.
18
19 (OECD 2017b)
20
21

22 23 **Revisiting the challenges of public sector EA**

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25 The properties chosen for evaluation are the goals of FINEA, the implementation
26
27 process and its challenges perceived by different stakeholders. We also asked questions
28
29 concerning the FINEA method, but in this article, we chose to concentrate on the
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31 process, not the product. We concentrate on the challenges to gain an understanding of
32
33 what things hamper EA implementation.
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37 38 ***Applying the CCP model to the grand challenges of public sector EA***

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40 We present the results through the CCP model (Figure 1). In our research, the context is
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42 the Finnish public sector at the level of the state government and its ministries, civil
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44 service departments and municipalities. The original content of the change was the
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46 advancement of interoperability and to unify the development processes of functions
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48 and IS. The aim is to better consider the strategic goals of public service development:
49
50 the enhancement of customer centeredness, sustainable development and service
51
52 production. The process is the implementation of the FINEA across different levels of
53
54 the Finnish public sector perceived by different stakeholders.
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Figure 1. Adapted CCP model (Pettigrew, 1985; Stockdale et al., 2008)

In the first-round results, the most pivotal challenges emerging from the data were divided into three main categories: 1. implementation ability and governance, 2. structures of government and 3. advancement of interoperability. In the second round, we asked whether the interviewees still considered these categories challenging. All issues were still considered grand challenges (Table 3). As an interviewee from state government put it,

“These questions are still current, and I have been thinking ... Will they always be challenging? We just try to solve them differently ... In those challenges are things that can be solved and advanced and progress has been made. But very slowly.”

Table 3. Old grand challenges in the CCP model perceived by stakeholders

Context-related challenges

The complicated and multi-layered structures of the public sector were seen as a challenge by all stakeholder groups. Some interviewees saw that this is currently an even a larger challenge. A silo-based structure is a problem when shared services are designed to be used throughout public sector organisations. There are many kinds of organisational silos in Finnish public administration. There are, for example, parliament, ministries in 12 different branches of administration, civil service departments and municipalities. Most of these are independent decision makers and have their own budget. A manager of an IT company describes them as a

“... silo-based structure. Well, you stumble upon it every now and then and it seems that silos exist even within organisations, and do not know about each other.”

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3 A brigadier general argued that only centralised budgeting would solve the problem of
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5 silos. A project manager of an IT company said that this is also about attitudes:
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8 “This is not just about technologies but also about management ... The challenge
9 of EA itself is that the work aims at unifying and is based on the goodwill of
10 people ... When you add politics and other stuff it leads inevitably to silos and
11 securing your own playfield.”
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15 Organisational structures are multi-layered, and in some parts of the
16
17 government, the structures have become even more complicated over time. A national
18 technology manager of an IT company stated that EA is not used in the planning of the
19 whole, where it is as its best. The tradition in the government is to develop the whole
20 from the viewpoint of existing organisational structures. To achieve better results, the
21 order should be reversed: the required organisational structure should be a result of the
22 development work.
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26 Progress in the contextual challenges can be seen in the reduced professionalism
27 that was a challenge ten years ago. This time, it came up only in one interview of a
28 ministerial advisor:
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31 “There are different professions and their history, and ways to understand and
32 produce things ... But a change has happened and people want to overcome
33 professional barriers ... In ten years the number of employees ... has decreased and
34 we have to combine the skills. And even form new skills. Those old professions do
35 not exist anymore and there is a need for education.”
36
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39 A manager of an IT company said that things have moved forward a lot from the
40 situation ten years ago. The need for co-creation has been understood, and there are also
41 shared functions and services. According to a development manager, things have also
42 progressed in the bigger municipalities, and they have recognised the problem and
43 started to raise the customer to the centre of development. This is certainly a huge
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3 effort, and there is a long road of development ahead. The CIO of a civil service
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5 department commented on the progress from the government's viewpoint:
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8 “The structure of the government ... is not designed, the model was built a hundred
9 years ago and the starting point was not then, and not necessarily completely even
10 nowadays, the customer. There are a lot of good ideas in the Ministry of Finance
11 and many things have progressed. But in a way how the ministries function and
12 how their responsibilities are seen from the viewpoint of the citizens or companies,
13 has not essentially changed. And this shows in concerns and contents.”
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18 ***Content-related challenges***

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20 The advancement of interoperability has progressed the most, which is good since it has
21
22 been the main goal of FINEA. An enterprise architect said that interoperability is
23
24 emphasised in Finland, since things are built on top of the existing infrastructure and not
25
26 from the scratch. Stakeholders from state administration and the managers of IT
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28 companies think that the interoperability has advanced more than the stakeholders from
29
30 the municipalities. The CIO of a large city described the challenge:
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34 “... we have this challenge in three levels. From the top, the national level, the
35 whole public sector. Between state administration and municipalities, the need for
36 daily integration is the smallest ... Between the municipalities and consortiums of
37 municipalities, the need is much bigger ... and the challenge is huge ... And the
38 third level is inside the municipalities. Meaning the different functions of the
39 municipality ... There the information is not at all in sync with each other. This is
40 because of the sector lines, which are tight for legislation's sake ... problem is
41 typically very large ... And if you think ten years back, nothing has substantially
42 got better ...”
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49 The advancement of interoperability was the main goal when FINEA work
50
51 started. It is difficult to say whether the advancement is due to EA work or something
52
53 else. A senior specialist in a civil service department describes this,
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3 “For me it’s hard to see ... but if someone shows me otherwise it will be good. But
4 that this EA program ... would have led to successful stories about interoperable
5 systems working over organisational boundaries ...”
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8
9 The definition of the term interoperability has been discussed during the ten-year
10 span. Now there are ongoing discussions about whether the term EA should be replaced
11 with the term interoperability in the legislation. To do that, the term should be defined
12 and the pursued goals specified. . An independent consultant brought up that
13 interoperability being seen only from the technical perspective is challenging.
14
15 Functional interoperability is also mentioned as an interoperability type. An interviewee
16 from the state government said that interoperability is about having an adequate and
17 well-functioning whole. A development manager of a municipality commented that
18 advancement of interoperability will remain a challenge if the ownership and
19 requirements are not defined. According to a manager of an IT company, services that
20 are developed and owned within one organisation are created in a good way, but the
21 ones where the processes are cross-sectional work poorly. The interoperability of
22 information is seen as being more challenging than technical interoperability. This is
23 partly due to the requirements for technical interoperability being better taken into
24 consideration. For example, the use of NADS is mandated by law, but the information
25 architecture behind NADS is not adapted to be suitable for different users.
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43 New shared systems and services, on the other hand, represent the progress
44 made in the area of interoperability. The NADS and the Suomi.fi services utilising it are
45 the key elements of interoperability on the national level. These services are mentioned
46 in the interviews numerous times, an example by a managing business analyst in an IT
47 company,
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55 “Suomi.fi ... offers these cross-sectional connections between organisations and is
56 a good and secure way to exchange information and advance things.”
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3 The functional interoperability has also advanced and governments' digitalisation
4 policies are drivers for the whole-of-government approach. In some organisations this is
5 well understood, as a department manager in state administration says,
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10 "In my recollection, we discussed this even ten years ago, that in our office we
11 can't make any silos. And this has been going on, we try to recognise the common
12 things as much as possible. Then we create the shared service for others to utilise."
13
14

15 16 ***Process-related challenges***

17 According to the interviewees, several challenges existed in EA implementation ten
18 years ago. The challenges focused on shared understandings in the development of new
19 services, implementation ability, business and IT alignment and governance (Isomäki &
20 Liimatainen, 2008). More than half of the interviewees considered implementation
21 ability and governance to still be a challenge, but some said progress had been made.
22 Implementation ability was mainly a concern from the interviewees from the public
23 sector. The law mandated that FINEA work was seen as being somewhat unsuccessful.
24 After the law was passed, there was a peak in EA work at the state administration level.
25 As time went on, the efforts made in EA modelling were often forgotten. Since the
26 Finnish municipalities have self-determination, the law did not have much of an effect
27 on their EA work. The main result of the law in regards to many organisations was that
28 EA architects were hired to do EA modelling. However, EA was not institutionalised in
29 the organisations' processes and therefore had no transformational effect. As a chief
30 digital officer says,
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35 "The trap is the same, it goes like, let's start EA work, ok let's start modelling the
36 architecture, now it is described and modelled, so it is done. And as a matter of
37 fact, nothing has happened, it is the same ... implementation ability, management
38 ability, both are definitely a challenge in every organisation."
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3 Undefined ownership of processes, IS and service chains were seen as problematic.
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5 There are many conflicts of interest, and resolving them would require modelling the
6
7 top layer of the operation or business models of public sector. This should be done from
8
9 the viewpoint of the customers to see who the owner is or to recognise the need to name
10
11 the owner. This problem was emphasised by the representatives of the cities:
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15 “In my opinion, implementation is a challenge, since the first thing would be to
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17 deal with the process owner ... Even nowadays you run into people weekly who
18
19 think information systems are somehow owned by IT management, although it is
20
21 the tool of the process owner to make the process happen ... And this is why the
22
23 implementation is limping, because the marching order is not known.”

24
25 Governance was seen as a challenge by the interviewees from the public sector
26
27 and IT companies. The main point was that the EA work is done on the level of IT
28
29 departments and is not accepted, nor are its benefits recognised by general management.
30
31 The governance of EA work was generally considered good, but the link between IT
32
33 and business was missing. This is the biggest problem according to a ministerial
34
35 advisor:
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38 “... the wrong people are doing EA, it is misplaced in the organisations ... It is
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40 done in IT department, and in the big picture, the top layer of EA should not be
41
42 done there ...”

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44 Misplaced EA is a problem in almost all of the organisations doing EA work. This
45
46 problem also appears in FINEA work, since the work is steered and developed by the IT
47
48 development unit at the Ministry of Finance. As a curiosity, the Ministry of Finance has
49
50 not modelled its own EA and does not do EA work. Several interviewees stated that EA
51
52 work should be driven by the operations people, not IT:
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55 “[EA] has been marked too much as the busy work of IT guys which has no
56
57 relation to the real world, little exaggerated.” Ministerial advisor
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4 “It is a fact that it was aimed to be the development of the organisation as a whole,
5 but it has remained as a hobby of the IT departments. This is obvious.” Senior
6 consultant
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10 If EA is developed solely in IT departments, the benefits remain modest. Mainly, the
11 manager level of state administration and IT companies have seen that implementation
12 ability and/or governance has been improving. Director of finance in state
13 administration,
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19 “... we have gone a lot forward. Nowadays none of our things moves forward
20 without looking through the EA and how the whole is composed and the interfaces
21 ensured.”
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25 Some organisations have implemented EA, and some of those use EA for business
26 process planning and development. Other organisations use EA in the development of
27 projects, and this has successfully built EA capabilities.
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31 32 33 **New challenges of public sector EA**

34 Ten years ago, the interviewees saw FINEA as technically oriented and asked for
35 emphasis of the activities and contents. Interviewees recognised the need for
36 productivity goals, concrete policies and common guidelines. Some interviewees were
37 sceptical of the possibility of successful EA work. At the time, there were challenges
38 regarding marketing and communicating EA, which are requirements for the
39 advancement of EA thinking. (Penttinen & Isomäki, 2010) Currently, some
40 organisations consider EA “business as usual”, while for others, it is still unfamiliar. As
41 argued above, the three grand challenges of EA still exist, and next, we will, based on
42 the second round of interviews, argue that new challenges have emerged. We have
43 divided them into two categories: 1. practising EA and 2. reconceptualising EA. Both
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3 are process challenges in the CCP approach. The results are presented in Table 4, and
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5 there are some differences in regard to stakeholder groups.
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9 Table 4. New grand challenges in the CCP model perceived by stakeholders
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12 *Practising EA*

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15 Ten years ago, EA in the public sector was in its infancy. Only the early adopters had
16
17 started EA work in the Finnish public sector. Although the use of EA is now mandated
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19 by law, EA has not been institutionalised widely. At the state government level, EA
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21 adoption has started in all the ministries, but the maturity level of EA is still quite low.
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23 In the public sector, the organisations are heterogeneous in size and resources, and this
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25 reflects on the investment in EA. In municipalities, there are some advanced EA users,
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27 mainly big cities, but most of the small municipalities have not yet even started. This is
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29 visible in our data. Interviewees from big cities that are advanced in EA adoption did
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31 not consider lack of motivation or resources as challenges. On the other hand,
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33 interviewees from cities only starting EA adoption considered lack of resources a major
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35 challenge. According to a development manager of a city,
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40 “Resources are drastically tight, even when people are interested and enthusiastic. I
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42 know that there are people eager to study ways to improve business functions. In
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44 reality, the time goes into everyday management.”
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46 Stakeholders from IT companies see that there is a lack of motivation for
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48 implementing EA in the state government. This is partly because of the problems of
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50 showing the benefits of EA. According to a senior specialist in the Ministry of Finance,
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53 “EA is past the hype stage. Now we are in the low point and searching for true
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55 facts ... why doing EA is beneficial. At this point, the benefits should be clearly
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57 visible.”
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3 A managing partner of an IT company explicated that in the public sector, things are
4 often quite theoretical. Practicality and implementation power are missing. In the
5 planning phase, the questions “Why?”, “What is this used for?” and “Does this enable
6 the change process?” are not asked often enough. This issue also came up for public
7 sector stakeholders. They mentioned, for example, EA being instructed too
8 mechanistically and the FINEA method being too complicated. Also, the understanding
9 of operational possibilities and opportunities for digitalisation are lacking. According to
10 a managing business analyst, EA is not strongly connected to strategy, and the goals are
11 vague. An assistant manager of a civil service department described the issues from the
12 organisation’s point of view:

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25 “We have not been able to institutionalise EA as part of our operations ... it started
26 to look like documenting, done afterwards. Why did this happen? ... Partly
27 because we could not justify why EA and its governance are important, and it
28 started to look bureaucratic ... We had a communication problem ... Then there
29 were operational changes ... we lost our EA capabilities ... Now EA is done in
30 addition to other work tasks. We have an IT architect, not an enterprise architect.”
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36 At the moment, there are many structural changes going on in the Finnish public
37 sector, and the interviewees worried that there is a lack of resources and capabilities for
38 holistic planning. In the optimal case, EA would be very useful in the management and
39 communication of change situations. The reality is that in many places, the EA work is
40 stalled. An enterprise architect described how the municipalities that started already ten
41 years ago have had obstacles and it has taken a long time to find an appropriate way of
42 doing EA and getting it as a part of development work. Usually progress has been made
43 only after leaving excessive technology orientation behind.
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53 Mainly, EA’s origin in IT management has led to problems in incorporating EA
54 as part of the operations development and management. Brigadier general says,
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3 “If we do this right, meaning moving from the method to describing operations,
4 then this [EA] has demand and opportunity. If we stick to method, it will be
5 rejected and seen as repulsive and then it will go badly. This is based on the
6 experiences in our own organisation.”
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10 Practising EA is challenging since there is a lack of motivation and resources and the
11 work is not in the management’s agenda. With inadequate resources, it is hard to get
12 value out of EA and hard to justify why management should provide resources for the
13 work. This makes practising EA a grand challenge, and the institutionalisation remains
14 deficient.
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20 21 22 ***Reconceptualising EA*** 23

24 The grand challenge is that EA as a concept is very problematic. This is not only due to
25 the various definitions of the word and different perceptions of it by stakeholders but
26 also many stakeholders discussed the need to replace the concept, and some gave
27 suggestions on how EA should be revised to answer the needs of the current society.
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32 The Finnish translation of EA means the whole-of-architecture, which is
33 semantically different than EA. The origins of the translation are in the Finnish private
34 sector, and nowadays, the term is widely used in the public sector. The perceptions of
35 what the whole-of-architecture means and the reasons for the need to replace the
36 concept vary. For example, a ministerial advisor, who has been responsible for the
37 development of the FINEA method, stated,
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46 “I have become allergic to the whole-of-architecture word. In my opinion, the ideas
47 are better received when they are introduced in other words.”
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51 The need to replace the term was mentioned frequently by the managers in the
52 public and private sectors. The need arises from EA being too much rooted in the IT
53 sector and hard to get a grasp on. Interviewees mentioned they cannot use the EA
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3 concept while talking to management, and it is mainly used in discussions and
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5 cooperation with IT personnel. Over 75 percent of the interviewees considered the EA
6
7 concept to be a challenge. Nevertheless, they do consider EA valuable and do not want
8
9 to end EA work. An enterprise architect in the civil service department says,

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12 “I trust it will find its own role little by little. Whether it will be called EA or
13 merged into something else in the business viewpoint will be seen ... I believe it is
14 a good model for implementing strategy and concretising it into different
15 organisational structures.”
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19 Interviewees mentioned the need for revising EA, for example a ministerial
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21 advisor:

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25 “In my opinion, it is taking this thinking model forward with different methods and
26 discussions ... And detaching from, a bit contradictorily, the method. And just not
27 necessarily so often discussing EA. It is like having natural methods and ways of
28 documenting for operations development in different contexts in public
29 administration.”
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34 The need for revising comes from changes in the operations environment. As a chief
35
36 digital officer in the civil service department says,

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39 “In fact, what is happening is that business is IT and IT is business ... and this kind
40 of planning, it is much broader, and the abstraction level is different.”
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44 Lack of understanding of the intertwined relationship between business and IT was
45
46 mentioned by several interviewees. There is a need for a disruption in the public sector
47
48 to help in realising that digitalisation consisting of IS, IT and data networks is part of
49
50 the business.

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52 EA has not yet been able to respond to the growing development speed in the
53
54 external environment; it is considered too rigid. Interviewees had different solutions for
55
56 renewing EA, such as connecting with business processes, design thinking, rebranding
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3 and emphasising the customer viewpoint. Some interviewees said that the significance
4
5 of EA will grow in the future when digitalisation of the public sector advances. For
6
7 example, a consulting officer stated,

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10 “The old problem of not looking at operations, information and systems together is
11
12 going to stay for a while. But when people realise that development of operations is
13
14 not possible without digitalisation and information management, it [EA] will
15
16 become a normal part of operations development ... What forms it will take and
17
18 whether we talk about EA or something else is a different matter. The key is that
19
20 we consider the whole and the connections between its parts.”

21 **Discussion**

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23 The challenges of EA have been researched to some extent (Kaisler, Armour &
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25 Valivullah, 2005; Lucke et al., 2012; Hauder et al., 2013; Banaeianjahromi &
26
27 Smolander, 2016; Kaisler & Armour, 2017; Lapalme et al., 2017) and also particularly
28
29 in the public sector context (Hjort-Madsen, 2006; Bui & Levy, 2017; Dang & Pekkola,
30
31 2017b). In the only follow-up study, Kaisler and Armour (2017) revisited the critical
32
33 problems of EA they first reported 15 years ago and found that the same problems exist
34
35 and are accompanied by new ones. Kaisler and Armour also believe that some or all EA
36
37 challenges will continue to exist in the future. The grand challenges of EA are, at least
38
39 partly, different in the public and private sectors. In public organisations, challenges for
40
41 IT alignment are a multitude of stakeholders with competing interests, a wide variety of
42
43 services, complex structures and governance problems (Rusu & Jonathan, 2017). In the
44
45 public sector, organisational resistance towards change plays a bigger role. For
46
47 example, the FINEA is mandated by law, yet nevertheless, only 17 percent of
48
49 participants of a survey in 2013 had completed EA adoption. In the private sector, it is
50
51 important to get management to commit to EA and ensure fluent communication
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53 between stakeholders. This is reflected in previous research (Lucke, Krell & Lehner,
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3 2010; Lucke et al., 2012; Jusuf & Kurnia, 2017). The results of our study and
4
5 recommended actions are summarised in Table 5. Recommended actions are based on
6
7 our data, experience and previous literature.
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11
12 Table 5. Summary of grand challenges and recommended actions

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14 We applied the CCP model to the grand challenges of public sector EA. The
15
16 grand *context challenges* are the structures of government that often impede fluent
17
18 development of EA. Overcoming the silo-based structures is a key in the successful
19
20 digital transformation. EA has not been able to help in restructuring the government
21
22 (Hjort-Madsen & Pries-Heje, 2009). Governments should find new ways of financing
23
24 development projects as shared initiatives. Co-creation that can include multiple
25
26 organisations from public and private sectors is getting more attention in the public
27
28 sector as a means to produce services. The main goal of FINEA is advancement of
29
30 interoperability, and it is the grand *content challenge*. Interoperability has advanced
31
32 through development of shared systems and services. The biggest challenge remains at
33
34 the level of operational and information interoperability. The creation of shared services
35
36 should be continued. The interoperability concept should be defined to be able to set
37
38 proper goals to guide and assess the development. The requirements for interoperability
39
40 will be even more important in the future when cross-organisational development
41
42 becomes the norm. EA should help organisations in collaboration by providing a
43
44 holistic overview, standards and guidelines directing shared initiatives.
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48 There are three grand *process challenges*. Implementation ability and
49
50 governance were challenges ten years ago and still are. The law-mandated EA use is
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52 widely seen as problematic and unsuccessful. The interviewees argued this, and it has
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54 come up in research (Hiekkanen et al., 2013; Lemmetti & Pekkola, 2014). The mandate
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3 to use EA has led to initiation of EA programs in governments without organisational
4 demand and motivation. Engaging in EA without understanding the business and having
5 a multitude of different stakeholders leads to problems in the institutionalisation of EA
6 (Hjort-Madsen & Pries-Heje, 2009; Janssen, 2012). The majority of municipalities have
7 overlooked EA since they do not see any benefits and there is a lack of capabilities. To
8 overcome the challenge, EA should be connected to everyday management, processes
9 and routines. In the first-round interviews, some questioned the possibility of successful
10 FINEA implementation. One reason for the hesitance was the EA's IT orientation.
11
12 Perceiving EA as an IT-related development method has certainly hampered the
13 implementation. IT orientation, institutionalisation of EA and the scarce resources are
14 the main reasons for the emergence of the new grand challenge of practising EA. To
15 institutionalise EA, it is important to get EA into the management agenda and connect it
16 with business processes. The capability concept was added in the latest FINEA version.
17
18 Organisational capabilities are combinations of a) operations models and processes, b)
19 employees and skills and c) information and systems. Ensuring appropriate capabilities
20 and resources is necessary for influential EA work. When EA work is in the adoption
21 phase in the organisation, using EA as a tool in development projects is a good way to
22 get the work started (Liimatainen, Heikkilä & Seppänen, 2008).

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42 One way to overcome the challenge of few EA resources is to introduce EA
43 thinking, which is a lightweight, utility-centred approach aimed at non-architects and
44 people outside the IT function that encourages them to adopt holistic thinking (Winter,
45 2014). EA thinking could be a way to promote EA and to provide needed skills for a
46 larger group of stakeholders in organisations. Developing agile EA could help in
47 answering the need for faster service development. Agile EA uses principles of agile
48 methods such as iterations and lean thinking, and the key to successful agile EA is
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3 realising that humans are an integral part of the system, not merely just users of the
4
5 system (Bloomberg, 2013). These kinds of new EA practices require reconceptualising
6
7 EA.

8
9 The need to reconceptualise EA is strong. It comes visible in our data, mainly in
10
11 the form of replacing the EA concept and in recent research (Janssen, 2012; Korhonen
12
13 et al., 2016; Lapalme et al., 2016). Janssen (2012) suggests that EA's scope should
14
15 move away from a technical focus towards a broader sociopolitical perspective that
16
17 includes capabilities and governance. This requires rebranding of EA. Rebranding can
18
19 be done by defining or modifying the core concepts. Another option is to emphasise the
20
21 human and customer viewpoints. This could be done by intertwining EA and design
22
23 thinking. Design thinking applies a design concept to business models, products and
24
25 services, typically taking a distinctly customer-centric view. According to Charajedaghi
26
27 (2011), foundations of systems thinking are sociocultural systems as well as holistic,
28
29 operational and design thinking. Intertwining systems thinking and EA would be an
30
31 interesting way to forward EA methodologically.

32
33 Most challenging are EA process-related challenges, in regard to previous
34
35 literature and the number of recognised challenges. Reconceptualising EA helps in
36
37 overcoming process challenges. It can be argued that context and content challenges are
38
39 the ones that affect EA, but EA has no or a very limited effect in forming them, since
40
41 the emphasis should be on reconceptualising EA for it to be able to stay relevant.
42
43 Recent advancements and emerging technologies, such as cloud computing, ubiquitous
44
45 computing, everything-as-a-service orientation, machine intelligence and blockchain
46
47 technologies, have nurtured innovation in public sector organisations as well. While
48
49 these technologies enable new possibilities in developing more clever, effective and
50
51 efficient public services, they will also inherently increase the complexity of EA. It is
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3 imperative that EA must evolve from its origins, where the key attractions were
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5 managing complex yet steady systems and technology portfolios and supporting the
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7 enterprise efficiency via automation.
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10 Our findings point out the need to include multiple stakeholders in EA practice
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12 and research. Different stakeholders' perceptions on EA influence the implementation
13
14 process and the acceptance of the changes required. Inclusion of many different
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16 stakeholders provides a holistic view of the context in which the EA is implemented.
17
18 We argue that the FINEA implementation could have been more efficient if the
19
20 questions related to CCP of the change would have been given more thought in the
21
22 planning and implementation. Finland as a research context is special because of the
23
24 law-mandated EA, and QLR is a formerly unused research approach in EA research.
25
26 Including multiple stakeholders, in both the public and private sectors, in qualitative
27
28 research on public sector EA is a rarely used approach. We applied the CCP model to
29
30 the grand challenges of public sector EA to give them wider context.
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34 The main goals of FINEA implementation, in the beginning of the work, were to
35
36 use EA in the advancement of interoperability and to unify development processes of
37
38 functions and IS. There has been some progress, but a lot is still to be done. It is
39
40 possible that EA is losing its momentum. The work has been ongoing for over ten years,
41
42 and it has been mandated by law for six years, but with continuing difficulties in
43
44 institutionalising EA, stakeholders are getting ready to abandon the concept. Based on
45
46 the analysis, we conclude that in order to answer the requirements of digitalisation and
47
48 the complexities of the turbulent environment governments face, EA needs to be
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50 revised.
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53 This article contributes to the limited body of empirical research on public sector
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55 EA. In this article, we present a qualitative longitudinal study about the challenges of
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3 public sector EA perceived by different stakeholders in a special context of law-
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5 mandated EA in Finland. The research context brings forth many limitations as far as
6
7 the generalisation of the results of the study are concerned. Nevertheless, understanding
8
9 this particular implementation of national EA in more depth gives insights about the
10
11 general phenomena. Further research should compare the results with results from other
12
13 countries and facilitate the better understanding of development of the EA approach to
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15 answer the challenges of developing societies in the fast-changing world.
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Table 1. Interviewees by organisational level, title, experience in EA and number

Organisational level	Title	Experience in EA (years)	No.
State administration	Ministerial advisor	8-12	3
	Director of finance	10	1
Administrative sector	Brigadier general	15	1
	Consulting officer	15	1
	Assistant manager	15	1
Civil service department	Chief digital officer	16	1
	Department manager	10	1
	Senior specialist	40	1
	Enterprise architect	10	1
City	Chief information officer	10-20	2
	Development manager	3-10	2

	Senior specialist	10	1
Management level of IT companies	Managing partner	13	1
	Managing business analyst	15	1
	Manager	15-17	2
Consultants	Lead EA consultant	15	1
	Senior consultant	10- 27	3
	Enterprise architect	14	1
	Project manager	10	1
	Independent consultant	33	1

Table 2. Timeline of FINEA implementation

Year	Action	Description
Initialisation of FINEA		
2006	Interoperability program	FINEA work started in the Interoperability program that aims at efficiency and interoperability in operations and IS by using EA. Done in co-creation between the Finnish public sector and private sector and a research project.
2007	First version of EA method	Method is based on TOGAF and co-created by Finnish public and private sector.
	<i>Round 1 interviews</i>	
Institutionalisation of FINEA		
2011	EA method 1.0	The first official version of the EA method and published as a public sector recommendation.
	The Finnish Act on Information Management Governance in Public Administration	To ensure IS interoperability, public sector organisations have law-mandated obligations to plan and describe their EA using FINEA.
2012	FINEA 1.0	FINEA is the structure for the co-ordination and development of interoperability between public sector organisations and services. It consists of EA method, EA governance model and EA maturity model.

1 2 3 4 5 6 7 8 9 10 11	2013	Arkkitehtuuripankki.fi	National EA solution including education, EA modelling tool, EA repository, EA description publication tool and EA modelling support services.
12 13 14 15 16	2015	Avoindata.fi	Web service for sharing Finnish open data and interoperability standards and guidelines.
17 18 19 20 21 22 23 24 25 26 27 28 29 30 31 32 33 34	2016	National Architecture for Digital Services (NADS)	Based on the Estonian X-Road, NADS is a compatible infrastructure that facilitates information transfer between organisations and services. NADS includes a national data exchange layer, a new national e-identification model and national solutions for the administration of roles and authorisations for organisations and individuals.
35 36 37 38 39 40 41 42 43 44 45 46 47 48 49 50 51 52 53 54 55 56 57 58 59 60	2017	Suomi.fi	Web service that offers citizens, companies and authorities a single point of access to services of government and municipalities, to the customer's own information and electronic messages.
		EA method version 2.0	More comprehensive than 1.0. Tighter connection with general management processes. Added guidance for capabilities, business models, visualisation models,

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		semantic interoperability, integration and cloud services.
	<i>Round 2 interviews</i>	
	FINEA 2.0	Defined as before, but consists now of EA method, EA governance model and continues development, EA capabilities of organisations and authorities and descriptions of common EA.

Table 3. Old grand challenges in the CCP model perceived by stakeholders

	Challenge	Stakeholder group					
		State administration	Administrative sector	Civil service department	City	IT company management	IT company

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							worker
Context	Structures of government	● x	◐ x ○ +	● x ○ +	◐ x	● x ○ -	● x ○ +
Content	Advancement of inter-operability	◐ x ○ -	○ x ◐ -	● x ○ -	◐ x ○ -	○ x ● -	● x ◐ -
Process	Implementation ability and governance	● x ○ -	● x	● x ○ -	◐ x	◐ x ◐ -	● x ○ +
		◐ rarely mentioned ◐ occasionally mentioned ● frequently mentioned - = diminished x = stayed the same + = increased					

Table 4. New grand challenges in the CCP model perceived by stakeholders

Challenge	Stakeholder group						
	State	Administrative	Civil service	City	IT company	IT	

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		administration	sector	department		management	company worker
Process	Practising EA	●	◐	●	◐	◐	●
Process	Reconceptualising EA	◐	●	●	○	●	◐
		○ rarely mentioned ◐ occasionally mentioned ● frequently mentioned					

Table 5. Summary of grand challenges and recommended actions

Challenge	Recommended actions and research directions

Context	Structures of government	Co-creation to overcome the silos. New ways of financing development projects.
Content	Advancement of interoperability	Defining the concept and setting goals accordingly. Building shared services as ecosystems.
Process	Implementation ability and governance	Connecting EA to everyday management, processes and routines. Defining the process and service owners.
	Practising EA	Getting EA into management agenda and connecting EA with business processes. Using EA as a tool in development projects. Ensuring appropriate resources and capabilities. EA thinking. Developing agile EA.
	Reconceptualising EA	Emphasising the human and customer viewpoint. Intertwining EA with systems and design thinking.

Figure 1. Adapted CCP model (Pettigrew, 1985; Stockdale et al., 2008)

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