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Enterprise Architecture in Public Sector Digitalization

Master's Thesis

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ABSTRACT OF
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Digitalization has been shaping our society already for decades. However, despite the rapid development of new technologies, the change from paper-based systems and processes in the public sector has been slow and somewhat painful. These challenges often relate to the difficulties in institutional restructuring, process redesign and inter-organizational collaboration. Enterprise architecture, on the other hand, aims to support the issues of alignment and integration, between the information systems and business processes. In this thesis digitalization and enterprise architecture are studied in public sector context. Also, the conceptual dimensions of both digitalization and enterprise architecture are investigated based on existing literature.

It appeared that the adoption of digital opportunities in a public sector organization can be either reinforcing or transformational. The latter one, however, requires major effort throughout the organization to support horizontal integration in order to enable a customer-oriented organization. Also, it was found out that enterprise architecture, rather than a single concept, constitutes a number of dimensions that steer its value-creation logic as well as adoption in an organization. Most importantly, enterprise architecture can be characterized as the realized organizing logic of the ICT and processes or as a meta process consisting of methods and artefacts that support decision making in order to build a such realized organizing logic.

This study concludes that in order to adopt digital transformation in the case organization, enterprise architecture should a) be exploited to create a common architectural vision of the enterprise and b) provide understanding of the current organization to move towards the vision. Also, enterprise architecture should support the sense-making of the novel technological developments and the adoption of them in the case organization. Finally, enterprise architecture should act both as a structure and a guiding vision for implementing the digital opportunities.

Keywords: enterprise architecture, ditatalization, public sector	Publishing language: English

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DIPLOMITYÖN
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Tekijä: Heikki Korhonen		
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Digitalisaatio on muovannut yhteiskuntaamme jo vuosikymmenten ajan. Uusien teknologioiden nopeasta kehitystahdista huolimatta muutos paperipohjaisista järjestelmistä ja prosesseista on ollut julkisella sektorilla hidasta ja jokseenkin kivuliasta. Haasteet liittyvät usein muutoksiin organisaatioissa ja prosesseissa, sekä organisaatioidenväliseen yhteistyöhön. Kokonaisarkkitehtuuri pyrkii tukemaan organisaatioita järjestelmien ja prosessien yhteensovittamisessa sekä integroinnissa. Tässä työssä tutkitaan kokonaisarkkitehtuuria ja digitalisaatiota julkisella sektorilla. Toisaalta tutkimuksen kohteena on myös kokonaisarkkitehtuurin ja digitalisaation käsitteellinen sisältö ja ulottuvuudet olemassa olevan kirjallisuuden perusteella.

Työn perusteella voidaan todeta, että digitalisaatiota voidaan omaksua organisaatiossa joko olemassa olevia prosesseja vahvistavalla tai muuttavalla tavalla. Jälkimmäinen edellyttää kuitenkin koko organisaatiota koskettavia toimenpiteitä poikittaisen integraation ja edelleen asiakaslähtöisen organisaation mahdollistamiseksi. Toisaalta, kokonaisarkkitehtuuri näyttää yhden käsitteen sijaan kattavan joukon eri ulottuvuuksia, jotka vaikuttavat sen arvonluonnin logiikkaan sekä omaksumiseen. Ennen kaikkea kokonaisarkkitehtuuri voidaan käsittää realisoituneeksi toimintaprosessien ja tietojärjestelmien väliseksi rakenteeksi, tai vaihtoehtoisesti tällaisen rakenteen syntyä ohjaavaksi metaprosessiksi.

Työn tuloksena selvisi, että prosesseja muuttavan digitalisaation omaksumiseen kohdeorganisaation kokonaisarkkitehtuurin tulisi luoda yhteinen visio tavoitearkkitehtuurista sekä tarjota ymmärrystä organisaation nykytilasta nyky- ja tavoitetilan välisen eron hahmottamiseksi. Lisäksi kokonaisarkkitehtuurin pitäisi tukea uusien digitalisaation myötä syntyvien teknologisten mahdollisuuksien tunnistamisessa sekä hyödyntämisessä. Laajemmin, kokonaisarkkitehtuurin tulisi toimia sekä rakenteena että ohjaavana visiona digitalisaation tuomien uusien mahdollisuuksien hyödyntämisessä.

Avainsanat: kokonaisarkkitehtuuri, digitalisaatio, julkinen sektori	Julkaisukieli: englanti

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Acknowledgements

This thesis summarizes my learning journey of the last fourteen years. Buying an HTML tutorial booklet from a PC store as a teenager turned out to have dramatic consequences, as I became seriously interested in computers and programming. In the final project work for the middle school I made idealistic calculations on how open source software will decrease information technology costs of organizations to fractions of what they used to be. As years have passed I have fortunately learned that information technology only creates value in interaction with people and organizations. That very interaction has been the focal point of my interest for the last couple of years and still inspires me.

This thesis was conducted as a part of the ACIO research program in the Aalto University School of Science. I owe thanks to the research program personnel for inspiring lectures as well as for fruitful discussion along the writing process of the thesis. Also, thanks to the case organization for sponsoring research in this area, as well as to the informants that helped build the empirical data of the study.

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On that journey I have been lucky to receive knowledge, support and inspiration from dozens of people. Thanks to all of you. Finally, I'd like to thank my parents and siblings for their support, as well as Lotta for the love.

Espoo, May 2015

Heikki Korhonen

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Abbreviations

DEG	Digital Era Governance
EA	Enterprise architecture
ICT	Information and communications technology
IS	Information System
IT	Information technology
NPM	New Public Management
SLR	Systematic literature review

1 Introduction

This thesis studies enterprise architecture in public sector digitalization. The study is conducted applying both theoretical and empirical analyses in order to better understand the concepts of digitalization, enterprise architecture and the interrelationship between them. Particularly, this thesis aims to provide guidelines on the application of enterprise architecture to support transformational change enabled by digitalization. The empirical data of this research comprises seventeen interviews that are analyzed using theoretical frameworks that are designed based on the literature review on public sector digitalization and enterprise architecture.

As the theoretical contribution this thesis aims to provide systematic analysis on the concepts of public sector digitalization and enterprise architecture by combining existing discourses. However, many of the findings are likely to be applicable also in the private sector. In addition, this thesis contributes to the knowledge on how enterprise architecture should be utilized in a public sector organization to support digitalization. Practically, this thesis aims provide the case organization with insights into the characteristics of public sector digitalization, as well as guidelines on how enterprise architecture should be applied to respond to and support it.

This chapter first presents the research background and motivation and the context for the research. Then research problem with more specific research questions are described. Finally, the scope and structure the research are outlined.

1.1 Research background and motivation

A new technological paradigm based in information and communication technologies has been shaping our society already for decades. Innovations in information and communicating technologies in 1970s, although unevenly diffused across the globe, started a process of structural transformation that has resulted in definitions such as “information society”, knowledge society” or as Castells himself prefers, “network society”. (Castells 2005: 3-4) Although the Internet has already connected a huge number of computers and people, it is apparent that we still live in the midst of that transformation, perhaps only in the beginning (e.g. Porter 2014). The US National Intelligence Council (2008) estimates that “by 2025 Internet nodes

may reside in everyday things – food packages, furniture, paper documents, and more".

However, despite the rapid development of new technologies, the change from paper-based systems and processes in the public sector has been slow and somewhat painful. Information and communication technologies have been used in the public sector most often to reinforce existing organizational arrangements, power distributions and service delivery patterns rather than to change them (Kramer & King 2005, Andersen & Henriksen 2006). Dunleavy et al. (2005) argue that ICT has been marginalized in the public management discourse, with undesirable implications. In addition – or perhaps as a result, several failed or delayed public IT programs in different countries have cast shadows on digitalization efforts. According to Di Maio (2006) some argue that more than 70% of e-government initiatives have failed to meet the initial transformation objectives in the early stages of e-government implementation. These failures often relate to the difficulties in institutional restructuring, process redesign and inter-organizational collaboration (Ferlie et al. 2003, Davison et al. 2005).

Hence it would be justified to say that in terms of digitalization the development of public sector processes and services has not kept up with the opportunities of technological developments. On the other hand, technological advancements alone do not constitute significant change, but require organizational and process and management changes to succeed (e.g Heeks & Bhatnagar 1999, Wiredu 2012, Lam 2005). This challenge of alignment and integration has triggered and driven the adoption of enterprise architecture – a method for architecting a coherent and responsive enterprise.

The concept of enterprise architecture, however, appears to comprise several definitions, schools (La Palme 2012) and methods of value creation (Tamm et al. 2011). Also, the value and transformativeness of EA have been questioned (Hjort-Madsen and Burkard 2006, Hjort-Madsen & Pries-Heje 2009). In some cases the return on investment calculated for enterprise architecture has been thousands of percents (Rico 2006). However, according to Tamm et al. (2011), many of the benefits in the EA literature have little evidence to support the claims. As a result, the true content and value-creation logic of enterprise architecture seems rather unclear.

The issues described here are not unknown to the Finnish public sector, where government agencies and local governments have been troubled in the jungle of legacy systems, cost cuttings and the growing demands for efficiency, agility and better services.

1.2 Research context

The research is conducted for one of the largest cities of Finland with a population of circa over 200,000. As the majority of Finnish municipalities, the case organization is willing to find ways to increase efficiency and service quality throughout the organization. Since digitalization can provide the possibility to both modernize existing processes and innovate radically new ones, it is considered as a promising source of sustainable development in productivity and service quality.

1.3 Research problem and objectives

The research problem of this thesis is "exploitation of enterprise architecture in public sector digitalization". The research focuses on three concepts, public sector digitalization, enterprise architecture and digital transformation. In order to cover the research problem, first the development of public sector digitalization and the e-government discourse are studied. The second part covers the concept of enterprise architecture and its role in the public sector. Finally, the potential role and success factors of enterprise architecture are analyzed in the context of digital transformation.

The research problem is divided into the following research questions:

1. How does digitalization impact a public sector organization?
2. What is enterprise architecture?
3. How should enterprise architecture be exploited to support digital transformation in the case organization?

Research questions	Sub-objectives	Method
1. How does digitalization impact a public sector organization?	a) What stages of digitalization can be identified? b) How is digitalization comprehended in the case organization?	SLR + Case
2. What is enterprise architecture?	a) What are the dimensions of enterprise architecture? b) What are the value-creating mechanisms of enterprise architecture?	SLR + Case
3. How should enterprise architecture be exploited to support digital transformation in the case organization?	a) How can enterprise architecture support transformational change? b) What is the desired direction of enterprise architecture in the case organization?	SLR + Case

Table 1: Research questions and sub-objectives

1.4 Research scope

The following constraints scope the research.

- The concept of public sector refers to both central and local government organizations although the case organization is a municipality, i.e. a local government. Naturally, there are major differences in the governance and distribution of public power across countries, but it is assumed that many of the public sector characteristics are as valid in local as well as central governments.
- Internet-enabled political participation and government transparency elements of the e-government discourse are mostly excluded. Citizens and companies are regarded as customers of the municipality, which then provides the services.
- Strategy process and strategic management are not included, even though they are often closely interrelated with enterprise architecture and digitalization. In this research, focus is on implementing or executing the given strategy with the help of enterprise architecture, as often described in EA literature. (e.g. Op ‘t Land et al. 2008: 21)

1.5 Research structure

The research comprises four parts and twelve chapters that are listed in Figure 2.

Figure 1:Research structure

Introduction and methodology	Theoretical framework	Empirical research	Conclusions
1. Introduction 2. Introduction to digitalization	3. Public sector digitalization 4. Enterprise Architecture	5. Data collection and analysis 7. Empirical findings	8. Results 9. Discussion

1.6 The method of systematically reviewing the literature

The literature review comprised two phases, a preliminary search and a critical literature review, as proposed by Saunders (2009: 58). The preliminary search was conducted to refine research ideas. With such keywords as "e-government", "public sector enterprise architecture", "public sector digitalization", it resulted in approximately 200 articles and books. A couple of discourses could be identified from the results, creating a foundation for the literature review. In the critical phase searching process was further iterated based on the results of the preliminary search, as the topics began to emerge. Finally, the results were analyzed in order to select a representative set for more accurate investigation.

Searches were limited to abstract and author-supplied abstract since "There are, however, problems with using a free text search. In particular, the context of a key word may be inappropriate, leading to retrieval of numerous irrelevant articles and information overload" (Saunders 2009: 85).

2 Introduction to digitalization and digital transformation

"Like a force of nature, the digital age cannot be denied or stopped."

- Nicholas Negroponte in Being Digital (1995)

In the end of the second millennium, a revolution of information and communication technologies began to reshape the society. In this fundamental shift information technology plays a similar role that the new sources of energy – steam engine or electricity – had in the industrial revolutions. (Castells 2000)

It appears that digitalization or digital transformation do not constitute specific scientific discourses. Rather, they seem to span over the society and disciplines, and - as Castells (2000) puts it – transforming the "social landscape of human life". This chapter briefly describes some of the trends and events that might help provide the broader context for the research.

2.1 70s and before – Roots of digitalization

The seeds of the digitalization were rooted already before the World War II (telephone by Bell in 1876, radio by Marconi in 1898 and vacuum tube De Forest in 1906). However, it was the "mother of all technologies", WWII, that encouraged the development of the first computers.

Although overlooked at that time, the invention of Transistor in 1947 by Bardeen, Brattain and Shockley enabled the processing of electric impulses in order to code logic and communication in binary mode. The reason for overlooking was obvious: valves, the component used for example in the first computers, had rather similar functionality and lower price at the time. (Braun & MacDonald 1982)

The price of transistor began to rapidly fall following the invention of integrated circuit (Kilby) and a planar manufacturing process by Fairchild Semiconductors. As a consequence, the price of a transistor dropped by 85 per cent between 1959 and 1962. The average price of an integrated circuit, on the other hand, fell from 50 to 1 dollars between 1962 and 1971.

These technological developments led to the introduction of microprocessor, "computer on a chip" in 1971, by and Intel Engineer Ted Hoff. As a result an

unprecedented computing power was available in a miniature size compared to previous alternatives. The diffusion of the microprocessor led to the invention of microcomputer in 1975, and the first commercially successful product, Apple II launched two years later. (Castells 2000) As predicted by Moore (1965), the number of transistors on a microchip has continued increasing exponentially, dramatically improving the performance of computers to the present day. Counting in the invention of TCP/IP protocol and growing ARPANET, Castells (ibid) states that the information technology revolution was born in the 70s.

As a side note for the context of this research, in Finland the new possibility to store and process data in digital form encouraged three hundred municipalities to establish a shared computing center, "Kunnallistieto", already in 1972. A couple of years later the coalition of large municipalities in the capital area, Helsinki, Espoo and Vantaa, founded a similar computing center, "PTK-tietokeskus", and so the era of municipal ICT in Finland had begun. (CGI1)

2.2 80s – Rise of information and information systems

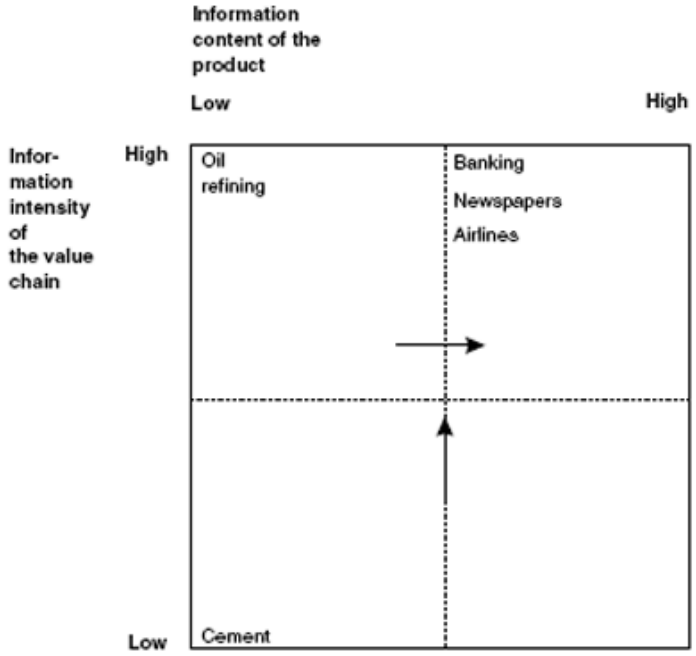
"The information revolution is sweeping through our economy. No company can escape its effects. Dramatic reductions in the cost of obtaining, processing, and transmitting information are changing the way we do business."

- Michael Porter (1985) in How Information Gives Your Competitive Advantage

In 1980s the diffusion of the information and communication technologies had reached a point where its impact on doing business was undeniable. Not only had it impact on individual companies, but on whole industry structures and the rules of competition. (Porter 1985)

Porter also noted, that while historically the physical component of the product had been dominant to the information component, it was possible to supply "far more information along with the physical product." To depict the situation, Porter presented an Information Intensity Matrix that highlighted the growing information intensity of both the value chain and the product. (ibid)

Figure 2: Information Intensity Matrix by Porter (1985)



In 1980s, as more and more computers were networked (Castells 2000) and regulation had reduced, the concept of interorganizational information system was introduced. Also, the strategic importance of information systems had increased to the point that the first attempts to the first steps of strategic business-IT alignment were taken. (Ives & Learmonth 1984, Henderson & Venkatraman 1993) The increasing role of information and communication technologies also began to encourage the idea that ICT could transform "business methods" (Benjamin et al. 1983), paving the way for business process reengineering.

Figure 3: The Strategic Opportunities Matrix by Benjamin et al. (1983)

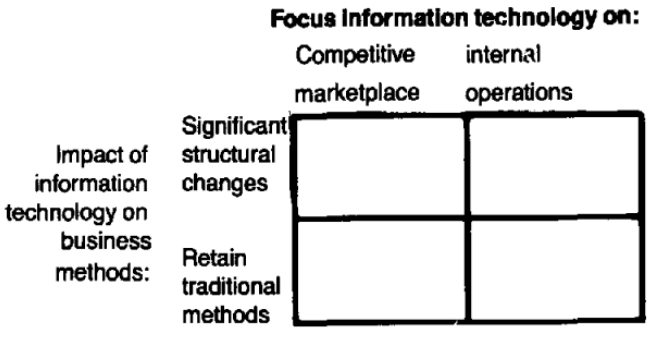


FIGURE 4. Strategic Opportunities Matrix [5]

If information and communication technologies were born in the 70s, it appears that in 80s they were adopted to organizational context gaining growing strategic significance. Computers became increasingly networked, whereas information systems got their interorganizational dimension.

2.3 90s – Birth and rise of WWW and mobile

By the beginning of 90s the Internet was still difficult to use for the masses. Also, at that time there were millions of computers in networks that were not part of the Internet, using incompatible communication protocols. The expansion of the Internet was only started by the introduction of the World Wide Web, a combination of hypertext (HTML) documents and the hypertext transfer protocol (HTTP). (Castells 2000)

The expansion of the Internet following the adoption of WWW triggered a major technological shift from standalone microcomputers and mainframes to networked devices, including mobile phones making technology pervasive. As Castells (ibid) describes, the network itself became the information processing system. The growing number of websites during the 90s is depicted below.

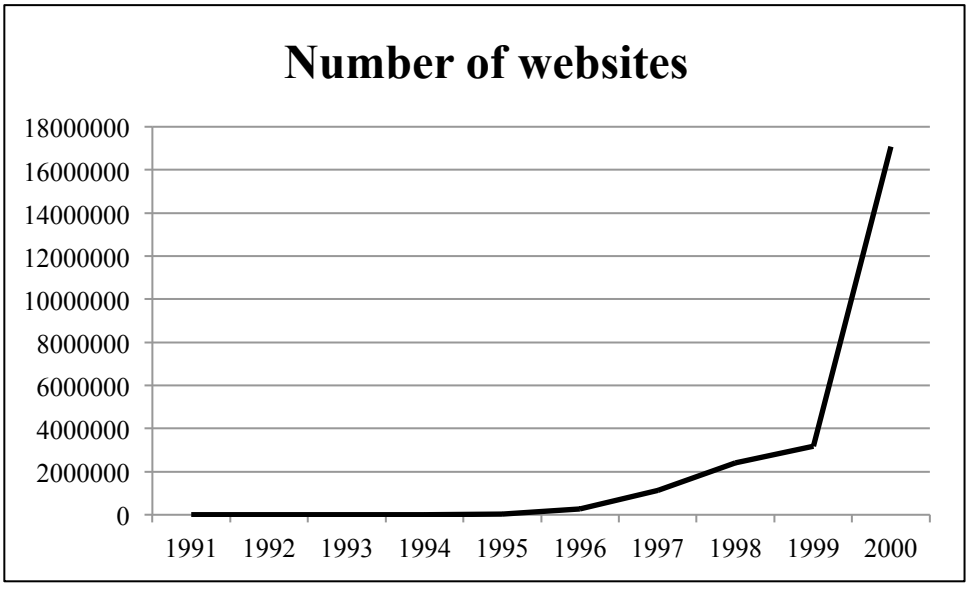


Figure 4: Number of websites during the 90s (NetCraft and Internet Live Stats)

In organizational context, early 1990s were the days of business process reengineering. Hammer (1990) writes in his article in Harvard Business Review:

"It is time to stop paving the cow paths. Instead of embedding outdated processes in silicon and software, we should obliterate them and start over. We should "reengineer" our businesses: use the power of modern information technology to radically redesign our business processes in order to achieve dramatic improvements in their performance."

Many of the IT investments in the 80s had turned out to be unsuccessful in terms of the desired productivity benefits (Keen 1991). Consequently, an idea that instead of automating current processes the information and communication technologies should be used to redesign processes from the ground up emerged (e.g. Hammer 1990, Hammer & Champy 1993, Davenport 1993; Venkatraman 1994). The concept of BPR seems to be perfectly in line with the definition of digital transformation be Westerman (2011). However, reengineering efforts failed rather often. Hammer & Champy (1993) suggest a failure rate of 70 per cent while Al-Mashari et al. (2001) found out that 45 percent of the BPR programs failed.

2.4 00s – Rise of social platforms

Only a short time after the dot-com bubble had burst, Porter (2001) wrote:

"The time has come to take a clearer view of the Internet. We need to move away from the rhetoric about "Internet industries," "e-business strategies," and a "new economy" and see the Internet for what it is: an enabling technology—a powerful set of tools that can be used, wisely or unwisely, in almost any industry and as part of almost any strategy."

Expansion of the Internet had led to the creation of new industries as well as to reconfiguration of existing ones. Also, it had led to the so-called dot-com boom, where the valuation of Internet-based companies would be "economically unsustainable". (ibid) The growth rate of the Internet user base, however, continued growing rapidly. Below is depicted the growth of the Internet user base in Finland, from less than 40 per cent in 2000 to almost 90 per cent in 2010.

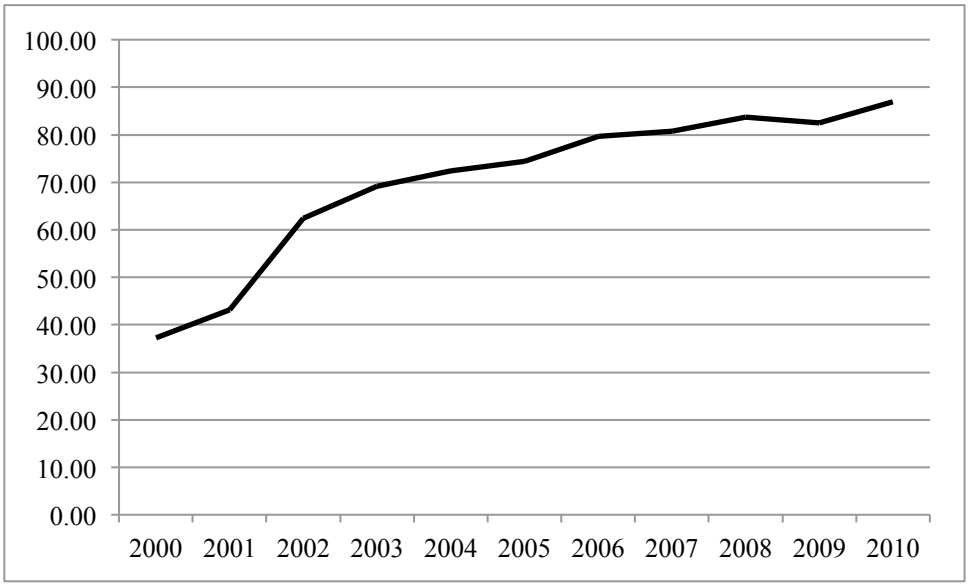


Figure 5: Percentage of Internet users in Finland, 16-74 years old (International Telecommunications Union (Geneva), June 2013)

After the dot-com boom, along with the growing number of users in the web, a concept called Web 2.0. It was shift towards more platform-like and more social web. Blogs started to replace personal websites, Wikipedia traditional encyclopaedias and meta-tags traditional directories. (O'Reilly 2007) The table below gives reflects the shifts by several examples.

Web 1.0	**Web 2.0**
DoubleClick	Google AdSense
Ofoto	Flickr
Akamai	BitTorrent
Mp3.com	Napster
Britannica Online	Wikipedia
Personal websites	Blogging
Domain name speculation	Search Engine optimization
Publishing	Participation
Content management systems	Wikis
Directories (taxonomy)	Tagging ("folksonomy")

Table 2: Web 1.0 vs. Web 2.0 adapted from O'Reilly (2007)

Consumers were increasingly creating, modifying, sharing and discussing content on Internet platforms (Kietzmann et al. 2011). The rise of social media platforms is well depicted by the growth rate of Facebook users between 2006 and 2010.

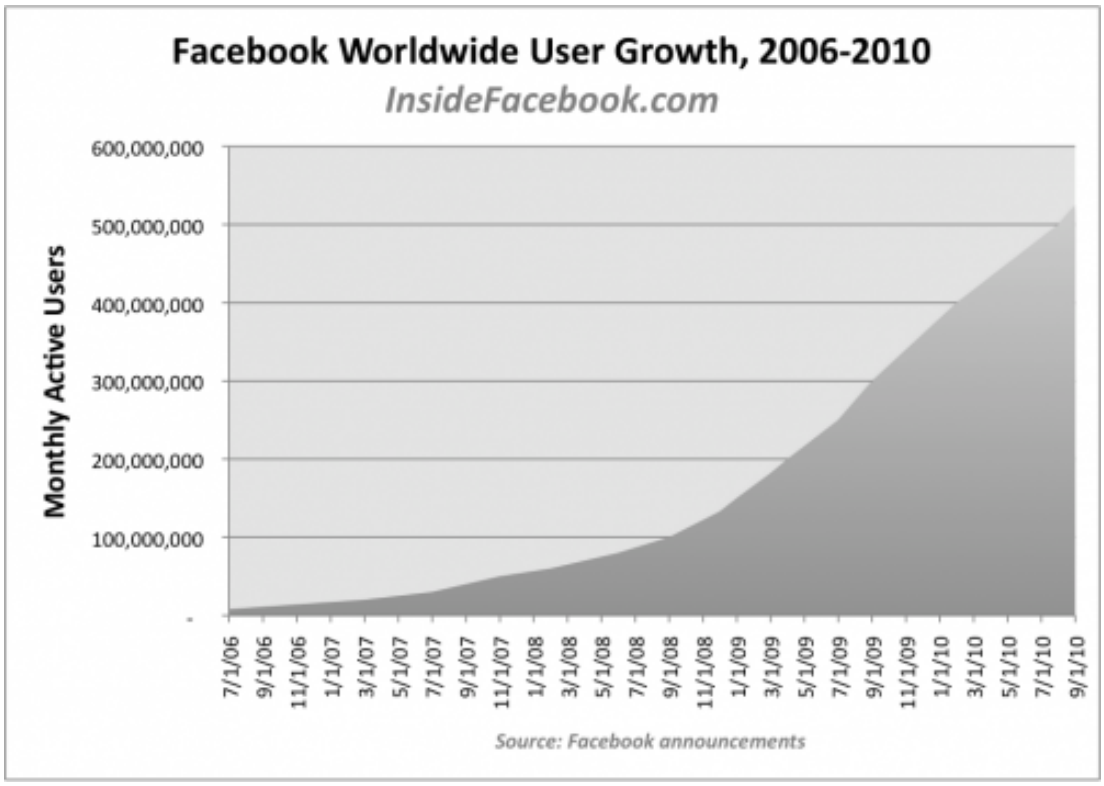


Figure 6: Growth rate of Facebook users between 2006 and 2010 according to InsideFacebook.com

2.5 10s – SMACIT and Internet of Things

"Now, in the third wave, IT is becoming an integral part of the product itself. Embedded sensors, processors, software, and connectivity in products (in effect, computers are being put inside products), coupled with a product cloud in which product data is stored and analyzed and some applications are run, are driving dramatic improvements in product functionality and performance."

- Porter and Heppelmann (2014)

Porter and Heppelmann (2014) suggest that the next technological transformation will be based on smart, connected products, the phenomenon often called "Internet of Things". Just as the previous transformations, Internet of things will restructure industries and reshape the value chain. However, whereas previous transformations have impacted the manufacturing, design, supply chain and marketing, this time the product itself becomes transformed as IT comes an integral part of it. (ibid)

2.6 Discussion

As Negroponte (1995) states, development into a more digital society and human life – digitalization – seems unstoppable. Major shifts enabled by the diffusion and adoption of technological innovations, as described by Porter on three different decades, have reshaped value chains and whole industries creating enormous opportunities for increased productivity and competitive advantage.

Westerman (2011) suggests that digital transformation – "the use of technology to radically improve performance or reach of enterprises" – happens in three areas: customer experience, operational process and business model. However, adopting the new technologies in order to transform organizational structures and business seems to be a challenging effort for any organization. Not only is it a challenge for current transformation initiatives, but also it appears that it has been difficult during previous technological shifts. Just as the business process reengineering discipline was encouraged by the struggle of creating significant productivity benefits with information and communication technologies, the current digital transformation comprises very similar mission, rhetoric as well as terminology. As the technological possibilities for such transformation have existed for decades, it appears that there is something very challenging in transforming organizational structures and processes for the digital era.

The next chapter analyzes digitalization specifically in the public sector, focusing on the era from late 1990s.

3 Public sector digitalization

This chapter walks through the digitalization specifically in the public sector. First, in order to set the context for the chapter, some historical background and the concept of bureaucracy are described. Then different concepts of public sector digitalization, namely electronic government, transformational government, digital era governance and virtual state are analysed. In addition, the work by Brown, Fishenden and Thompson (2014; 2011) on digital government delivery is examined. The concepts presented here are not separate from each other but rather seem to build on each other. Each of them brings a unique perspective to the matter of public sector digitalization, which according to the literature review, does not exist as a discourse in the literature. Finally, a synthesis is created to combine different schools. It aims to provide a holistic view into the dimensions and stages of public sector digitalization.

As noted before, the public sector in this research covers both central and local government. Much of the literature is based on research on central government, but in this research the public sector is considered as a whole.

The chapter aims to answer the first research question "*How does digitalization impact a public sector organization?*" as well as the first sub-objective a) *What stages of digitalization can be identified?* Moreover, it sets the context for the research questions two and three.

3.1 Background

"The modern form of public administration executes with the pen everything which previously would have been done by word of mouth. Hence many pens are set in motion. In every branch of administration bureaux or offices have multiplied, and have been accorded so great a power over citizens that in many countries a veritable bureaucracy, rule by offices, has developed."

- The German Brockhaus Encyclopaedia 1819 (in Albrow 1970)

The excerpt above describes the early days of bureaucracy when public administration developed from word of mouth to a written form. These paper-based systems were refined through the 1920s and then lasted until the 1980s when new

storage methods allowed free-text searching of data. Although not exactly digitalization, those paper-based systems constituted bureaucracy as socio-technical system. (Dunleavy et al. 2006: 15-16)

Apart from the military and scientific computing in the 40s and 50s, the use of computers in public administration started to grow in late 60s along with cheaper mainframe computers. It had a positive impact particularly in accounting, leading to greater systematization. In the 80s the desktop computers and relational databases improved the ways officials worked and information was stored and queried. However, the fundamental operation – "modus operandi" – of the registries and systems was not changed. (ibid)

Dunleavy et al. (2005) argued that IT had been excluded from the central texts of public management theory, and there had been a "significant divorce" between the centrality of information technologies and their marginality. Despite the notions on information age in late 90s and early 2000s, the authors considered that the neglect of IT had been "unhealthy".

One may argue that the neglect has also turned out rather expensive. According to the Independent, in 2010 several delayed IT projects had cost British tax payers £26 billion (Savage 2010). In 1998, despite the rapid technological developments, a British welfare agency with 68,000 employees had only eight PCs with an Internet connection (Dunleavy et al. 2006: 16).

Similar challenges are not unknown in Finland either. A report by the National Audit Office (2011: 9-10) stated in the national development programs of healthcare IT had been modest, when compared to the objectives and requirements. The report not only criticized the inadequate program management, but also the fact that the new IT systems were built on the existing organizational structures and policies. Programs focused on ICT with insufficient development work on productivity of processes. Another report by the National Audit Office (2013: 88) found out that the number of information systems in the Finnish Government organizations had altogether 4000 information systems.

3.2 Electronic government

Many authors agree that 1) electronic government is a potential way to a government administrative reform, 2) citizens demand better public services and 3) information and communication technologies are a key component in order to deliver those better services. However, it is also widely agreed that the promises of better, more efficient and transparent electronic government have not been fulfilled. (Gil-Garcia 2012) In 2002 Moon argued that the electronic government had not been as effective as the rhetoric would suggest (p431). The state of the e-government initiatives was described as primitive, often only disseminating government information on the web.

There appears to be some disagreement on the concept of electronic government. Gil-Garcia (2012) suggests that e-government could be seen as a totally new phenomenon or on the opposite, a new name for utilizing information and communication technologies in government context. Scholl (2009) and Lee (2010) describe e-government as a multidisciplinary field with challenging issues, since multiple paradigms and standards interact within it.

3.2.1 Definitions

According to Gil-Garcia (2012), there is not an agreement on the definition or scope of e-government. Generally, electronic government comprises the selection, implementation, and use of information and communication technologies in government settings (Fountain, 2001; Moon, 2002). More precisely, the concept has been structured into three approaches (Gil-Garcia and Luna-Reyes 2006).

- Evolutionary approach: *"By constructing a series of stages through which different governments are journeying"*
- Definitional approach: "*Electronic government is characterized by (a) the use of ICTs (computer networks, internet, telephones, and faxes), (b) the support of governmental actions (to provide information, services, administration, products), (c) the improvement of government relationships with citizens (through the creation of new communication channels or the promotion of citizen engagement in the political or administrative process), and (d) the use of a strategy to add value to the participants in the process*"
- Stakeholder-oriented approach: categorizing e-government by its relationship with other entities, including Government to Citizen (G2C), Government to Business (G2B) and Government to Government (G2G)

Gil-Garcia et al. (2003) defines e-government as the intensive or generalized use of information technologies in government for the provision of public services, the improvement of managerial effectiveness, and the promotion of democratic values and mechanisms. According to the United Nations E-government Survey (2014: 2) *"e-government can be referred to as the use and application of information technologies in public administration to streamline and integrate workflows and processes, to effectively manage data and information, enhance public service delivery, as well as expand communication channels for engagement and empowerment of people"*.

OECD (2003) suggests that the definitions of e-government fall in three groups. The first group focuses on the delivery of online services. The second group focuses on the use of ICT in government services, processes and other activities. The third group defines e-government as a capacity to transform public administration through the use of ICT.

3.2.2 Stages of electronic government – evolutionary approach

Several stage models have been suggested to model to maturity stages of electronic government, but they are fragmented in terms of perspective (Lee 2010). Some of the maturity models are listed in the table below.

Framework	Less mature	→	→	More mature
Layne & Lee (2001)	**Catalogue** (online presence, downloadable forms)	**Transaction** (services & forms online, working database supporting online transactions)	**Vertical integration** (local systems linked to higher level systems, within similar functionalities)	**Horizontal integration** (across different functions, one stop shopping)
Moon (2002)	**Information dissemination / catalogue**	**Two-way communication** / **Service and financial transaction**	**Vertical and horizontal integration**	**Political participation** (voting online)
Andersen & Henriksen (2006)	**Cultivation** (horizontal and vertical integration)	**Extension** (extensive use of intranet, personalized web interface for customer processes)	**Maturity** (abandoning intranet, transparent processes)	**Revolution** (data mobility across organizations, application mobility across vendors, customers own data)
Gartner Group / Baum &	**Web Presence**	**Interaction**	**Transaction**	**Transformation**

Maio (2000)					
Deloitte's Six Stage Model (2001)	**Information publishing / dissemination**	**Official two-way transaction**	**Multi-purpose portals**	**Portal personalization** **Clustering of common services**	**Full integration and enterprise transaction**
West (2004)	**Billboard stage**	**Partial service delivery stage**		**Portal stage** (executable and integrated service delivery)	**Interactive democracy**
Siau & Long (2004)	**Web Presence**	**Interaction**	**Transaction**	**Transformation**	**E-democracy**
Asgarkhani (2005)	**Internal functional efficiency through ICT**	**Internal communications and workflow management**	**C2G, B2G, G2G transactions**	**Digital democracy**	**Integrated electronic and digital governance**
Hiller & Bélanger (2001)	**Emerging web presence**	**Enhanced web presence**	**Interactive web presence**	**Transactional web presence**	**Fully integrated web presence**

Table 3: E-government stage models

The stages are synthesized in Lee (2010) in which e-government evoluation is divided into five metaphors and altogether nine stages, based on the existing stage models. He also notes the division of stages into citizen / service oriented concepts and, on the other hand, operation and technology oriented concepts. The model is described in the table below.

Metaphors	**Descriptions**	**Stages / concepts**	
		Citizen and service	**Operation and technology**
Presenting	Present information in the information space	Information	
Assimilating	Assimilates (or replicates) processes and services in the information space with the ones in the real world	Interaction	Integration
Reforming	Reform the processes and services in the real world to match the information space requirements, fitting for efficiency	Transaction	Streamlining
Morphing	Change the shape and scope of processes and services in the information space as well as the ones in the real world, fitting for effectiveness	Participation	Transformation

e-Governance	Processes and service in both worlds are synchronously managed, reflecting citizen- involved changes with reconfigurable processes and services	Involvement	Process management

Table 4: Meta synthesis of e-government stage models by Lee (2010)

Another meta-synthesis by Gil-Garcia and Martinez-Moyano (2007) divides e-government evolution into seven stages. In *initial presence* stage government information is organized and presented online by individual agencies. In *extended presence* stage information is specialized, aggregated, more dynamic and allows the most basic transactions. *Interactive presence* allows useful interactions for the citizens through often a government-wide portal, setting the first possibilities for transforming the relationship between the government and the citizen. In the *transactional presence* stage secure transactions are available for citizens to perform government procedures online. *Vertical integration* stage comprises the virtual and physical integration of government websites, processes and structures within a function. On the other hand, in *horizontal integration* the integration happens between different government agencies, services and policy domains. This stage requires restructuring cross-organizational boundaries but also the transformational redistribution of intra and interorganizational power. In *total integration stage* all the government services are provided through a single portal independently of the internal functions.

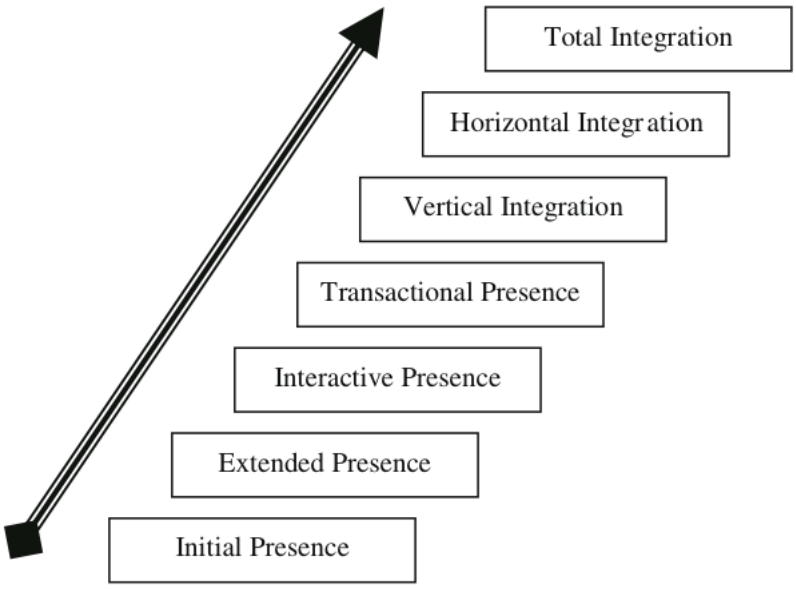


Figure 7: E-government stages by Gil-Garcia and Martinez-Moyano (2007)

Unlike Lee (2010) Gil-Garcia and Moyano (2007) do not separate the citizen perspective from the technology perspective, but the stages are on a single scale.

As mentioned in the scope constraints of the research, e-democracy and electronic political participation are excluded in this study. Essentially all stage models seem to consist of the online presence, online transaction, vertical integration and horizontal integration stages. Of these stages the horizontal integration stage often appears to be considered as transformational, since it enforces changes in terms of organizational and process settings.

3.3 Transformational government

Despite the popularity of the e-government discourse, it has been acknowledged that the first stages of it – namely presence, transaction have not produced significant improvements in productivity. (Weerakkody & Dhillon 2008) As Layne and Lee (2001) and Sarikas and Weerakkody (2007) noted, many e-government initiatives have troubles passing the transaction phase. On the other hand, as discussed in the previous chapter and also noted by Layne and Lee (2001) and Mansar (2006), that particularly the in the later stages business process reengineering is required to enable centralized and integrated services. Also, Klievnik and Janssen (2009) argue that that the evolutionary models neglect the discontinuity between the stages, and that the models have not produced much support for public sector organizations.

Murphy (2005) defines transformational government as "radically changing the way government conducts its business internally and externally". According to the UK Cabinet Office (2006) transformational government comprises reengineering and re-designing business with technology in order to improve services. Weerakkody et al. 2011 define t-government as quoted below.

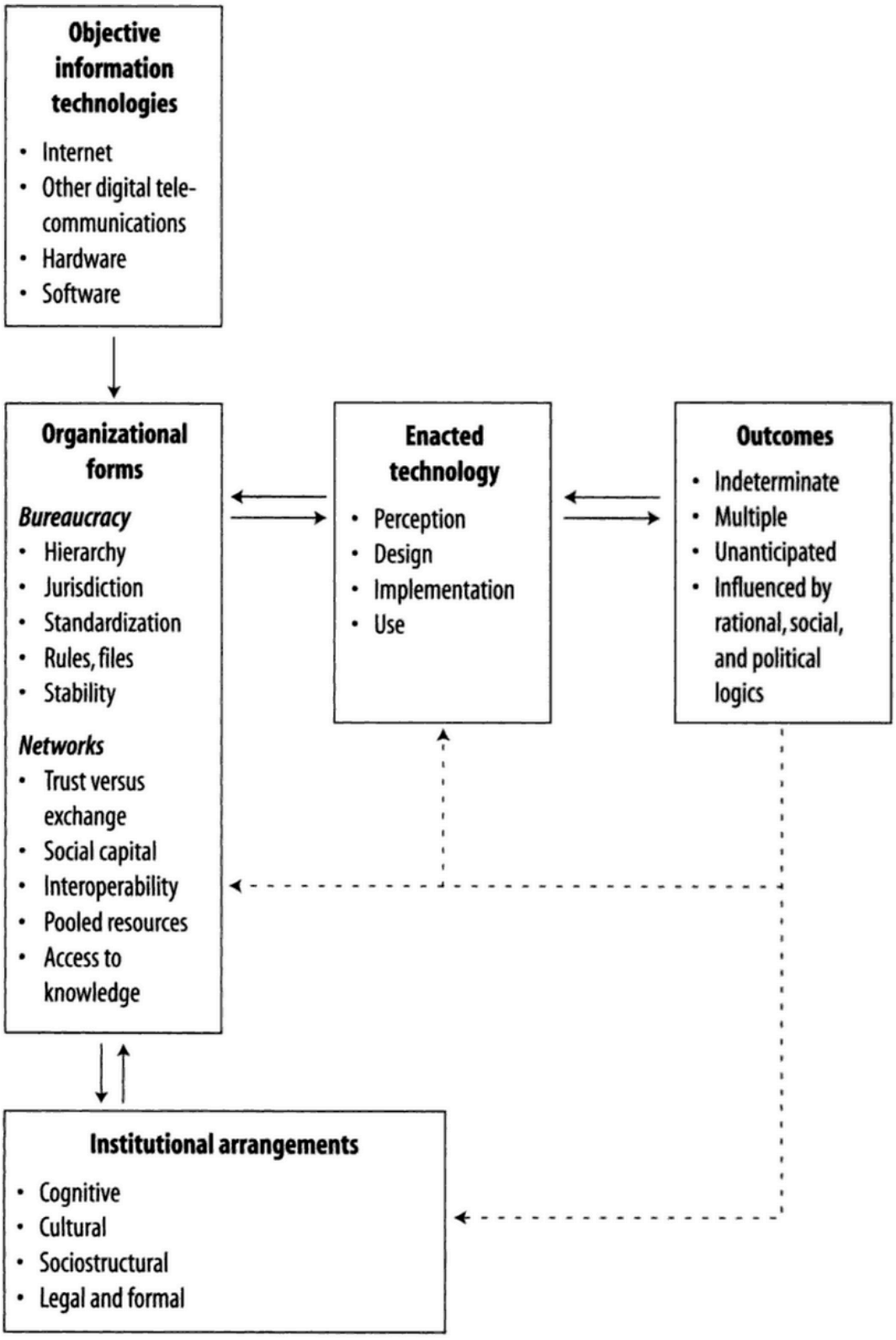
"t-Government is the ICT-enabled and organization-led transformation of government operations, internal and external processes and structures to enable the realization of services that meet public-sector objectives such as efficiency, transparency, accountability and citizen centricity."

In comparison to e-government, t-government aims to achieve major, transformational changes. However, t-government is often considered as the second phase of e-government.

3.4 Virtual state and the technology enactment framework

Fountain's (2001) work, even though criticized by Dunleavy et al. (2006) on an overly optimistic terminology, brought together many aspects of the public sector digitalization.

Fountain's technology enactment framework describes how "individuals in institutions tend to enact new information systems to reproduce existing rules, routines, norms and power relations if institutional rules are clear and no salient alternative uses are visible in the environment". (Fountain 2001) The framework gives reasoning for the mechanisms how information technology is adopted in public sector organizations.



In addition of the framework, Fountain (2001) also made and tested propositions on the relationship between technology, organizations, institutions and individuals. They are listed below.

1. Government agencies will resist the potential for dramatic efficiency gains if those gains translate into loss of resources (budget and personnel) for the agency.
2. Federal interagency networks will be difficult to build and maintain because the formal institutions of the federal government reward agency-centered activities and discourage cross-agency activities.
3. Agencies lack resources for learning to use IT.
4. Intergovernmental and public-private networks will over shadow cross-agency IT-based networks because the institutional context favors those arrangements more readily than cross-agency federal networks.
5. Agencies are likely to focus reform efforts on constituents, or "customers," who also are potential or actual strategic allies in the appropriations process.
6. The nature of changes necessary to develop a network will affect the probability of success of the effort.
7. The culture, history, mental models, and standard practices of a policy domain or agency will affect technology enactment — that is, whether and how an agency uses the Internet.

Both the technology enactment framework and the related propositions provide context for the challenges in digitalizing the public sector. They emphasize the characteristics and issues of adopting new technologies and shed light on high failure rate of transformational e-government initiatives. Particularly, they elaborate the multidisciplinary nature of public sector digitalization (Scholl 2009; Lee 2010) and issues of institutional restructuring (Ferlie et al. 2003; Davison et al. 2005).

3.5 Digital Era Governance

In order to bridge the gap between the central role of ICT and the marginality of ICT in public management literature, Dunleavy et al. (2005) present the concept of “Digital Era Governance”. It highlights the organizational, political, cultural, cognitive and behavioural aspects of digitalization instead of direct technological effects. As the name implies, digital era governance focuses particularly on the changes in governance – enabled by digital technologies. (ibid)

In addition to the marginalization of ICT, Digital Era Governance is strongly motivated by experiences on the New Public Management (NPM) governance paradigm. NPM has been the dominant managerial paradigm in the past two decades, but its problems are now widely acknowledged. Based on disaggregation, competition and incentivization, NPM has increased institutional and policy complexity creating unwanted consequences. As a post-NPM movement, Digital Era Governance aims at the opposite – reintegration, needs-based holism and digitization changes in the public sector management. (ibid) Dunleavy et al. (2005) argue, that particularly the disaggregation theme of NPM has failed to produce the desired results. Many of its trends including purchase-provider separation, agencification, quasi-government agencies have been wholly or partially reversed. Similarly, trends in the competition theme such as quasi-markets have been reversed.

The reintegration theme of DEG aims to bring back together elements that were disaggregated into separate organizations by the NPM reform. However, its not centralization back into the old structure, but a partly synthesizing "anti-thesis" to the NPM school. The authors argue, that the disaggregation of the public sector has to the responsibility of the citizens to integrate the public services themselves. A related theme, needs-based holism, seeks to "simplify and change the entire relationship between agencies and their clients". Re-engineering of processes to remove unnecessary steps is linked with larger and more encompassing administrative blocks. Moreover, this is hoped to lead into greater agility as well. The digitization changes comprise the digitalization of public services in order to realize contemporary productivity gains. Instead of creating supplementary electronic channels, a fundamental transition to fully digital operations is desired. (Dunleavy et al. 2005)

The differences are summarized in the table below.

Dunleavy et al. (2005)	**New Public Management, NPM** (Disaggregation, Competition, Incentivization)	**Digital Era Governance, DEG** (Reintegration, needs-based holism, digitization changes, i.e. organizational and policy changes for citizen-centricity)

Table 5: Differences between NPM and DEG paradigms according to Dunleavy et al. (2005)

3.6 Delivering the digital government

Building on the concept of Digital Era Governance Fishenden and Thompson (2012) state that the service delivery models of the NPM era service delivery model with involving "unchecked development of monolithic, outsourcing style private sector involvement". The authors argue that that in the UK the current model has led to an "aggregation of supply", i.e. few suppliers dominating the market place.

Fishenden & Thompson (2012) argue, that in the future public services will be delivered a) on Internet-enabled digital platforms and b) with open standards and architecture. In addition, the article argues, that this development will over time drive change towards commoditized public services and greater innovation. Standardizing business processes and technology standards will also lead to vendor-agnostic position. This position would be an opposite to the current situation, where "black-boxed" technologies are organized around integrators. (ibid)

The authors call the new service delivery model "Open Architecture". Whereas in NPM the disaggregation happened in structures, Open Architecture aims to disaggregate a "continuous process of innovation" that leverages the commodity services. The differences between the Open Architecture and the NPM era delivery model are described in the table below.

NPM Features	Open Architecture Features
Disaggregation at organizational level	Organizational level disaggregation results from disaggregation at service-delivery level into bespoke and commodity elements
Static, "top-down" replacement of one bespoke organizational structure for another, rewarding complexity	Replacement of static structure with dynamic, "bottom-up" process, rewarding simplification and platform reuse
Standardized technical solutions, suppliers, and commercial arrangements	Plural technical solutions, suppliers, and commercial arrangements
Plural business logic and technical standards	Standardized business logic and technical standards
Proprietary standards and technology platforms	Open standards and technology platform

Table 6: Differences between the NPM and Open architecture models by Fishenden & Thompson (2012)

Ultimately the Open Architecture paradigm suggests a change to the role of the public sector, particularly in terms of innovations, towards an ecosystem like Apple's or Google's. Those ecosystems are characterized by a wide range of content providers and innovators building a multitude of applications that the platform owner

can cherry pick and invest in. (ibid) The differences to the NPM model are summarized in the table below.

Fishenden & Thompson (2012)	**Current NPM model** (standardized technology, suppliers and commercial delivery vehicle)	**Open model, commodity ecosystem** (standardized business logic and technology standards, government as a platform)

Table 7: Summary of the differences between NPM and Open architecture paradigm by

3.7 Synthesis

This chapter has investigated the evolution and characteristics of public sector digitalization. Several concepts and models were identified and analysed. Electronic government, transformational government, digital era governance and open architecture each provide insights into the topic. Further, the work by Fountain (2001) sheds light on the issues that impact the adoption of digital technologies in the public sector.

Several stage models were presented to describe the evolution of electronic government. They seem to develop in multiple dimensions, as their scope and perspective varies. In terms of services, the models suggest evolution through web presence and transactional web services towards a service transformation. On the other hand, integration maturity appears to advance from vertical integration within a function towards horizontal integration between functions. The desired result, enabled by horizontal integration comprises customer-oriented services and a possibility to one-stop shopping of public services.

Transformational government builds on the findings that electronic government, particularly the early stages, has not generated the desired productivity gains. It suggests that radical, ICT-enabled organizational-led transformational change is needed to reach the objectives of electronic government, i.e. citizen centricity and efficiency.

Digital Era Governance, on the other hand, aims to update the public management paradigm in order to better support the digitalized society. It builds on the critique of the New Public Management paradigm, and suggests re-integration, needs-based holism and digitization changes as an anti-thesis. As an organizational paradigm its objective is to innovate governance, not technologies. Fishenden and Thompson (2012) build on the digital era governance, and argue that the traditional contract

model of creating services is out-dated and has led to the undesired effects of vendor lock-in. As an anti-thesis the authors suggest “Open Architecture”, a platform for commodity services with standardized business logic and technology standards.

Technology enactment framework and the related propositions by Fountain (2001) provide insight to the adoption of digitally induced change in the public sector. They support the fact that objective technologies, i.e. the technological part of the digital change, are just one and easily resisted element of public sector digitalization.

The synthesis of this chapter aims to answer the research question on the stages as well as characteristics of public sector digitalization. These characteristics are discussed based on the findings described earlier. First, there seems to be a strong consensus in the literature, that digitalization is an organizational issue. This is highlighted by the e-government stage model particularly in the later, transformation and horizontal integration stages as well as by transformational government, digital era governance and technology enactment framework. The organizational change is further challenged by the constitutional, legal and jurisdictional limits, as summarized by van Scholl & Klischewski (2007). Perhaps as a consequence, studies suggest ICT has been used to propagate and reinforce existing processes, organizations and power distributions, rather than change them (Kraemer and King, 2005; Weerakkody et al. 2011; Fishenden & Thompson 2012). As van Veenstra et al. (2010) put it, “change in public organizations, however, is a complex and unpredictable process.”

As a conclusion, public sector digitalization in this thesis is divided into two parts. “The easy part of digitalization”, reinforcing current processes, organizations and power distributions has been widely implemented, but generally the results have not been desirable. On the other hand, in the “hard part of digitalization” transformational changes need organizational and process reengineering, which has turned out to be very challenging for public sector organizations. However, according to the literature, it seems to be the only way to substantially better productivity and services. This division forms the theoretical foundation for this research.

In addition to the division to “easy” and “hard” part, one can also identify certain dimensions of digitalization. First, digital services can be either copies of their analog counterparts in an electronic format. On the other hand, as suggested by the transformation stage of e-government as well as t-government and digital era governance, transformational services are to be redesigned in order to utilize the nature of digital. Related to the services, another dimension that is often highlighted is organizational orientation. In the early stages of e-government, the transactional services can be produced in the traditional organizational setting based on functional silos and departments. However, in order to enable “one-stop shopping” or truly user-centered public services, customer-driven organizational settings are needed.

Stage of integration seems to develop from vertical integration within a function towards horizontal integration between the functional silos. As Layne and Lee (2001) suggest, “the full potential of information technology, from the citizen’s perspective, can only be achieved by horizontally integrating government services across different functional walls (or “silos”)”. One could argue that horizontal integration and customer-driven organization are the different sides of the same coin, where one implies the other.

As discussed earlier, the nature of change is vastly different in the transformational change; hence the nature of change constitutes one of the dimensions. The last dimension emerges from the work by Fishenden & Thompson (2012) and concerns the contractual model of information systems. As discussed earlier, the traditional models has based on outsourcing to large system integrators, but in many cases led to inability to innovate rapidly. As a solution, the authors suggest an open ecosystem of commodity services. This change of ICT procurement model is thus added as the fifth dimension.

The synthesis based on the literature is visualized below.

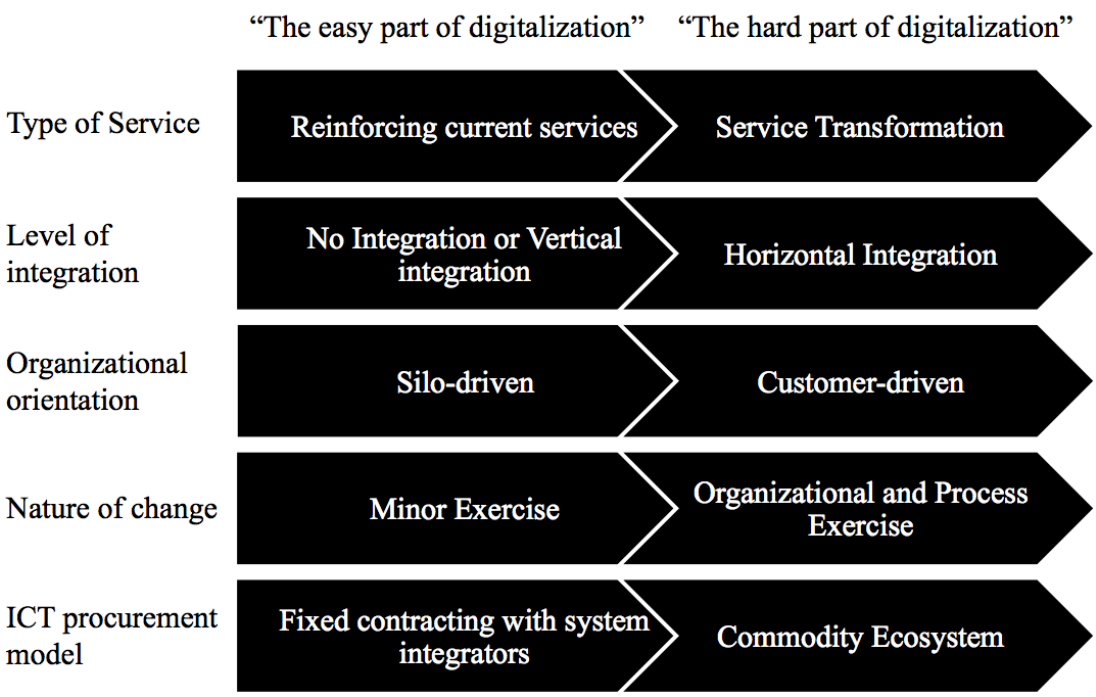


Figure 8: Dimensions and stages of public sector digitalization

4 Enterprise Architecture

This chapter investigates the concept of enterprise architecture. Primarily it aims to answer the research question two: *"What is enterprise architecture?"*

4.1 History

In the late 1980s, the increasing number and complexity of information systems and had made integration and architectural issues more relevant than ever. In the United States this phenomenon worried the National Institute of Standards and Technology, which focused on the "issues related to integration and productivity" in its Workshop 5 in 1988. According to the workshop report, issues such as organizational boundaries, legacies and inertia must be coped by the organization to achieve the desired level of integration. (Fong and Goldfine 1989)

As one solution to the growing integration and information management challenge, the workshop suggested enterprise architecture: a method that would bring together business, information, information system, data and delivery system architecture. This was logical, since "these higher level issues [business and information requirements] impact data and technology architectures and decisions" (ibid, p136).

Similarly, John Zachman argued in 1987, that the increasing complexity of information systems needs an architecture to manage the integration aspects of the system. As a result, he suggested a matrix representation that would comprise different dimensions of the system on different abstraction levels. (Zachman 1987) The framework was, however, designed for information systems architecture. In his (1993) paper Zachman further extends the framework to cover enterprise architecture.

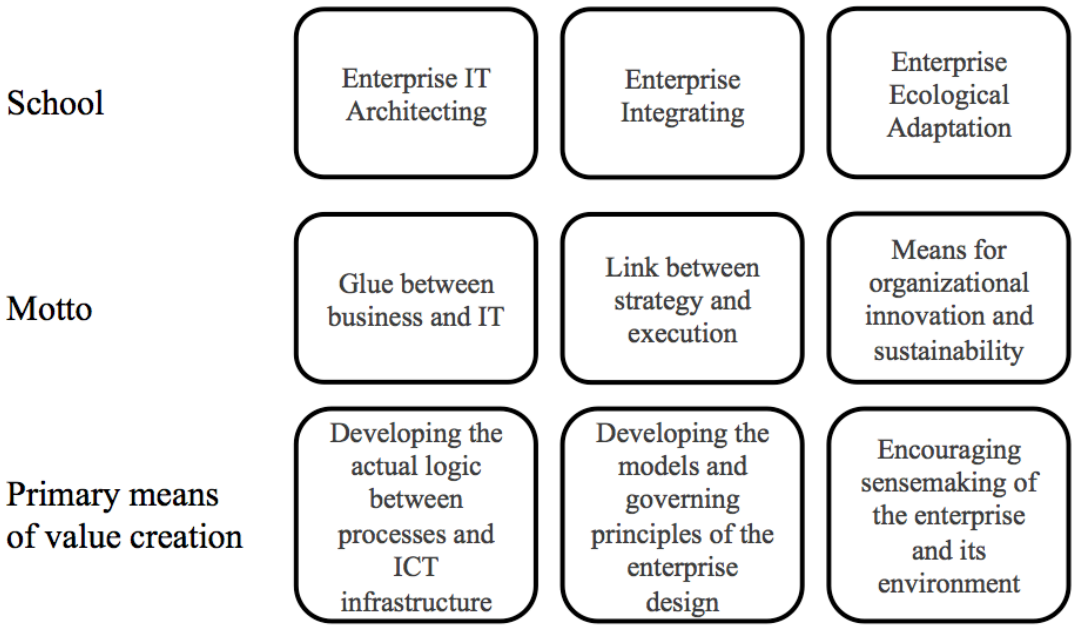
4.2 Definitions

The concept of enterprise architecture still remains without a commonly agreed definition and some practitioners even consider it adolescent (Op 't Land 2008: v). In this research no single definition is adopted, because the complexity of the concept and multitude of definitions are likely to impact the way EA is viewed and implemented. The following table lists various definitions of enterprise architecture based on the systematic literature review.

Gregor et al. (2007)	A descriptive representation of the basic arrangement and connectivity of parts of an enterprise (such as data, information, systems, technologies, designs, business processes)" (adapted from the ISO 15704 standard; International Organization for Standardization, 2000)
Shah & El Kourdi (2007)	An integrated and holistic vision of a system's fundamental organization, embodied in its elements (people, processes, applications, and so on), their relationships to each other and to the environment, and the principles guiding its design and evolution (IEEE Std 1471-2000 IEEE Recommended Practice for Architectural Description of Software-Intensive Systems, IEEE, 2006).
Amit Bhagwat (2009)	The (usually recursive) structural and functional composition of components of a collection of organizations, where the organizations have a common set of (essentially functional) goals
Lankorst (2004)	Coherent whole of principles, methods and models that are used in the design and realisation of an enterprise's organizational structure, business processes, information systems, and infrastructure"
Chief Information Officers (CIO), 2001	"Enterprise Architecture (EA) is a strategic information asset base, which defines the mission, the information necessary to perform the mission and the technologies necessary to perform the mission, and the transitional processes for implementing new technologies in response to the changing mission needs. EA includes a baseline architecture, target architecture and a sequence plan"
Op 't Land (2008)	A coherent set of descriptions, covering a regulations-oriented, design-oriented and patterns-oriented perspective on an enterprise, which provides indicators and controls that enable the informed governance of the enterprise's evolution and success.
Open Group (2014)	The continuous practice of describing the essential elements of a sociotechnical organization, their relationships to each other and to the environment, in order to understand complexity and manage change
Dahalin et al. (2010)	Enterprise Architecture is a blueprint for how an organization achieves the current and future business objectives using IT.
	A complete model of the enterprise; a master plan which acts as an integrating force between aspects of business planning such as goals, visions, strategies and governance principles; aspects of business operations such as business terms, organization structures, processes and data; aspects of automation such as application systems and databases; and the enabling technological infrastructure of the business such as computers, operating systems and networks.
Kappelman & Zachman (2013)	Enterprise Architecture (EA) is a set of concepts and practices based on holistic systems thinking, principles of shared language, and the long-standing disciplines of engineering and architecture.
Ross, Weill & Robertson (2006)	The organizing logic for business processes and IT infrastructure reflecting the integration and standardization requirements of the company's operating model.
Bernard (2012)	The analysis and documentation of an enterprise in its current and future states from an integrated strategy, business and technology perspective.
Gartner IT Glossary	A discipline for proactively and holistically leading enterprise responses to disruptive forces by identifying and analyzing the execution of change toward desired business vision and outcomes. EA delivers value by presenting business and IT leaders with signature-ready recommendations for adjusting policies and projects to achieve target business outcomes that capitalize on relevant business disruptions. EA is used to steer decision making toward the evolution of the future state architecture.
Hoogervorst (2004)	A coherent and consistent set of principles and standards that guides enterprise design.
Finnish Law 10.6.2011/634§3	The description of the structure and inter-relationships of public sector organizations, services, business processes, information and data, information systems and technology.

Doucet et al. (2008) identify three modes of enterprise architecture: *foundation architecture, extended architecture and embedded architecture*. Foundation architecture is driven by the IT organization, and its mission is to align IT and business. Extended architecture, rooted in enterprise engineering moves the focus to business transformation and business agility that are enabled by, for example, shared business platforms, strategic alignment and organizational improvements. In extended architecture EA is an organic part of the enterprise design and management diffused and aligned with the organization.

In rather similar manner La Palme (2012) categorizes enterprise architecture in three schools, "each with its own belief system". *Enterprise IT architecting* considers EA as the glue between business and IT. Definition by Ross et al. (2006) where EA is the organizing logic between ICT infrastructure and business processes would fit in this school. *Enterprise Integrating* school on the other hand sees enterprise architecture as the link between strategy and executing, widening the scope from enabling business to implementing strategy and providing organizational coherence. Definition by e.g. Op 't Land (2008) would fit in this school as it considers EA as the method to govern enterprise's evolution as a whole. In *Enterprise Ecological Adaptation* school EA is considered as "the means for organizational innovation and sustainability". This view is the most holistic out of the three, and encourages system-in-environment coevolution. The ecosystem thinking is highlighted by Laverdure and Conn (2012) in their Sustainable Enterprise Architecture (SEA). Based on systems-thinking, SEA "emphasizes the long-term perspective, focusing on how the enterprise can identify and respond effectively to a range of strategic disruptions".



4.3 Enterprise IT Architecting

As on example of the Enterprise IT Architecting school, the work by Ross et al. (2006) is investigated. Their research is based on over 400 companies from 1995 to 2005. In addition to enterprise architecture, the book presents three related concepts, namely "foundation for execution", operating model and IT engagement model. (Hence the name "foundation architecture" in Doucet's (2008) analysis.) As mentioned earlier, the authors define enterprise architecture as the "organizing logic for business processes and IT infrastructure reflecting the integration and standardization requirements of the company's operating model".

4.3.1 Operating model

As described in the definition earlier, operating model is a closely related concept to enterprise architecture. Ross et al. (2006) define operating model as *"the necessary level of business process integration and standardization for delivering goods and services to customers"*. The authors argue, that aligning ICT investments and business process capabilities directly with the business strategy of an organization can be challenging since it is often multifaceted and shifting. Consequently, the operating model is needed to provide a more stable and actionable view to the business strategy. The authors stress that the choice for the operating model should be the first step in building the foundation, since it drives the design of it. (ibid)

The operating model consists of two dimensions: *standardization* and *integration*. Standardization refers to the extent of reduction in variability in business processes to increase predictability and efficiency – "regardless of who is performing the process or where it is completed". Integration, on the other hand, refers to the extent how data is shared across processes and organizations to improve customer experience, coordination and agility – to name a few. Together the dimensions form a four-cell matrix depicted below.

Business process integration		
High	**Coordination** • Shared customers, products or suppliers • Impact on other business unit transactions • Operationally unique business units or functions • Autonomous business management • Business unit control over business process design • Shared customer / supplier / product data • Consensus processes for designing IT infrastructure services; IT application decisions made in business units	**Unification** • Customers and suppliers may be local or global • Globally integrated business processes often with support of enterprise systems • Business units with similar or overlapping operations • Centralized management often applying functional / process / business unit matrices • High-level process owners design standardized processes • Centrally mandated databases • IT decisions made centrally
Low	**Diversification** • Few, if any, share customers or suppliers • Independent transactions • Operationally unique business units • Autonomous business management • Business unit control over business process design • Few data standards across business units • Most IT decisions made within business units	**Replication** • Few, if any shared customers • Independent transactions aggregated at a high level • Operationally similar business units • Autonomous business unit leaders with limited discretion over processes • Centralized (or federal) control over business process design • Standardized data definitions but data locally owned with some aggregation at corporate • Centrally mandated IT services
	Low **Business process standardization** High	

Table 8: The four operating models by Ross et al. (2006)

Ross et al. (2006) suggest that debate on the operating model by senior managers helps clarify the vision for how the company will operate and differentiate. This vision is an important building block for the foundation for execution (ibid).

4.3.2 Enterprise architecture

According to Ross et al. (2006) enterprise architecture builds on the choice of operating model, since it should reflect the integration and standardization requirements of the operating model. Enterprise architecture should give a long-term view to business processes, technologies and application. However, the authors

criticize massive analytical efforts with lots of drawings. The key element of enterprise architecture could be, for example, organization's shared technology environment, standardized processes with shared data. (ibid)

When it comes to describing the enterprise architecture, the authors suggest a *core diagram* consisting of

1. Core business processes
2. Shared data driving core processes
3. Key linking and automation technologies
4. Key customers

Below is an example of a core diagram template, describing the enterprise architecture of a company with the coordination operating model. (ibid)

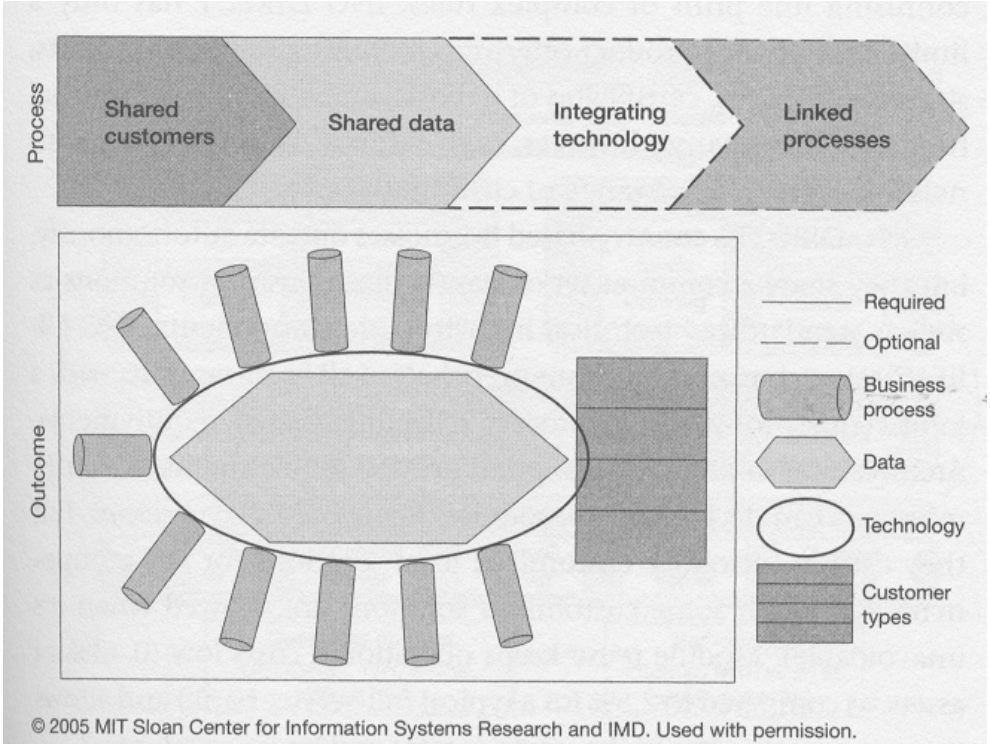


Figure 9: Core diagram of a company with a coordination operating model (Ross et al. 2006)

Ross et al. (2006) also suggest the concept of enterprise architecture maturity, through which companies move when building their foundation for execution. Moving through the stages is challenging and requires organizational learning, but rewards in terms of reduced IT operating costs and greater strategic agility. The stages are

1. Business silos architecture
2. Standardized technology architecture
3. Optimized Core architecture
4. Business modularity architecture
5. (Dynamic venturing architecture)

The first stage, business silos architecture is built around the needs and optimization of individual functional units. It does not constrain activities or investments performed by individual business unit, which often makes it likable by functional managers. Even though it may provide efficient one-off solutions for specific needs of the different business units, after time a legacy of incompatible and non-standard systems get increasingly complex. Over one third of IT investments are on local applications. (ibid)

In the second stage, standardized technology, emphasis is moved from local applications to shared infrastructure. IT begins to shape (and constrain) business solutions, which, however, rewards in risk and cost management. Also the number of applications starts to decrease due to consolidation initiatives. Instead of individual technologies for business solutions, organizations begin to look for technology platforms that solutions need to commit to. Also, a corporate CIO role is often present at this stage, driving the standardization and consolidation efforts. (ibid)

In the optimized core stage IT builds reusable data and business process platforms, that enable an enterprise view of data and applications. Although optimized and digitized business processes can be harder to change fundamentally, they help build products and services on the core easier and faster. (ibid)

In the business modularity stage customized and reusable modules enable strategic agility as they extend the optimized core in a “plug-and-play” manner. Modularity supports local experiments that can be then spread over the company. This “platform for innovation” creates responsiveness without sacrificing the standardized core. (ibid)

The below table summarizes the characteristics of each enterprise architecture maturity stage.

	Business Silos	Standardized Technology	Optimized Core	Business Modularity
IT capability	Local IT applications	Shared technical platforms	Companywide standardized processes or data	Plug-and-play business process modules
Business objectives	ROI of local business initiatives	Reduced IT costs	Cost and quality of business operations	Speed to market; strategic agility
Funding priorities	Individual applications	Shared infrastructure services	Enterprise applications	Reusable business process components
Key management capability	Technology-enabled change management	Design and update of standards; funding shared services	Core enterprise process definition and measurement	Management of reusable business proceses
Who defines applications	Local business leaders	IT and business unit leaders	Senior management and process leaders	IT, business and industry leaders
Key IT governance issues	Measuring and communicating value	Establishing local / regional / global responsibilities	Aligning project priorities with architecture objectives	Defining, sourcing, and funding business modules
Strategic implications	Local / functional optimization	IT efficiency	Business operational efficiency	Strategic agility

Table 9: Learning requirement of the EA maturity stages by Ross et al. (2006) (Adapted from Ross 2003)

4.3.3 IT engagement model

Ross et al. (2006) argue that in order to build the foundation for execution and move through the enterprise architecture maturity stages, organizations should utilize a governance mechanism. In the top performing firms this mechanism, IT engagement model introduced by Robertson and Fonstad (2006) has the following features.

1. *Companywide IT governance* including decision rights and accountability framework
2. *Project management* including formalized project methodology
3. *Linking mechanisms* that link project-level with the companywide IT governance

4.3.4 Foundation for execution

Just as one can drive with a bicycle without thinking about it, Ross et al. (2006) argue that a foundation for execution will help company to automate routine tasks free management attention to relevant issues. The authors define the foundation for execution as the "*IT infrastructure and digitized business processes automating a company's core capabilities*".

This foundation for execution is formed by the previously described concepts: operating model, enterprise architecture and IT engagement model.

4.4 Enterprise Integrating

The Enterprise Integrating school is investigated primarily through the work by Op ‘t Land et al. (2008). As La Palme (2012) states, in this school enterprise architecture is about executing the strategy while ensuring the coherency of the enterprise, include IT as one element. Doucet et al. (2008) calls this school “extended architecture”, since it extends enterprise architecture to cover all dimensions of an organization.

4.4.1 Positioning enterprise architecture

Op ’t Land et al. (2008) argue that there is a methodological gap in strategy execution, between strategy and programme management. Particularly, they argue that there is a need to make strategy more unambiguous, specific and actionable.

On the other, the authors suggest that enterprise architecture is “an integral part of the governance of an enterprise and its transformation”. Consisting of the target system, governing system and the environment, the governance paradigm describes the realization of a process in terms of interaction with the environment as well as its “internal authority”, i.e. the governing system. Op ‘t Land et al. (2008) apply the governance paradigm to enterprise transformation, which is visualized below.

According to authors, enterprise architecture, along with strategy and programme management should be positioned as a part of the governing system for enterprise transformation.

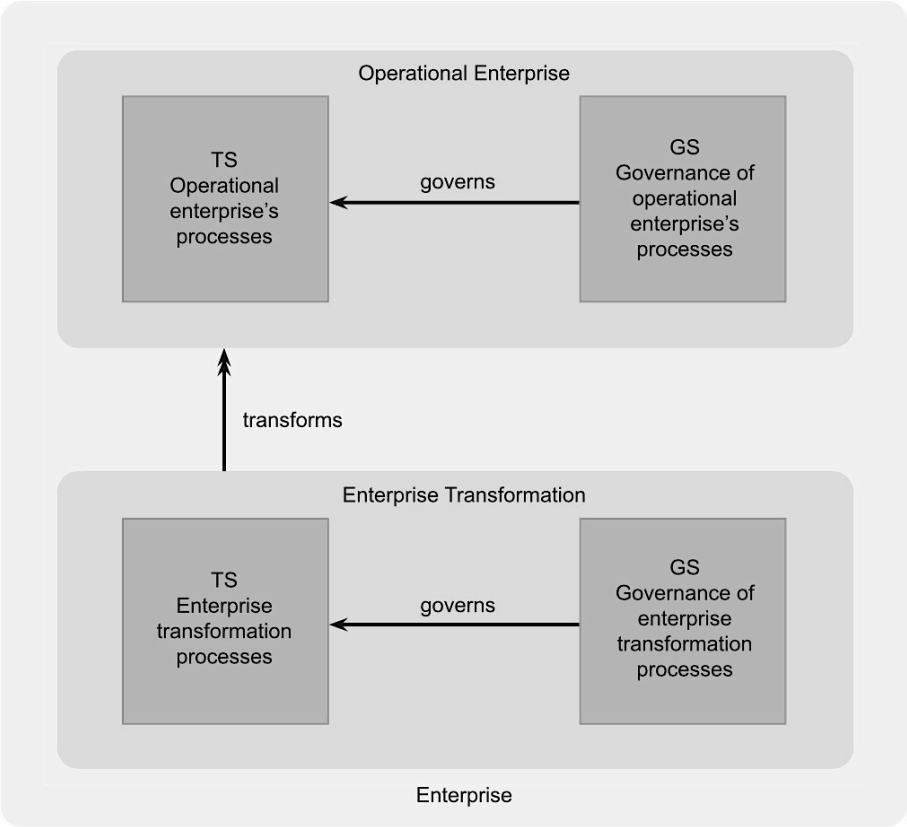


Figure 10: Governance paradigm in enterprise transformation by Op 't Land et al. (2008)

In order to be able to govern enterprise transformation, Op 't Land et al. (2008) suggest a dashboard metaphor for enterprise architecture. The dashboard should be able to provide insights to the enterprise's current and future state, current and expected performance as well the direction and progress of its transformation process. Also, enterprise architecture should provide the controls in order to influence the transformation process.

The authors also list seven applications of enterprise architecture, which should help position EA in the context of other organizational activities.

- *Situation description* of the existing situation
- *Strategic direction* to express and motivate the future direction
- *Gap analysis* between the current situation and desired future direction
- *Tactical planning* for the intermediary steps of the transformation
- *Operational planning* to give context and direction for project portfolio
- *Selection of partial solutions* to guide decision-making on crafting business processes and services

- *Solution architecture* to provide a design of the actual steps of enterprise transformation

4.4.2 Defining enterprise architecture

Op' Land et al. (2008) argue that enterprise architecture consists of regulation-oriented, design-oriented and patterns-oriented perspectives. Regulation-oriented perspective covers the principles, rules, guidelines and standards that govern the design of an enterprise towards to the desired direction. The design-oriented perspective, on the other hand, focuses on the specification and modelling of an enterprise – "in all its facets". Finally, the patterns-oriented perspective comprises the use of the design patterns that meet the requirements of the regulative perspective. Consequently, the authors provide the following definition for enterprise architecture.

"A coherent set of descriptions, covering a regulations-oriented, design-oriented and patterns-oriented perspective on an enterprise, which provides indicators and controls that enable the informed governance of the enterprise's evolution and success."

Also, the authors describe enterprise architecture as an active planning and steering instrument to translate strategy into projects and programs. In order to do so, enterprise architecture comprises principles, models, views and frameworks.

4.5 Enterprise Ecological Adaptation

Enterprise ecological adaptation school by La Palme (2012) further extends the concept of enterprise architecture. The scope of EA is broadened 1) from the organization itself to the ecosystem and 2) from strategy execution to strategy design. Consequently, instead of a tool for business-ICT alignment or strategy execution, enterprise architecture is considered as "a means for organizational innovation and sustainability". The enterprise ecological adaptation school is investigated through the work by Hoogervorst (2009), Laverdure and Conn (2012), Graves (2008), Proper (2014), La Palme and de Guerre (2013) and La Palme (2012). Although the article by Laverdure and Conn (2012) focuses on unexpected disruptions in the environment, it is still considered a relevant example of the enterprise ecological adaptation school. It should be noted, that in case of this school, the analysis of Doucet et al. (2008)

differs from the one by La Palme (2012). Doucet suggests that the third mode of EA would be embedded architecture, i.e. enterprise architecture that is embedded "ubiquitously" in the organization.

4.5.1 Positioning enterprise architecture

Proper (2014) argues that several social, economical and technological challenges force organizations to a continuous change, including enterprise transformations, migrations, mergers and acquisitions. However, the change happens not only due to planned change efforts but also because of emergent and unplanned activities by the employees. Proper calls this changing organization "enterprise in motion", and divides enterprise into two aspects. Running aspect concerns the operational activities whereas motion aspect covers the changing part. Proper further divides both aspects into *steering* and *producing* systems, based on the control paradigm.

Proper (2014) argues by citing Op 't Land (2008) and Dietz (2008) that architecture is a bridge between strategy and design, and that consequently architectural steering is positioned between steering of strategy and design. Steering at strategic level concerns the definition and evolution of the organization's strategy. On architectural level steering takes constraints and requirements from the strategic level. Thirdly, architectural level limits the design level (e.g. designing business processes). Proper (2014) argues, however, that the lines between the different levels cannot be drawn since they shift over time.

As described in the picture below, Proper (2014) sets the sense-think-act paradigm inside the steering aspect of the organization. Sensing refers to receiving signals both from the environment and the target system, i.e. the organization itself. Thinking part comprises a SWOT analysis of those signals in relation to coordinative goals as well as formulating an intervention plan. Finally, acting means performing the intervention plan can influence the organization itself but also, as La Palme (2012) found, the environment. The sense-think-act paradigm is depicted within the control paradigm in the picture below.

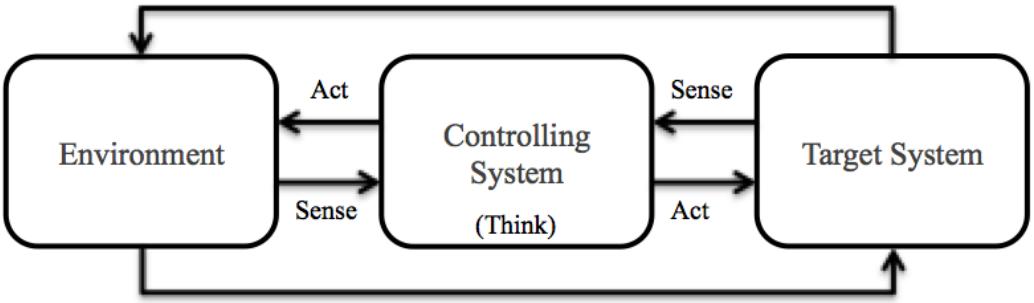


Figure 11: Sensing, acting and thinking in the control paradigm by Proper (2014)

The sense-think-act paradigm in the context of Proper's (2014) enterprise in motion –framework is depicted below. Although positioned in the steering system of the motioning system, Proper argues that the very paradigm actually exists in all the quadrants in some form. Essentially though, the producing system seems to correspond the target system whereas the steering system is similar to the controlling system.

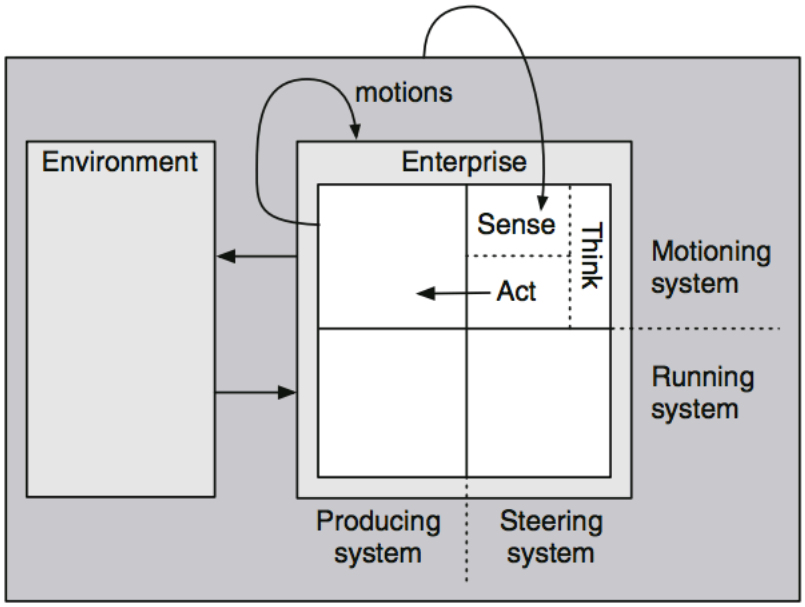


Figure 12: Structure of the enterprise in motion by Proper (2014)

Proper (2014) argues, that enterprise architecture is primarily about essential sense-making, i.e. it should make sense of past and future motion of the enterprise in regards of the strategy. Further, it should formulate, rationalize and motivate the desired future motion as well as the interventions to achieve it.

In Hoogervorst (2009) enterprise architecture is investigated in the context of enterprise governance and enterprise engineering. Hoogervorst suggests that organizations should bee viewed as "organized complexities". The organized nature implies *order*, which then manifests in *design*. Enterprise governance is the method for creating and sustaining the order, whereas enterprise engineering supports the enterprise design. (ibid) Enterprise engineering, on the other hand, consists of *enterprise ontology* and enterprise architecture. Enterprise architecture then provides the *"normative guidance for design, in order for the enterprise to operate as a unified and integrated whole, whereby various enterprise objectives must be satisfied"*. In relation to strategy, the author suggests that enterprise architecture converts strategic objectives into coherent and consistent design principles and standards. This ensures a "unified and integrated design" that allows strategic objectives to be operationalized.

La Palme and de Guerre (2013) present a complexity management and enterprise sustainability oriented view on EA, based on open socio-technical systems design, called "Enterprise-in-Environment Adaptation". They argue that enterprise architecture should comprise both the social system including e.g. people, culture, norms and the technical system including technology, tools and materials. Also, the boundary of EA should be broadened to cover not only the organization but also its partners and other stakeholders. The characteristics of EA would include adjectives such as facilitating, participative, democratic, holistic, learning and shared. Compared to traditional types of enterprise architecture, EA should be participative instead of top-down, contextualist instead of mechanistic, and holistic instead of piece-meal. (ibid)

La Palme and de Guerre (2013) argue, that the outcome of enterprise architecture should not be a set of artefacts or a new system, "but rather a system that is capable of learning, which is the basis for continuous active adaptation". They criticize the tool and artefact centricity of traditional EA approaches stating that they hinder conversation and consequently EA. The authors argue, however, that "Enterprise-in-Environment Adaptation" requires cultural transformation that many organizations are not willing to get into.

4.5.2 Definitions

Graves (2008) argues that even though often considered as an IT matter, enterprise architecture "isn't much about IT". The author continues stating, that the business architecture is the core of enterprise architecture. Enterprise architecture is defined as *"the integration of everything the enterprise is and does"*. Hoogervorst (2009), on the other hand, defines enterprise architecture as *"a coherent and consistent set of principles and standards that guides enterprise design"*. Conn and Laverdure (2012) move the focus more to the environment. They argue that enterprise architecture should focus less on technology but on the ways technology helps businesses survive in the uncertain and changing business context. As a consequence, the mission of EA is to help organization identify and respond to strategic disruptions ranging from societal and economic and environmental. They explicitly call EA with this focus "Sustainable Enterprise Architecture" (SEA).

4.6 Value creation

Tamm et al. (2011) examine the value created by enterprise architecture to the organization. They divide EA into "definition", which is the enterprise architecture planning process, and "representation", which consists of the EA artifacts such as descriptions and documentation. In addition, the article identifies the concept of "EA guided operating platform" by Ross et al. (2006), which is given the term "realization" in this research. Tamm et al. (2011) states that value can be created by the EA directly, i.e. the definition and representation, or indirectly through the EA guided operating platform.

Ross et al. (2006) suggest that EA is the organizing logic between business processes and ICT infrastructure, meaning the actual, realized dynamics between business and ICT. As for describing the architecture, they recommend a one-page core diagram of the core business processes, shared data, key technologies and key customers (p50-51). Navigating the "architecture maturity" stages from business silos to business modularity increases strategic agility and lowers IT operating costs (p71). As described earlier, enterprise architecture is a part of the foundation for execution, i.e. the EA guided operating platform. Value creation from EA is thus indirect.

On the other hand, many authors seem to consider EA as the governing or describing mechanism for the realized and desired enterprise. (e.g. Op' t Land et al. 2009,

Bernard 2005) This mechanism is supposed to create strategic agility too, but primarily through descriptions, principles and plans instead of the "realized architecture". (Tamm et al. 2011) In this case value is created through the representation, i.e. the artifacts of EA. The authors remind, however, that as Boh & Yellin (2006) and Segars and Grover (1996) argue, the EA artifacts do not automatically lead to their implementation. The division to governing and describing EA is supported by Hoogervorst (2004). It divides enterprise architecture into descriptive and prescriptive (or normative) definitions. Prescriptive definitions define how artifacts should be realized. Descriptive concept "factually describes characteristics of existing artifacts".

Thirdly, according to Tamm et al. (2011) value can be created through the EA planning process itself. The authors cite Segars and Grover (1996) on the finding that EA can have a positive effect on overall organizational alignment in addition to business and IT alignment. Segars and Grover (1996) argue that this happens due to the dialogue and facilitation as well the identification of interdependencies between the different parts of the organization. This view is emphasized in the work by La Palme and de Guerra (2013).

4.7 Analysis

This chapter analyzes the characteristics of and differences between the enterprise architecture schools presented earlier.

4.7.1 Scope and content of EA

Based on the literature one could argue that the concept enterprise architecture has at least three scopes or "schools": Enterprise IT architecting, Enterprise Integration and Enterprise Ecological Adaptation (La Palme 2012. In this chapter the each school was analyzed based the selected works. However, as argued by Tamm et al. (2011), in addition to the schools there are also three areas or "abstraction levels" of EA, namely EA planning, EA artifacts and the EA guided operating platform, that create value by different means. In this analysis the schools are further compared as well as analyzed in the context of the abstraction levels suggested by Tamm et al. (2011)

Despite the different views, the starting point and fundamental objectives for enterprise architecture is surprisingly similar in all three schools: changes in

industries, including increasing competition and compliance requirements, as well as growing technical and organizational complexity demand coherence, responsiveness and strategic agility. (e.g. Ross et al. 2006; Op ‘t Land et al. 2008; Proper 2014) However, the challenge is approached from rather different directions.

The work by Ross et al. (2006) suggests, that in order to respond to the challenge, a foundation for execution, i.e. the EA guided operating platform is needed. Automated and digitized core processes provide robustness and predictability, thus letting resources focus on innovation and development tasks. The authors warn about massive documentation efforts, but stress the importance of co-operation between IT and business management in devising the core diagram, which is then approached project by project, supported by the IT engagement model. Value is thus created primarily by the EA guided operating platform, and secondarily by EA artefacts and EA planning.

Op ‘t Land et al. (2008) suggests that enterprise architecture provides descriptions, design- as well as regulation- and patterns-oriented ones, about the enterprise. As the result, management is provided with models, views and guidelines. As intermediate results, principles guiding the design decisions and solution alternatives are created. As intangible results, communication takes place between stakeholders. Also, the views addressing stakeholders’ concerns are to be increase their commitment for the change intentions. (ibid) Compared to the enterprise IT architecting school, a vast majority of the focus is on documents, both models and principles. This is emphasized by the definition of EA being a “set of descriptions”. Value is thus created primarily by the EA artefacts (representation), secondarily through the EA planning and EA guided operating platform (definition and realization).

La Palme (2012) argues that in the enterprise ecological adaptation school the role of EA is “nurturing” organizational learning and sense-making, seems to suit this category well too. La Palme and de Guerra (2013) represent the enterprise ecological adaptation school by presenting the “Enterprise-in-Environment Adaptation” paradigm. They emphasize facilitation and group-dynamics perspective and the social aspect of enterprise architecture. They also argue, that value of EA is created largely by the “conversation and teamwork” as well as the desired outcome of EA, a “learning system”. This “learning system” seems to have similarities with the EA

guided operating platform concept. Even though EA guided operating platform is a primarily a technical system and the learning system has strong social dimension, both outcomes could be categorized to the "realization" abstraction of EA, on the contrary to representation and definition. Value is thus created primarily by the EA planning and the "learning system", i.e. definition and realization.

One should note that by analyzing the references, particularly Hoogervorst (2009) and Graves (2008), it seems that the enterprise ecological adaptation school has major differences in the focus of EA. Particularly Hoogervorst (2009) appears to be close to the enterprise integrating approach. Concepts such as innovation or system-in-environment adaptation are not found in his terminology. On the other hand the present work by Proper (2014) was included in the enterprise ecological adaptation school due to the emphasis on interaction with the environment and sense-making. It should be noted, however, that by his previous works his emphasis seems to be closer to the enterprise integrating school. Consequently, in this research the EEA school is primarily characterized by the works by La Palme and de Guerra (2013) and Proper (2014).

4.7.2 Levels of normativity

It seems that, according to the various authors referred in this chapter, there are different levels of normativity (level of prescription compared to description) in the enterprise architecture schools. As mentioned by Hoogervorst (2004), architecture can be generally divided into prescriptive and descriptive. Descriptive EA consists of of descriptions whereas prescriptive EA appears to consist of principles and guidelines that guide design and limit design freedom. (ibid) Hoogervorst (2010) defines these principles as "*predefined design action orientation pertinent to one or more design domains"*. Also, he argues that architecture "expresses *ex ante* how systems must become", not "*ex post* how systems are".

On the other hand, the concept of EA by Ross et al. (2006) is based on the idea that there is a commonly target architecture that is in line with the operating model debated with the senior management. From this perspective, enterprise architecture expresses "ex ante how systems are", following the notation by Hoogervorst (2010). The different levels of normativity are listed in the table below. Considering the

context, the term system here means any organizational system, not just technical one.

Descriptive	"ex post how systems are"
Prescriptive (or normative)	"ex ante how systems must become"
Common target (Ross et al. 2006)	"ex ante how systems are"

Table 10: Levels of normativity

4.8 Discussion

The theoretical part of Enterprise architecture is discussed from two perspectives. First, the different dimensions of EA are presented earlier are discussed. Secondly, the notions of "normative" or "prescriptive" are reflected.

4.8.1 Dimensions of EA

When analysing the three schools of enterprise architecture presented by La Palme (2012), it appears that not only the scope of school varies, but also the focus and value creation logic. In this research the framework provided by La Palme (2012) is consequently extended by the abstraction levels of EA noted by Tamm et al. (2011). As a result, a framework depicted by a 3 x 3 matrix of the EA dimensions emerges. The different schools, based on the selected works presented in this chapter are positioned in the matrix.

Based on particularly the work by La Palme and de Guerra (2013), it could be argued that the concept of EA guided operating platform, "realization" should be extended to cover elements outside the concept of "foundation for execution", as the scope of EA broadens. La Palme and de Guerra (2013) define the outcome of EA as an organizational system capable of learning. This would be rather natural extension to the EA guided operating platform since it spans from IT implementation towards enterprise sustainability and organizational learning.

As a result, the framework should comprise three columns, the schools introduced by La Palme (2012). The three rows, adapted from Tamm et al. (2011) are thus definition, representation and realization. In addition to Tamm et al. (2011) the realization in EI and EEA schools covers the EA guided operating platform as well

as any “EA guided” technical or socio-technical system, of which scope depends on the scope of EA.

4.8.2 Normativity of EA

It appears that both Enterprise Integration and Enterprise Ecological Adaptation schools represent the descriptive and prescriptive views to enterprise architecture. Despite the differences in scope and focus, they resemble each other by the idea of “informed decisions”. On the other hand Enterprise IT Architecting school adopts the Common target ideology, which differs fundamentally from the two other schools. Instead of making informed decisions with the help of enterprise architecture, enterprise architecture is the commonly decided organizing logic between ICT and business.

One could argue that, despite the sounding rather theoretical, these levels of normativity have a significant impact on implementing enterprise architecture in the organization. It is likely that descriptive EA does not require broad organizational commitment, since it only describes how things are now, i.e. ex post. Prescriptive EA, on the other hand, is likely to require certain level of commitment to principles and guidelines in order to reach a coherent enterprise. The focus of normativity lies, however, in the way “how systems must become”. Finally, the work by Ross et al. (2006) emphasizes the common goal depicted in a core diagram, i.e. expressing “ex ante how systems are”. In their work majority of the “how systems must become” is included in the IT engagement model rather than in the scope of enterprise architecture.

4.8.3 Synthesis

The positions of the different schools in relation to the abstraction levels presented by Tamm et al. (2011) were mostly presented in the previous chapter. As a summary, based on the select works in the schools, Enterprise IT architecting emphasizes the EA guided operating platform, i.e. realization. Enterprise integration, on the other hand, is largely concerned about the artefacts of EA, i.e. the representation. In Enterprise ecological adaptation school the focus varies based on the author, but one can argue that there is a shift from the artefact focus to 1) EA planning processes and 2) realization in the form of an “organizational system that is capable of learning”.

This synthesis is depicted in the table below. The darker background colour implies emphasis in the corresponding school of EA.

	Enterprise IT Architecting	**Enterprise Integration**	**Enterprise Ecological Adaptation**
Definition (planning process)	Senior management debating the operating model, Design or facilitation of the core diagram by IT management (Ross et al. 2006)	Communications between the stakeholders, (Op 't Land et al. 2008)	Facilitation, nurturing the EA design process, conversations and teamwork (La Palme and de Guerra 2013), sense-making (Proper (2014)
Representation (descriptive, prescriptive and common target artefacts)	One-page Core diagram (Ross et al. 2006) Common target.	Regulation-, design- and patterns oriented descriptions of the enterprise including models, principles and views (Op 't Land et al. 2008) Descriptive and prescriptive.	Models as inputs to sense-making (Proper 2014), Tools to guide analysis and decision-making (La Palme and de Guerra 2013) Descriptive and prescriptive.
Realization	Foundation for execution (Ross et al. 2006)	Implementation of the descriptions (Op 't Land et al. 2008)	An organizational system that is capable of learning (La Palme and de Guerra 2013)

Table 11: Schools and abstraction levels of EA

It should be noted that, first, the matrix only proposes priority differences of the different school. Naturally all of the abstraction levels happen in all of the schools. Secondly, as La Palme (2012) reminds, the schools of EA are to large extent generalizations of the enterprise architecture discipline. Keeping those constraints in mind, the matrix, however, emphasizes the fragmented scope and nature of enterprise architecture. It also explains the difficulties in defining EA, and is likely to explain the difficulties in communicating EA in organizations.

5 Data collection and analysis

This chapter first describes the setting of the empirical part of this research. First the context for the research, i.e. the case organization is presented. Then data collection of the empirical data is described. Finally, the data analysis described.

5.1 Introduction to the case organization

The research is conducted for one of the largest cities in Finland with a population of more than 250,000. As the majority of Finnish municipalities, the case organization is willing to find ways to increase efficiency and service quality throughout the organization. Since digitalization can provide the possibility to both modernize existing processes and innovate radically new ones, it is considered as a promising source of sustainable development in productivity and service quality.

The case organization consists of four functional sectors as well as the coordinating structures. Following the Finnish local government model, the city is ruled by the city council and city board, as well as committees and boards. The four functional sectors are Education and Cultural Services, Social and Health Services, Environment and Technical Services and Public Utilities Sector. The city is led by the Mayor with the Mayor's office that is part of the Corporate Group Administration. The organization is depicted below.

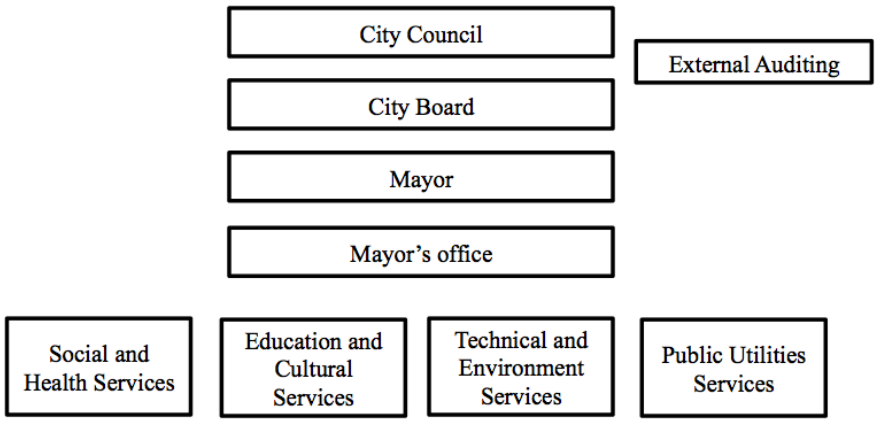


Table 12: The case organization

5.1.1 ICT in the case organization

The ICT function of the case organization was reorganized during the writing on this thesis. Since the interviews were conducted during the old organization structure,

that will be used as the context for this research. The old ICT organization followed a hybrid centralized-decentralized paradigm, where each sector had its own ICT department. These departments were – to some extent – coordinated by the central ICT organization in the Mayor's office. In addition, ICT service production was consolidated to a separate "ICT services" organization in the "service" function of the city. The old organization is visualized in the diagram below.

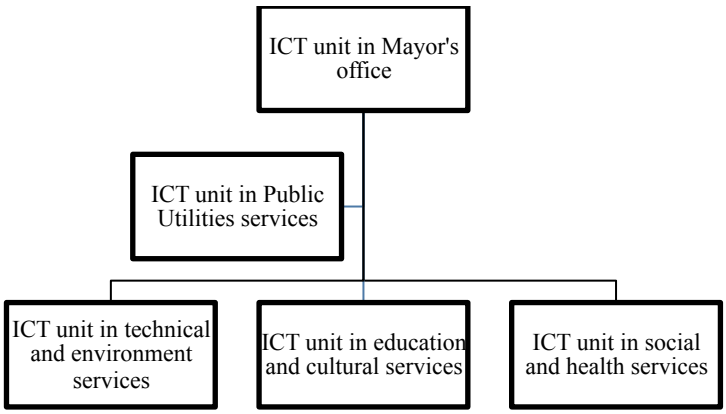


Figure 13: ICT organization in case organization

5.1.2 Enterprise architecture in case organization

The case organization has defined EA as "a tool that helps manage the combination of services and processes, and technology". It is reflected in two ways. First, the EA principles steer the development of operations and services, and particularly the development and maintenance of related information systems. There are 25 principles in seven categories: general, operations-related, information-related, information system –related, technology-related, procurement-related and security-related. The principles are guided by the strategy of the case organization.

Secondly, there are dedicated architects in the areas of technology, information, information systems as well as business architecture. These architects, along with representatives from the decentralized ICT organizations form the core of the "enterprise architecture working group" that meets every other week. According to the EA principles development and acquisition of major information system should be overseen by the group. ICT development director leads group as well as enterprise architecture work generally. Officially, the enterprise architecture of the city of the case organization is owned by the Mayor.

The following diagram describes the concept of enterprise architecture in the case organization. It is based on the Finnish public administration principles, but refined locally. Enterprise architecture is divided in four domains: business, information, information system and technology that are guided by the strategy of the city.

Strategy	• Strategic goals • The "strategy story" of the case organization • EA principles
Operations	• Customers • Services • Processes
Information	• Information needs of processes and their management • Information flows between processes
Information system	• Applications creating information • Cross-application integrations
Technology	• Physical technology infrastructure and standards, on which the applications as well as the integrations between them are built on

Table 13: Enterprise architecture domains in the case organization

5.2 Introduction to enterprise architecture in the Finnish public sector

Both central and local government information management is currently steered by the Ministry of Finance and the Act on Information Management Governance in the Public Administration (634/2011) (VM2015). The act aims to improve the efficiency of public administration as well as improve public services and the accessibility of them. This is to be realized by ensuring and improving the interoperability of information systems and by guiding the steering of information management. (Finlex2015). In addition, so called a public administration recommendation (JHS) 179 defines a method for both enterprise architecture planning and modelling.

The definition of enterprise architecture appears to vary in the Finnish public sector, as it does in the broader scope. In the aforementioned act EA is defined as

"The description of the structure and inter-relationships of public sector organizations, services, business processes, information and data, information systems and technology."

Rather than whole organization, the act focuses on interoperability of information systems. Also, it is rather description-intensive by nature and scoped as "ICT enterprise architecture".

On the other hand, on the current website of the Ministry of Finance enterprise architecture is defined as *"the whole that consists of activities, processes, services, information and data, information systems as well as the functions produced by them"*. Further, it is described as the *"holistic approach to govern and develop the activities and structure of organizations and information systems"*. *(*VM2015) Here, the focus is moved away form descriptions and information systems towards developing the organization as a whole.

5.3 Research methodology

The author takes an interpretivist position in the research. According to Saunders et al. (2010: 593) it is "the epistemological position that advocates the necessity to understand differences between humans in their role as social actors". Even though digitalization and enterprise architecture are both complex and human phenomena, an objectivist stance would lack credibility.

This research is conducted using an abductive approach to the research topic. Stanford Encyclopedia of Philosophy describes abduction as an "Inference to the Best Explanation", which means that multiple possible hypothesis are created (SEP1). In abductive reasoning the theoretical and empirical understanding are iteratively combined and compared along the research (Dubois and Gadde 2002). In other words, theory and empirical observations are not tested against each other in order to determine whether a theory holds true (Kovács and Spens, 2005). According to Eisenhardt (1989) abductive reasoning is typical in case studies, as it deepens the understanding of the case and allows for better construction of theory towards theoretical, not statistical, generalizations.

The research is an exploratory single case study. Case study method in general is used when the research is focused on the nature or reasons of an event or a phenomenon, the researcher has little control over events and the focus is on a real-life matter (Yin, 2009).

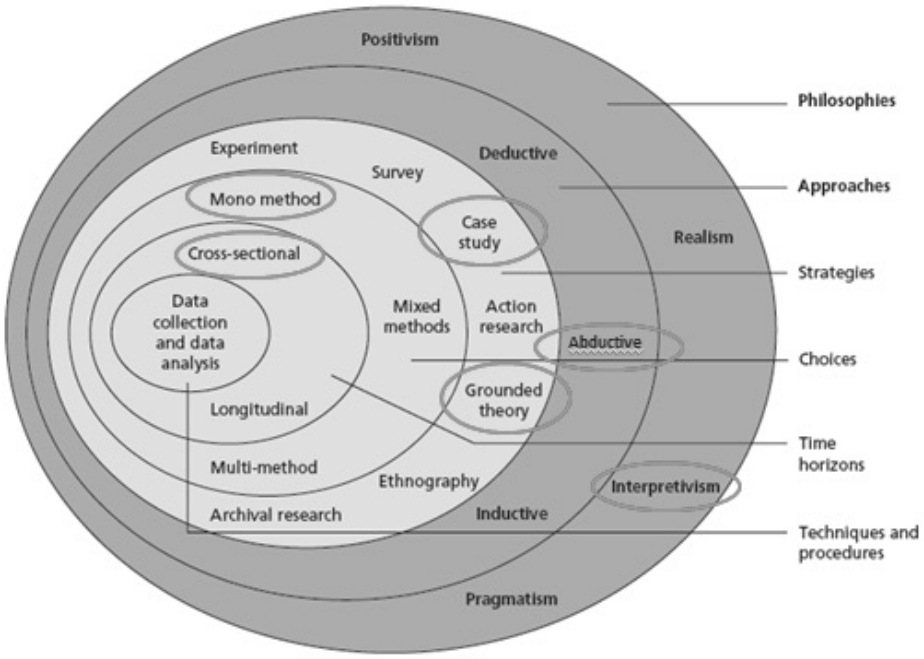
The research applies grounded theory as the analysis method for the data. Grounded theory involves the discovery of theory through the analysis of data (Martin and Turner 1986). In other words, grounded theory is not used in its traditional form for

inductive reasoning (Saunders et al. 2010: 148), but for systematically analysing the research data for reflecting it with the literature.

Being master's thesis, the primary aim of the research is to improve the practice of enterprise architecture in the case organization, it is categorized as "applied research" by Merriam (2009, p4). The secondary aim of the research is to "contribute to the knowledge base in the field", which lends it some characteristics of pure research (ibid).

Since the research is undertaken in only one organization and with 17 interviewees, any it can provide very little evidence for generalizing the causes and their effects. On the opposite, the research aims to map the conceptions and understanding of the themes, and then reflect those on the findings from the literature, thus suiting the definition of qualitative research. Merriam (2009: 5) states that *"qualitative researchers are interested in understanding how people interpret their experiences, how they construct their worlds, and what meaning they attribute to their experiences."* The data is cross-sectional, spanning over months in the autumn of 2014.

Figure 14: Research methodology as adapted from Saunders et al. 2009



5.4 Research process

The research has two sources of data. First, the literature on digitalization and enterprise architecture is systematically reviewed. The systematic literature review forms theoretical foundation for the thesis.

The empirical part of the study comprises seventeen semi-structured interviews. Small refinements were made to the interview questions after the first interviews. Interviews were analyzed using open coding method of grounded theory approach.

Empirical findings were then reflected with the literature, after which the final results to the interview questions were drawn.

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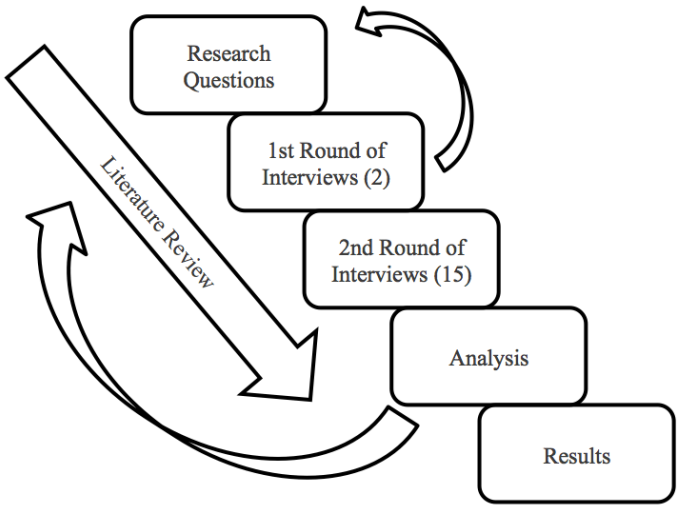

Figure 15 Research process

5.5 Data collection

As mentioned earlier, the primary data was collected in seventeen face-to-face interviews, one interviewee at a time. The interviews followed a semi-structured format, where a list of themes and questions were covered. The questions were, however, slightly modified according to the organizational position, as described by Saunders (2009: 320). The questions were refined during the first two interviews, leading to the final set of questions. All of the interviews were audio-recorded transcribed.

5.6 Sampling

The interviewees were selected based on the idea that they should

a) be at least somehow, yet not necessarily deeply familiar with the ideas of digitalization and enterprise architecture,
b) together represent the different organizational and power setting of the case organization,
c) represent both ICT and non-ICT oriented organizations and views.

The interviewees' represented different organizations as described the following table.

Organization	Number of interviewees
Mayor's Office – ICT unit	5
Mayor's Office – non-ICT	3
Sectors – ICT units	3
Sectors – non-ICT	2
ICT services	2
City council	2

Table 14: Interviewees in organizations

In addition, the interviewees could be categorized into managerial and specialist roles. In this categorization, the members of the city council were categorized into managerial positions, since they make decisions on the issues rather than specialize in them. As a result the following sampling table was constructed.

	Managerial Role	Specialist Role	Total
ICT unit	4	6	10
Non-ICT unit	5	2	7
Total	9	8	17

Table 15: Sampling of interviewees by role and ICT-orientation

On the other hand, the interviewees could be also categorized based on their organization. Since the power setting of the case organization consists of a central and decentralized parts, it was valuable to know whether the organization of the interviewee would impact their views.

	Central organization	Other	Total
ICT unit	5	5	10
Non-ICT unit	3	4	7
Total	8	9	17

Table 16: Sampling of interviewees by organization and ICT-orientation

5.7 Interview questions

The interviews consisted of circa thirty questions and were divided into four themes. First, the questions about the current job and background of the interviewee were asked. This part also worked as an "ice-breaker" to ease the communication in the latter parts. Secondly, questions about their understanding of the current and desired future state of digitalization were asked. The third part comprised similar questions, but focused on enterprise architecture. Finally, the concepts of digitalization and enterprise architecture were integrated, as the role and characteristics of enterprise

architecture to support digitalization were asked. The interview structure is presented in the following table.

Theme	Sub-themes	Related research questions
1. Introduction	Career length Most important stakeholders Experience in development projects	
2. Digitalization in the case organization	Estimate on own familiarity with the concept General "thoughts" about the concept Definition of the concept Relation to e-services Challenges with the current situation in terms of digitalization Desired future state Means of reaching the future state	RQ1
3. Enterprise architecture	Estimate on own familiarity with the concept General "thoughts" about the concept Definition of the concept Importance of EA Challenges Current and desired future benefits	RQ2
4. Enterprise architecture in digitalization	Impact of digitalization on EA Current and future support for digitalization by EA Role of EA in radical change	RQ3

Table 17: Interview structure

5.8 Analysis of the data

The data was analysed using the open coding method found in the grounded theory (GT) methodology. The process of analysis is described below.

1. Reading through the interview transcripts and coding of concepts that arise from the text.
2. Reading through the interview transcripts and structuring and classifying the codes.
3. Analysis of the classification, considering the roles in the sampling of the interviewees.
4. Reflection of the analysis with the syntheses from the literature.

5.9 Validity and reliability of the data

Yin (2009: 40-44) argues that the evaluation of case studies should combine both the reliability and validity analysis of the research. (Yin 2009: 40-44; Saunders 2009: 156). According to Saunders (2009), *"reliability refers to the extent to which your data collection techniques or analysis procedures will yield consistent findings"*.

Validity, on the other hand, is refers to the extent how valid the findings are, i.e. whether their appearance reflects reality.

Robson (2002) identifies four threats to reliability. *Subject or participant error* can happen, for example, when the interview situation impacts the interviewee's answers. *Subject or participant bias* means that the interviewee does not answer honestly due to, for example, social pressure. *Observer error* can happen if the interview is not conducted consistently. Finally, *observer bias* is caused by the observer's interpretation of the replies.

Robson (2002) also lists various threats to validity. History of events related to the research topic may reduce the validity of the answers. On other hand, the interviewee may optimize the answers to support her work in the future. Also, there may have been instructions or other changes to the work of the interviewees during the interview process, which impacts the answers. Fourthly, it is possible that mortality during the (particularly longitudinal) research process affects the results. Finally, ambiguity about causal direction should be carefully minimized.

The described threats were minimized using various means. The interviews were conducted during a three-month period in the fall of 2014. The interview structure was kept as consistent as possible, with only minimal modifications outside the core questions. All of the interviewees were provided with the theme of the research beforehand, but all of them were new to the questions in the interview situation. This policy was followed despite a few requests to receive the questions beforehand. Also, all of the participants were willing to attend the interviews.

However, social pressure in the organization related to the interview topics may have affected the answers. Even though the interviewees were anonymous in the empirical data, in practice people are likely to know quite well who were interviewed. Also, the concepts in the interview were rather complex which may affect the results.

6 Empirical findings

This chapter presents the empirical findings of the research. The three sections of the interview are covered: digitalization, enterprise architecture and the impact of digitalization on enterprise architecture.

6.1 Self evaluation

In the beginning of both digitalization and enterprise architecture sections of the interview, the interviewees were asked about their familiarity with the concepts. The overall averages were 3.85 (digitalization) and 3.99 (enterprise architecture) from range from one to five, five being the higest. Clearly above the neutral, these averages indicate rather strong self-confidence in the studied subjects.

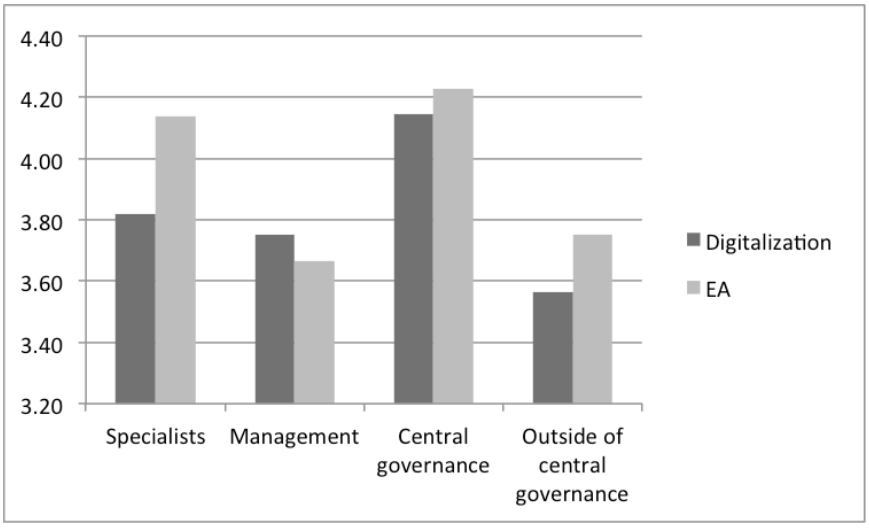

Figure 16: Self evaluation of familiriaty with digtalization and enterprise architecture

The datapoints deviated very little, lowest score being 2.75 (n=2) and only five estimates of score 5, “very familiar”. Consequently, most of the estimates were between three and four, just above neutral.

Despite the small margins, there appears to be three kinds of notable differences. First, enterprise architecture is considered more familiar amongst the specialists than amongs the management by a margin of 0.47. Secondly, both digitalization and enterprise architecture are considered more familiar within the central governance than outside of it, differences being 0.58 and 0.48 respectively. Since the enterprise architecture and digitalization agenda are led from the central governance, these

findings indicate that knowledge and information are better shared within the central governance than towards sectors. Also, the findings might indicate that the interviewees in the central governance are more specialized on the subject matters.

6.2 Stakeholder analysis

A brief stakeholder analysis was conducted by asking the interviewees about the most important stakeholders in their work. The findings are depicted below. In addition to the data depicted below, central governance and sectors were mentioned altogether 13 times.

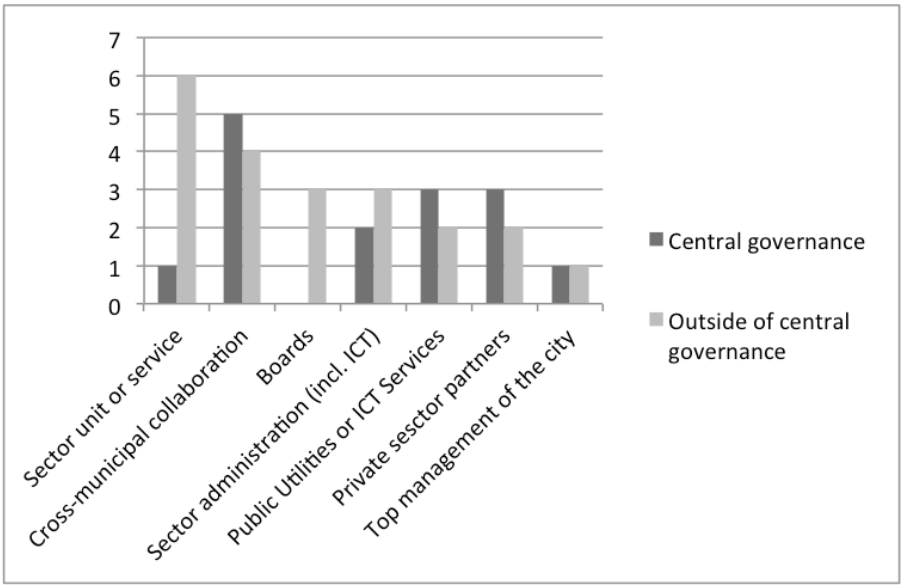

Figure 17: Stakeholder analysis

The stakeholders with largest differences between the central governance and the sectors are "sector unit or service" and political leadership. This indicates weaker visibility from the central governance to both units of the sectors and the political leadership. On one hand, this naturally reflects the organizational structure of the city. However, it also points out the slightly different viewpoints that characterize work between the organizations. This phenomenon is visualized below.

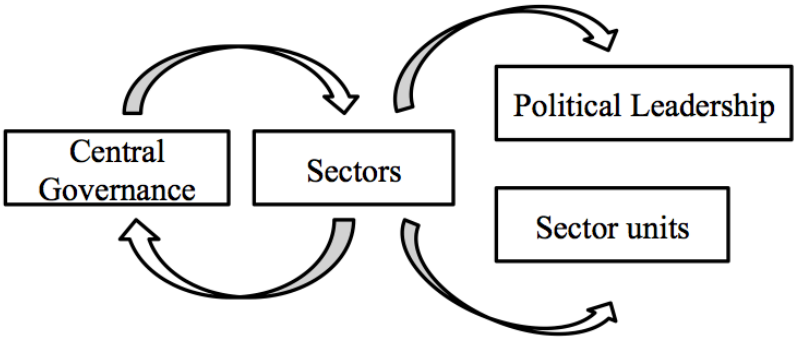

Figure 18: Stakeholder visibility in the case organization

6.3 Digitalization

The first section of the interview focused on digitalization generally as well as specifically in the case organization. First, the terminology and conceptions were inquiried. The following questions concentrated on the adoption and impact of digitalization in the case organization.

The questions aimed to shed light on the RQ1: "How does digitalization impact a public sector organization?" and particularly the second sub-objective: "How is digitalization comprehended in the case organization?"

6.3.1 Digitalization as a term

Digtalization as a term was found mostly a positive trend with new opportunities. However, some interviewees outside the central governance also pointed out previous bad experiences and considered it a new term with old content. Generally, the term was considered more positive amongst the central governance.

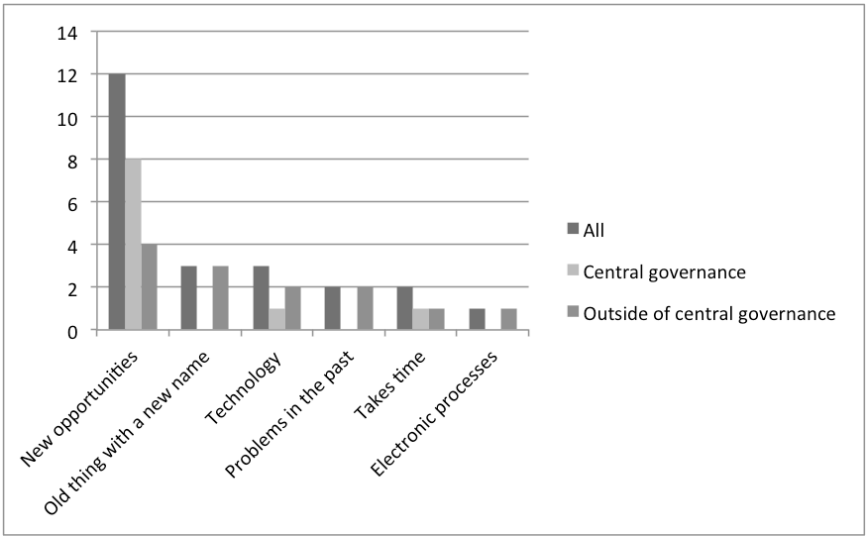

Figure 19: Digitalization as a term

6.3.2 Digitalization vs. e-services

The difference between the concepts of digitalization and e-services was found generally significant. Digitalization was considered to impact the operations more fundamentally and throughout the whole process, whereas e-services were considered as electronic extensions of existing services. This finding reflects the terminology of the digitalization agenda that has been communicated in the case organization during the research.

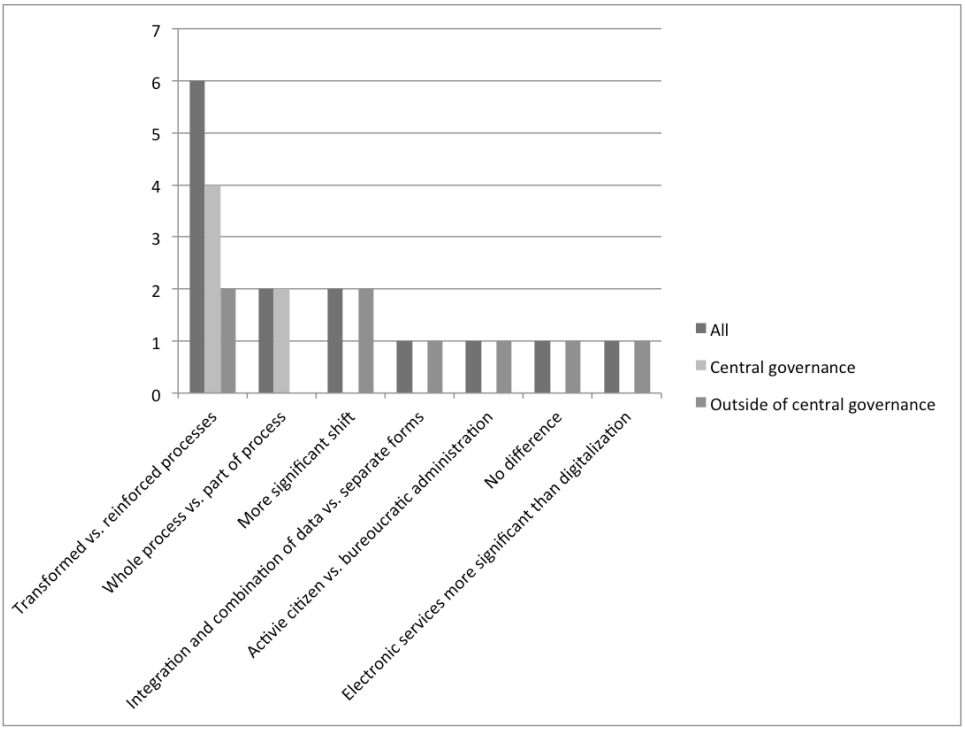

Figure 20: Digitalization vs. e-services

6.3.3 Hindering digitalization

The factors hindering digitalization deviated rather much amongst the interviewees. The five most important factors found were lack of courage, bureacracy, legislation, legacy ICT environment and the lack of development time allocated in operative work. Outside the central governance legislation and lack of development time were found more often a hindering factor, whereas in central governance the siloed processes and organizations were found troublesome.

Also, some of the factors are likely to be interrelated. Lack of courage, organizational culture and rigid decision-making all refer – to some extent – to the characteristics of a public sector organization (lähde). Bureacracy and jurisdiction, on the other hand, reflect the legislative environment of public sector generally. Both lack of skills and unclear terminology of digitalization represent a perceived lack of knowledge and skills.

It should be noted, that amongst the 13 most important factors, only two were strictly ICT-related. This emphasizes the non-technological part of digitalization.

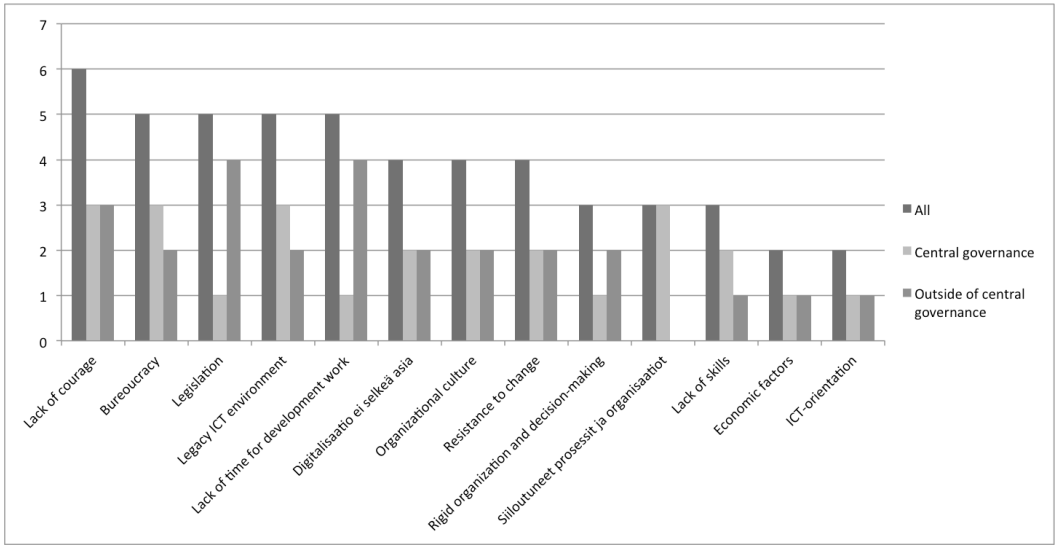

Figure 21: Factors hindering digitalization

6.3.4 Ideal future of services in the case organization

When asking about the ideal future of the services of the case organization in 2020 or 2025, the results were surprisingly deviated. Altogether there were 37 different "futures". Some categories could be, however, found. Four of the future ideals were related to time and place independence of services. Another four comprised general

utilization of new technology. Two mentions of self-service processes were mentioned.

If categorizing even more broadly, circa half of the future ideals were somehow related to process development enabled by information and communication technologies. The more accurate description, however, varied all the way from productivity improvements to mobile health terminals. In addition, several answers were given in comparison to the current situation, without a clear picture of the future as such.

These findings are likely to reflect at least two issues. First, it seems that a common vision of the future services of the case organization does not exist. Secondly, the finding might also reflect the fact that the interviewees find the current digitalization trend unpredictable.

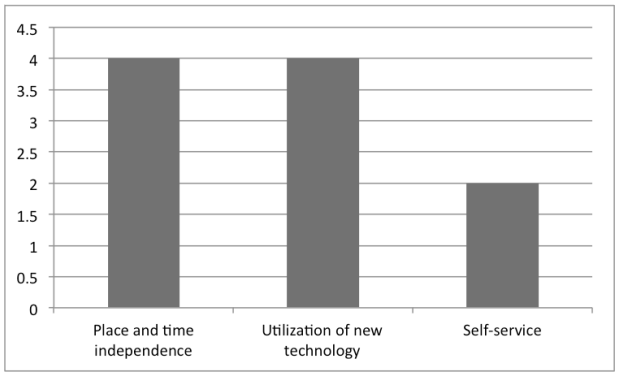

Figure 22: Future ideals of services in the case organization

6.3.5 Means for the ideal future

Again, when asking the means for the ideal future, 42 different means were described. Only two of them were mentioned by three different persons, all the others by one or two persons only. However, when categorizing the means more broadly, 11 of them were related to collaboration and four of them were related to an ecosystem or platform.

The finding indicates that in addition to a lack of common vision, there does not seem to be an agreement on the means to the ideal future organization. This further signifies the unclarity of the future of the case organization.

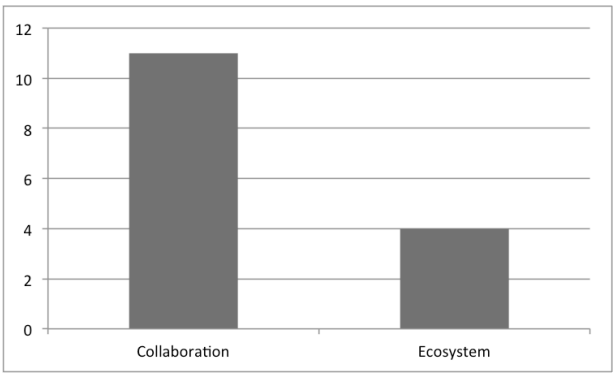

Figure 23: Means for the future ideals

6.3.6 Summary

According to the empirical data it appears that digitalization is expected to impact the case organization in a holistic and mostly positive way. New digital opportunities do not reinforce current processes and services, but require holistic changes to the mode of operation. On the hand, organizational culture including lack of courage and bureoucracy, as well as technological legacy hinder those changes.

Also, it appears the there is no clear vision of the outcome of the digitalization trend in the case organization, i.e. a desired future for the organization. Also, the means of adopting digitalization towards the desired future deviate massively across the interviewees.

6.4 Enterprise Architecture

The second section of the interview focused on enterprise architecture. First, the definition of and conceptions about enterprise architecture were enquiried. After opinions on current challenges and desired benefits were asked. Finally, the interviewees were asked to evaluate the steering of enterprise architecture both in the case organization and nationally.

The questions aimed to shed light on the RQ2: “What is enterprise architecture?”.

6.4.1 Enterprise Architecture as a term

The intuitive ideas about enterprise architecture covered different dimensions and schools of enterprise archtitecture. Most commonly EA was considered as a tool for decision-making or a “bad term with difficult content”. As only six mentions of 32 were negative, EA was generally perceived positively. Interoperability, the main

theme in the Finnish public sector EA definitions and discussion is the third most common intuitive idea.

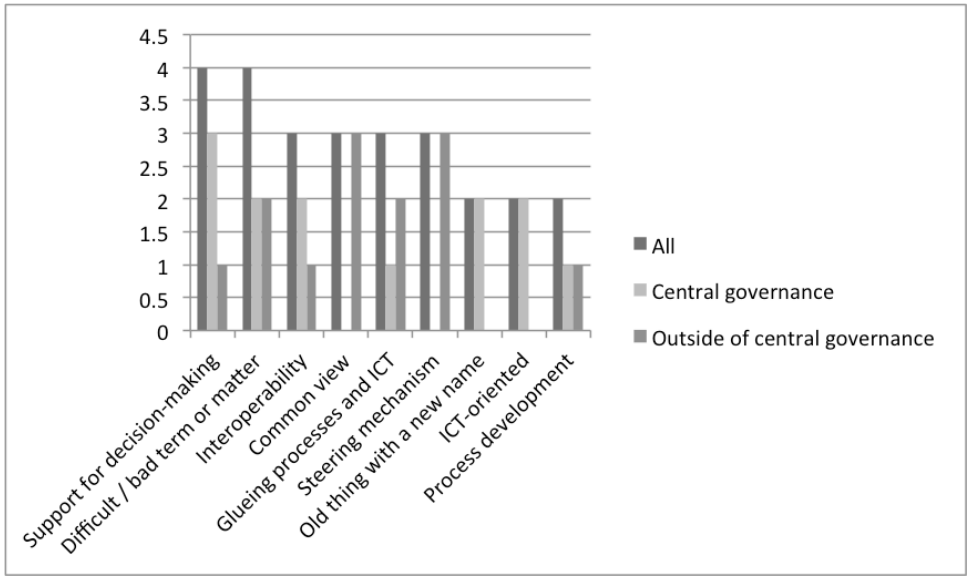

Figure 24: Enterprise architecture as a term

6.4.2 Defining Enterprise Architecture

When defining enterprise architecture, it was most commonly considered as support tool for decision-making or development, categorizing in the enterprise integration school. This view was dominant within the central governance. However, operational enterprise architecture and a comonly agreed future, as presented by Ross et al. (2006) were also represented, but more significantly more commonly outisde the central governance. Some interviewees considered EA to categorize both in the Enterprise IT Architecting and Enterprise Integration schools.

The definitions appear to support both dimensions of the synthesized framework. The representation layer in both EITA and EI schools are emphasized, but mentions of operational EA, "realization" were also found. The EA planning processes was generally neglected in the definition. Also, the characteristics of the Enterprise Ecological Adaptation school were found in only one answer.

Altogether, there seems to be essentially three different views of Enterprise Architecture amongst the interviewees. Most commonly EA was seen as descriptive and prescriptive artifacts that help make informed-decisions. On the other hand, EA is also considered as the operational foundation of the organization. Thirdly, EA is

defined as a common target (or a view of a common target), towards which the organization should move.

	Enterprise IT Architecting	Enterprise Integration	Enterprise Ecological Adaptation
Definition (planning process)			~1
Representation	4 (core target diagram)	10	
Realization	5		

Table 18: Definitions of enterprise architecture in the case organization

6.4.3 Challenges this far

The three most common challenges of enterprise architecture in the case organization were implementation to operational development work, unclear role or understanding of EA and fragmented leadership. These challenges are likely to be interrelated, or at least have similar root causes. For example, fragmented leadership and unclarities are likely to significantly complicate implementation to operational development work.

In addition to the conceptual and organizational fragmentation, some considered the EA descriptions themselves difficult. Also, the long time span of EA work was found to be a challenge.

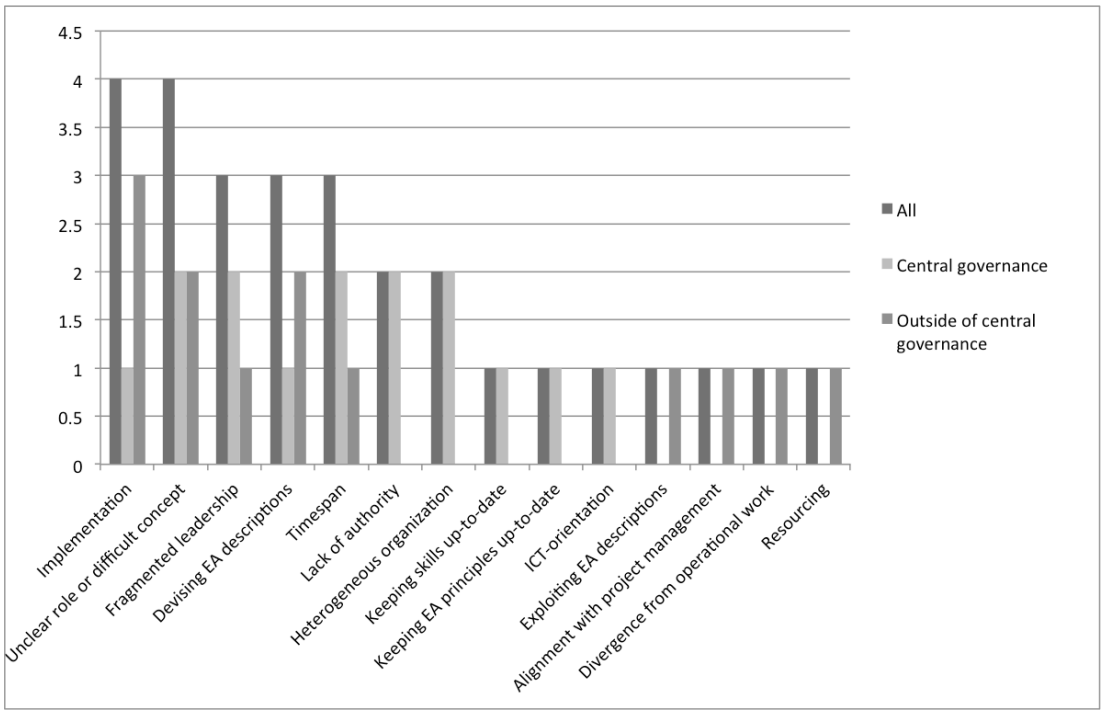

Figure 25: Challanges of EA work this far

6.4.4 Achieved and desired benefits

Thus far, according to the interviewees, the benefits of enterprise architecture in the case organization have comprised improved communication, project governance, "understanding of the whole as well as prevention of overlapping solutions. Improved communication was found in the central governance, where as project governance was considered a benefit outside of it. Prevention of overlapping solutions is most likely a consequence of the previously mentioned benefits.

Enterprise architecture was generally found to be beneficial, except for the most common benefits, the answers deviated significantly. Only one interviewee estimated that the benefits have not been measured. Although the EA planning processes was not emphasized in the definitions, enterprise architecture was also considered to support and trigger discussion and thinking.

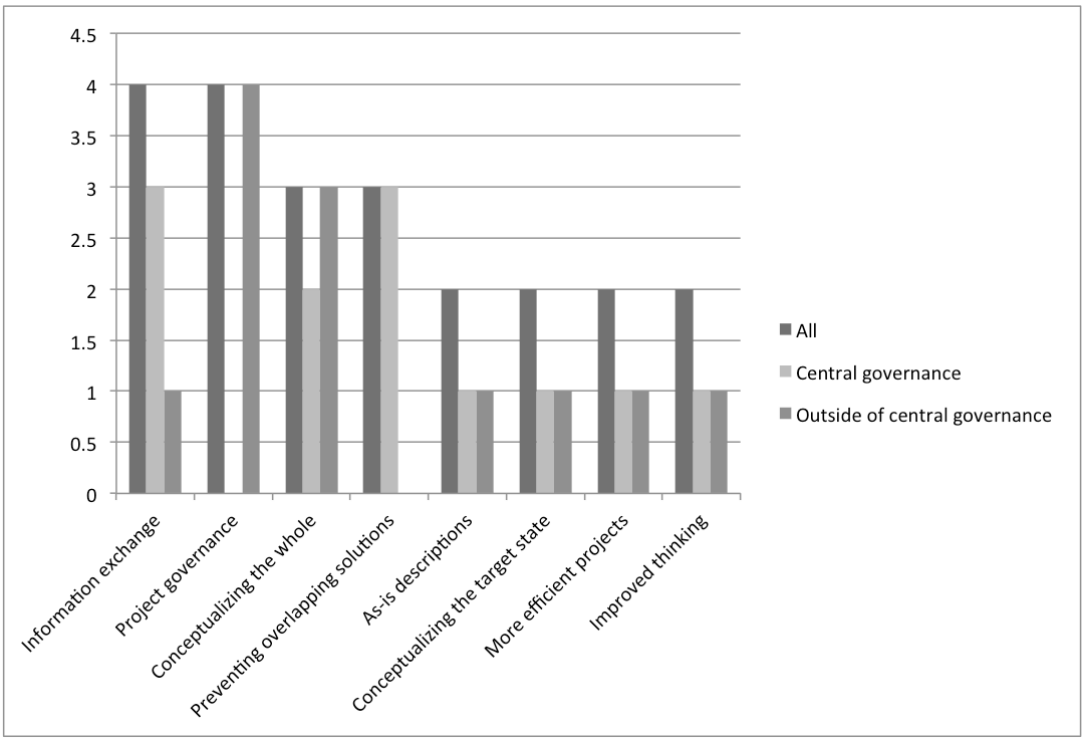

Figure 26: Perceived benefits of enterprise architecture in the case organizatin

The desired benefits were rather different from the achieved benefits, and deviated again significantly. Within the central governance the most common were interoperability and extendability, organizational intergration, adoption of digitalization as well as agility. Outside the central governance architectural descriptions were the most desired benefit although they were only mentioned by two interviewees.

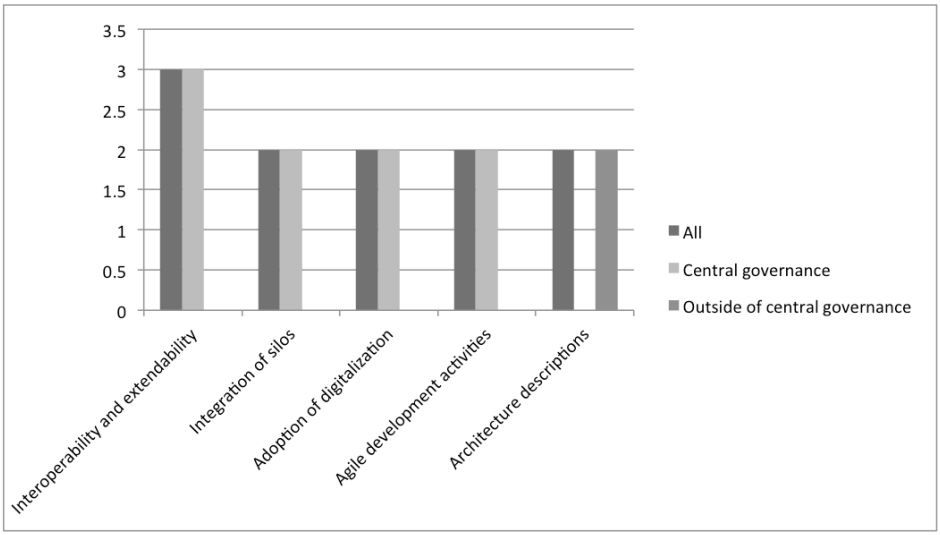

Figure 27: Desired benefits of enterprise architecture in the case organization

6.4.5 Evaluating national EA

The national enterprise architecture work in Finland was evaluated generally negatively. Only three mentions of 14 were somewhat positive: national EA was perceived as a frame for EA work in the case organization. Most commonly national EA was experienced distant and fragmented, without concrete benefits.

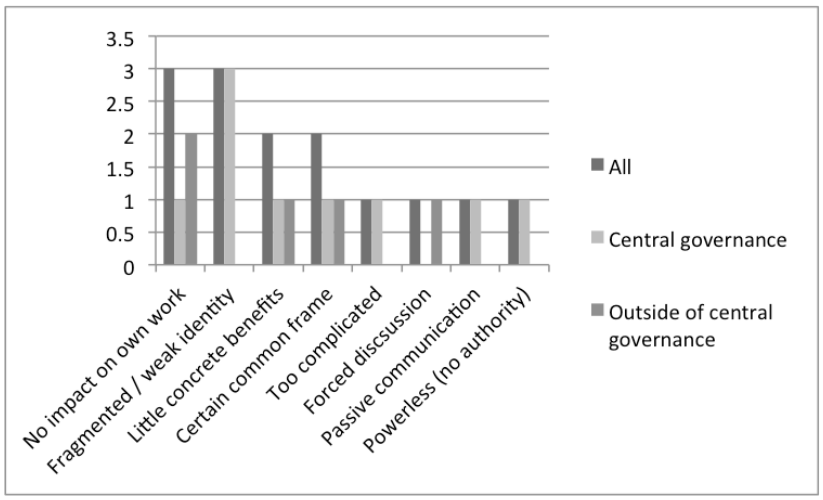

Figure 28: Evaluation of the national EA by the interviewees

6.4.6 Evaluating EA in the case organization

Enterprise architecture in the case organization was evluated low in maturity, but "forward-moving". Slow time-span as well as implementation were also mentioned as challenges, but EA was still considered as "developed" in relation to other cities.

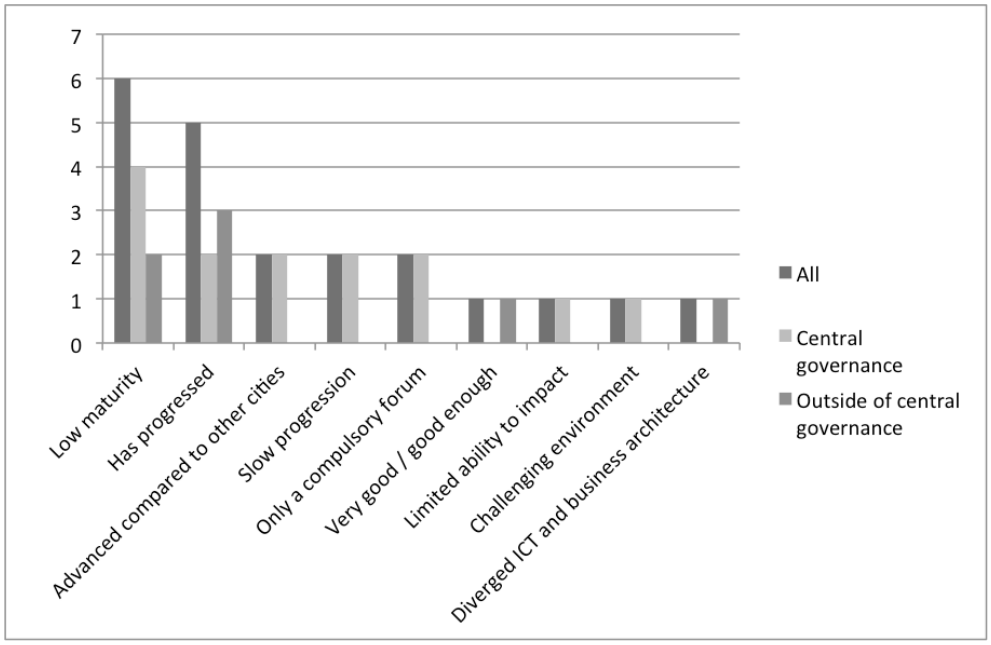

Figure 29: Evaluation of enterprise architecture in the case organization

6.4.7 Summary

According to the empirical data it seems that the concept of enterprise architecture has three different meanings in the case organization: tool for supporting decision-making, common view of the target and operational foundation. Thematically the answers are positioned in Enterprise IT Architecting and Enterprise Integrating schools. Conceptual unclarities are also likely to hinder the implementation of EA to operational development work. The current EA work in the organization is perceived beneficial particularly in terms of communication and project governance. In the future technological and organizational integration as well as agility are seen as the benefits of enterprise architecture.

6.5 Enterprise architecture and digitalization

The last section of the interview focused on the intersection of enterprise archtiecture and digitalization. First the mutual impact between the two concepts was enquiried. Secondly, the interviewees were asked about the exploitation of enterprise architecture in digitalization and digital transformation.

The questions aimed to shed light on the RQ3: “How should enterprise architecture be exploited to support digital transformation in the case organization?” and particularly the second sub-objective: “What is the desired direction of enterprise architecture in the case organization?”

6.5.1 Mutual impact between EA and digitalization

When asking about how enterprise architecture and digitalization impact each other, over half of the interviewees estimated that enterprise architecture supports digitalization. Most often enterprise architecture was considered as a “structure” for digitalization, whereas some saw it as a vision. Also, it was mentioned that digitalization impacts the architecture principles. Overall the mutual impact was seen positive.

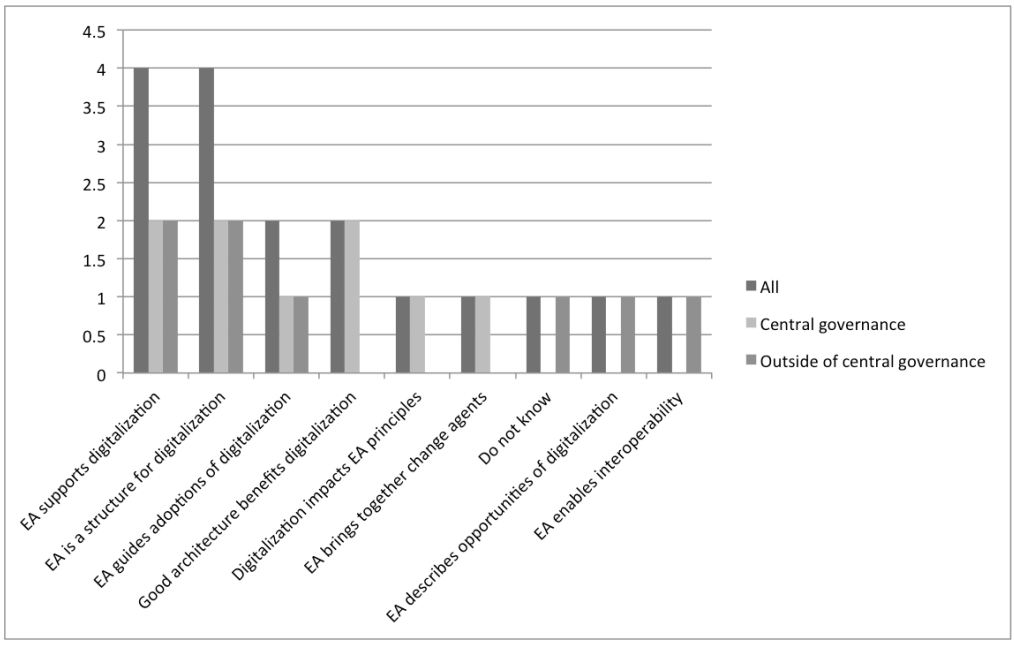

Figure 30: Mutual impact between EA and digitalization

6.5.2 Requirements of digitalization for EA

Interviewees estimated that digitalization poses requirements to enterprise architecture work. Requirement for up-to-date architecture principles was mentioned most often, but also novel thinking and foresight as well as up-to-date skills were required more than once. The current skillset in the case organization was considered unanimously lacking.

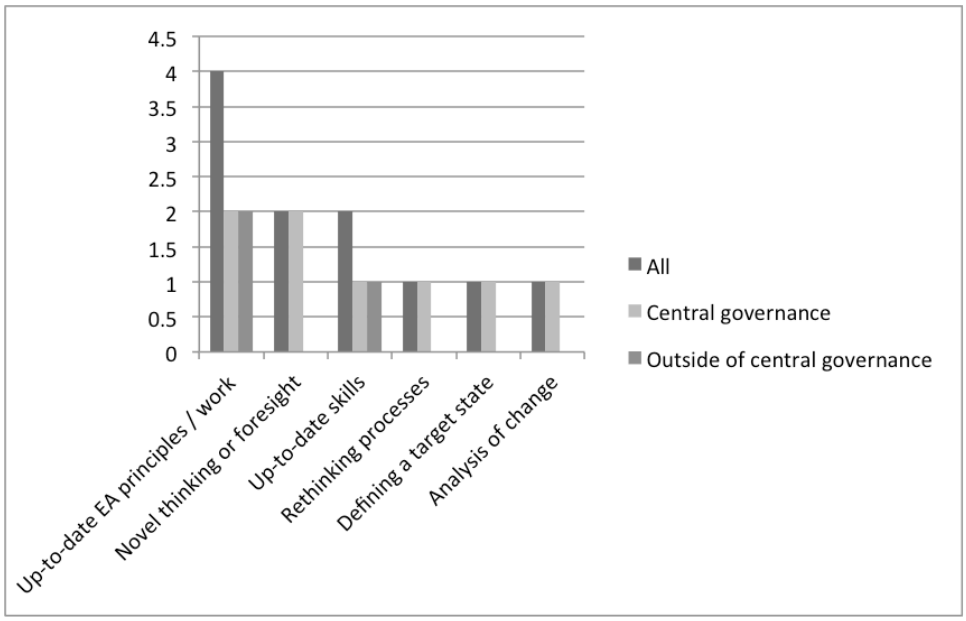

Figure 31: Requirements of digitalization for enterprise architecture

6.5.3 EA future direction

The desired future direction of enterprise architecture in the case organization was enquiried via three different questions, each with its own focus. First, in the enterprise architecture section the interviewees were asked about the direction of the future of EA in the case organization. Secondly, the role of EA in digitalization in the future was enquiried. Finally, some of the interviewees were asked about the role of EA in radical innovation in the case organization.

The answers categorized into three classes which, however, did not follow the corresponding questions. The most common characteristics of future enterprise architecture were a common target. Secondly, the role of EA descriptions to support decision-making was considered important too. Thirdly, enterprise architecture was hoped for to help identify new possibilities from the technological environment.

On the other hand, compared to the current situtation, several desired directions of EA were found. Cross-municipal co-operation, implementations to operational development work as well as collaboration and discussion were such desired improvements. Two interviewees also mentioned that the focus of EA should move from ICT to organization and processes. A few interviewees also saw that the agilility enabled by enterprise architecture would support the adoption of digitalization in the case organization.

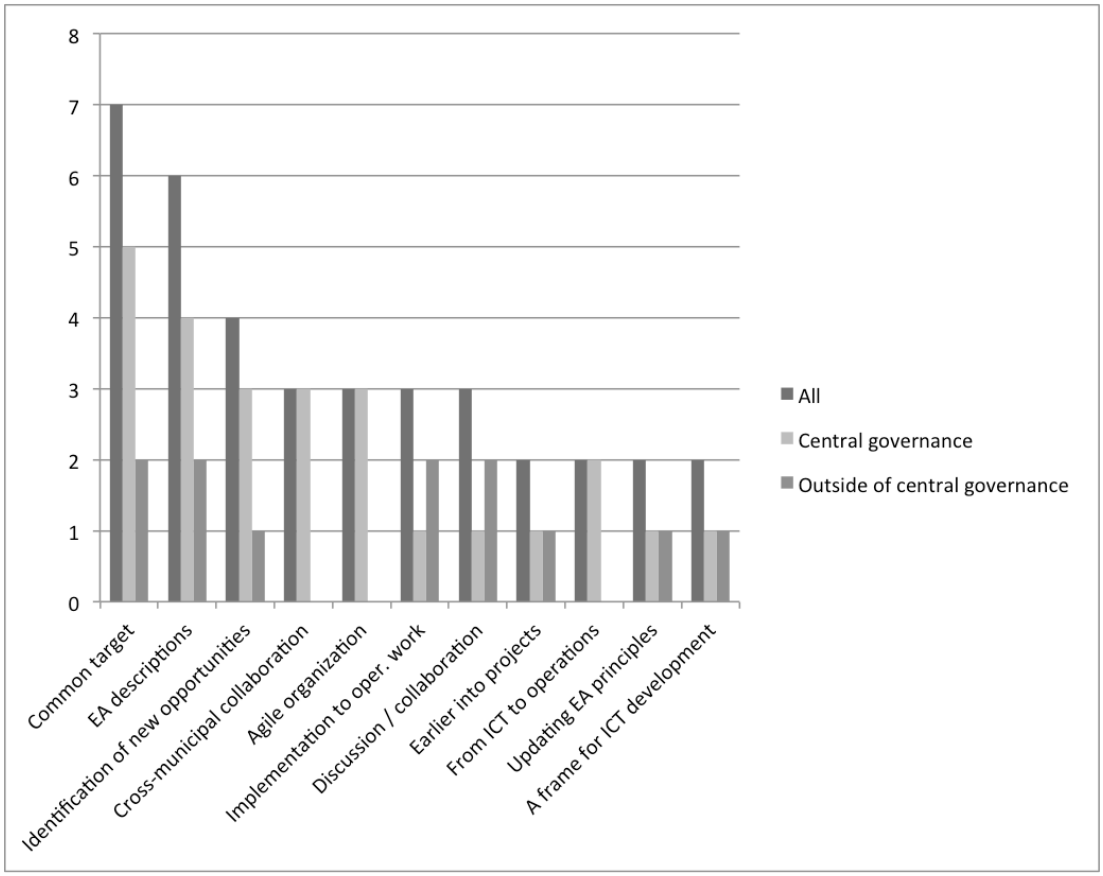

Figure 32: Desired characteristics of enterprise architecture in the case organization

6.5.4 Summary

Digitalization is expected to impact enterprise architecture as the EA principles and mental models need to be updated to reflect the undergoing development. On the other hand, enterprise architecture is seen as both a structure and vision for digitalization. What comes to the desired direction of EA, the interviewees most often emphasized a common view of a target and identification of opportunities from the environment in addition to EA artifacts. Also, collaborative efforts between other municipalities as well as implementing to operational development were considered characteristics of future EA in the case organization.

7 Results

In this chapter the empirical findings are discussed and reflected on the theoretical frameworks as well as the research questions of the study.

7.1 Public sector digitalization

The first research question concerned the public sector digitalization, more precisely the characteristics and stages of it.

Research questions	Sub-objectives	Method
1. How does digitalization impact a public sector organization?	c) What stages of digitalization can be identified? d) How is digitalization comprehended in the case organization?	SLR + Case

Table 19: Research question 1

The first research question was studied based on both the systematic literature review as well as empirical data. The literature review resulted in a synthesis, where digitalization in the public sector is divided into two parts. “The easy part” comprises the reinforcement of current processes and services with with new technology. Horizontal integration of systems and processes is not needed, which allows continuing a siloed organizational setting. Consequently, the overall change needed is relatively minor. On the other hand, in the “hard part” of digitalization processes and services are transformed in a customer-driven orientation. As horizontal integration is required across the organization, the change concerns the organizationa as a whole. This framework primarily answers the first sub-objective of RQ1: Even though e-government is often divided to four or more stages as discussed in chapter x, synthesis of the literature suggests that from the organizational perspective public sector digitalization can be divided into *reinforcing* and *transformational* stages.

The framework also answers the RQ1 by suggesting, that the impact of digitalization on a public sector organization heavily depends on the way the organization adopts it. Adopting the “easy part”, reinforcing current processes and services with new technologies impacts only the technological aspect of the organization. On the other hand, adopting the “hard part” impacts the organizational setting as a whole.

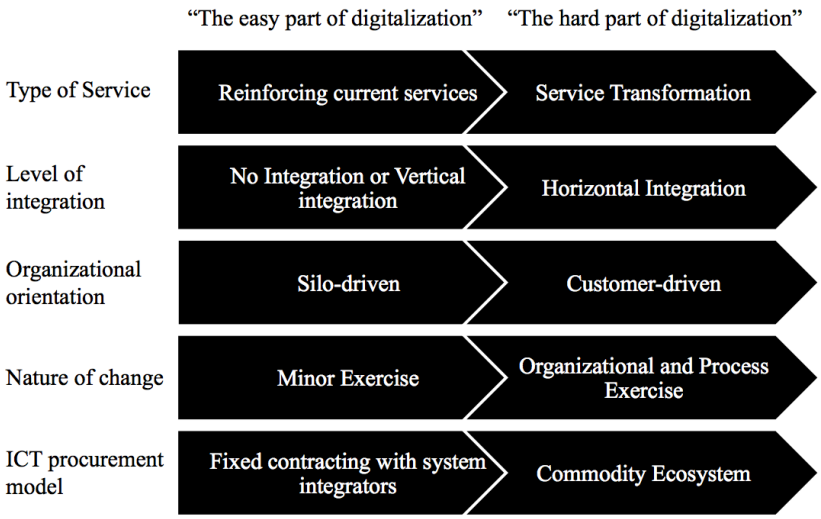

Figure 33: The easy and hard part of digitalization

The first research question, particularly sub-objective b) was further studied through the interviews. The interviewees had adopted the concept of digitalization as a transformational change compared to electronic services, which were considered as examples of the "easy part of digitalization". The impact of digitalization was most often positively experienced.

Even though the reaction to digitalization was mostly positive organizational culture including lack of courage and bureoucracy, as well as technological legacy were considered to hinder the adoption of it.

7.2 Defining enterprise architecture

The second research question concerned the nature and dimenisons of enterprise archtiecture. It aims to map the concept of EA in order to provide framework for the RQ3.

2. What is enterprise architecture?	c) What are the dimensions of enterprise architecture? d) What are the value-creating mechanisms of enterprise architecture?	SLR + Case

Table 20: Research question 2

The second research question was again answered by both the literature review and the empirical data. A multitude of different definitions and unclarities in the value-creating logic led to the synthesis combining the work by La Palme (2012) and Tamm et al. (2011). Combining these works provided a matrix that covers both the scopes and value-creation logics of previous EA literature. The three scopes could be

described as “glue between ICT and business”, “bridge between strategy and strategy execution” and “a facilitation tool for system-in-environment adaptation”. On the other hand, the division of enterprise architecture into EA planning, EA artefacts and EA guided operating platform presents three different value abstraction levels through which enterprise architecture exists and creates value in an organization.

	Enterprise IT Architecting	**Enterprise Integration**	**Enterprise Ecological Adaptation**
Definition			
Representation			
Realization			

In addition to scope and abstraction level, it in the liteature review it was also found that the normativity of EA varies. In addition to the descriptive (descriptions) and prescriptive (principles) enterprise architecture, a third level of normativity (“commonly agreed target”) emphasizes a common decision on the to-be EA guided operating platform in an organization. Together these dimensions dimensions answer RQ2: “What is enterprise architecture?”

In the case organization enterprise architecture is comprehended in mostly three different ways, which are present in the synthesis from the literature: descriptions for informed-decision making, common target and operational enterprise architecture. The findings further support the suggested framework.

In terms of value creation enterprise architecture in the case organization does not follow the previously mentioned abstraction levels, but is more focused on communication and project governance. This is likely to stem from adoption of EA as part of the project governance, with a focus on EA principles.

7.3 Enterprise architecture in public sector digital transformation

The third research question concerenced the exploitation of enterprise architecture in public sector digital transformation.

3. How should enterprise architecture be exploited to support digital transformation in the case organization?	c) How can enterprise architecture support transformational change? d) What is the desired direction of enterprise architecture in the case organization?	SLR + Case

Table 21: Research question 3

While the previous research questions were primarily based on literature and secondarily on the empirical data, RQ3 aimed to combine the concepts in the context of the case organization.

Drawing from the synthesis of RQ1, one can say that the transformational adoption of digitalization is a cross-organizational exercise that largely happens outside the scope of a dedicated ICT function. Even though process and information integration naturally demand technical interoperability, it was found out that particularly in the "hard part of digitalization", horizontal integration needed for customer-oriented services cannot happen strictly within the technical realm. Such radical changes are likely to require significant commitment and time allocation from senior business management as well. This idea was also found in the empirical data. Many of the interviewees thought that there should be a shift in the focus of enterprise architecture from ICT to the operational units. As a result, one could say that as in digital transformation the focus of all change shifts away from ICT, the focus of EA should shift so too.

When exploring the desired future of enterprise architecture generally in the case organization and particularly in digital transformation, the empirical data suggests various needs and roles for EA. First, and most commonly, the need for a common target was raised. As described in the previously, enterprise architecture in the Finnish public sector as well as in the case organization has been characterized by descriptions and principles. The finding suggests, that in addition to these, a common target should be included in the EA work in the case organization. Also, not only should the common target concern invididual solutions or processes, but rather the case organization as a whole, i.e. the enterprise.

Thirdly, EA is still considered a descriptive method to support informed decision-making in the case organization. Understanding the current organization was seen as one of the key factors towards digitalization changes. There was, however, some

disagreement about modelling the preciseness of the as-is model. On on hand it was considered as waste of time, on the other hand it was seen as a critical success factor for designing the to-be process. This disagreement was also found in the literature, and should be further studied critically both academically and in the case organization. According to this study, modelling the current situtation is considered important.

Fourthly, enterprise architecture was considered as a method to identify digitalization-enabled opportunities in the environment and further map them to the context of the case organization. This idea is also found the enterprise ecological adaptation school of the synthesis, where EA is used to facilitiate system-in-environment adaptation.

As a summary, the roles for enterprise architecture in public sector digitalization appear to vary across the different dimensions of EA. This further signifies the conceptual width and depth of the matter, which is likely to challenge the adoption and implemention of EA in the case organization. When mapping the answers to the synthesis of RQ2, one can see that these ideas span across the matrix as well as the normativity levels.

8 Disucssion

This chapter presents the synthesis of the findings, followed by theoretical contributions. Based on the synthesis a few managerial implications are suggested. The chapter ends with an analysis of the limitations of the study and suggestions for future research.

8.1 Synthesis of the findings

In this thesis digitalization and enterprise architecture have been studied in public sector context. Particularly, the focus has been on the role of enterprise architecture in digital transformation in the case organization. Also, the conceptual dimensions of both digitalization and enterprise architecture have been investigated. It appeared that the adoption of digital opportunities in an organization can be either reinforcing or transformational. The latter one, also called digital transformation, requires major effort throughout the organization to enable horizontal integration to enable a customer-oriented organization. On the other hand, it was found out that enterprise architecture, rather than a single concept, constitutes a number of dimensions that steer its value-creation logic as well as adoption in an organization. Most importantly, enterprise architecture can be characterized as the realized organizing logic of the ICT and processes or as a meta process consisting of methods and artefacts that support decision making in order to build such realized organizing logic.

This study concludes that in order to adopt digital transformation in the case organization, enterprise architecture should a) be exploited to create a common architectural vision of the enterprise and b) provide understanding of the current organization to move towards the vision. Also, enterprise architecture should support the sense-making of the novel technological developments and the adoption of them in the case organization. Enterprise architecture should act both as a structure and a guiding vision for implementing the digital opportunities.

Finally, digitalization should be embraced in close collaboration with the business management and operational development resources of the case organization as well as with other municipalities. In the best case organizational commitment and effort

drive an enterprise architecture -guided ecosystem that is an agile platform for the novel, even transformational digital opportunities.

8.2 Theoretical contributions

This study has aimed to deepen the understanding of both public sector digitalization and enterprise architecture. First, different discourses of public sector digitalization were synthesized to provide a holistic view of the different dimensions of digitalization. Compared to existing literature on electronic governance, the study has focused more on the process and organizational reengineering aspects. Based on existing literature a framework was created that further emphasizes the difference between electronic services and ICT-enabled process redesign. This difference was also found in the empirical data.

Secondly, enterprise architecture literature was critically analyzed to build an understanding on what is meant by the concept of enterprise architecture. It was found out that the concept not only has different scopes but also different levels of value creation. A framework combining the works by La Palme (2012) and Tamm et al. (2011) was created to depict those dimensions. In addition, the division of enterprise architecture to descriptive and prescriptive was further complemented by the idea of "common vision" found particularly in the work by Ross et al. (2006). It also appeared that the division into dimensions and normativity levels was found in the empirical data.

8.3 Managerial implications

Five managerial implications are suggested based on the results of the study. The suggestions constitute themes that combine findings from the literature review as well as the empirical data. The themes comprise "From ICT to business", "Going for the foundation for execution", "From opportunities to reality", "From central governance to the shopfloor" and "Limited value added of national EA activities".

8.3.1 From ICT to business

The findings of this study indicate that a) adopting digitalization in a way other than just reinforcing current process requires significant commitment also outside the ICT organization and b) in some cases EA was considered ICT-oriented in a negative way. Also, the work by Ross et al. (2006) emphasizes business management

commitment to the operating model that steers the enterprise architecture. On the other hand, while the interviewees agreed that enterprise architecture should be owned by the top management in the central governance, it was also noted that the ownership of EA activities should be closer to the level responsible for strategy execution.

Conseqently, it is suggested that there shoud be such a resource or multiple resources in the sector organizations who have a) a solid understanding of the sector's substance area and processes, b) tight connections to the business management of the sector, c) broad understanding of digital opportunities in the sector's substance area and d) conception of enterprise architecture in the sector's context. The primary aim of these resources would be to bridge the gap between the EA ownership in the central governance and sector management responsible for strategy execution. Also, these resources would be in a critical role in debating the operating model, as needed for the foundation for execution.

8.3.2 Going for a foundation for execution

The second suggestion is also based on both literature and empirical findings. The work by Ross et al. (2006) emphasizes a common target architecture based on the operating model debated by the top management. Secondly, a common vision or target was the most desired future direction of EA in the empirical data. Thirdly, it was found out that currently there is no common vision of the digital services in the case organization. Consequently, the operating model should be debated and the target architecture of the enterprise should be created in the case organization.

Since the case organization is deeply siloed, the common target should critically review the integration requirements of the to-be processes and aim for a customer-driven future enterprise. This ambition is also present in both the literature and empirical data. Further, incentives and policies should be set in order to steer ICT and non-ICT development programs towards the future target.

8.3.3 From opportunities to reality

Thirdly, the interviewees were keen on using enterprise architecture as a method for identifiying and adopting digital opportunities in the environment. However, the current legacy information systems were considered as a hindering factor in adopting digitalization.

Consequently, along with building the foundation for execution a mechanism should be built that supports the identification and fast protyping of digital opportunities for a limited customer segment. This mechanism should also continuously interact with the EA activities to reflect the principles and technology selections with technological development.

8.3.4 From central governance to the shop floor

One of the findings of the study was that the implementation of EA to the operational development work has been challenging. However, the knowledge of the operational work would be invaluable input to the EA work. Likewise, operational development work outside the realm of enterprise architecture is likely to steer the organization away from the architectural goals and direction.

Conseqently, there should be a) a strong presence of resources from the operational development work in the EA activities of the case organization and b) the operational development personnel should be trained and motivated to both the EA methods and the common target.

8.3.5 Limited value added of national EA activities

Lastly, outside the scope of the case organization, it was found out that the current national EA activities are considered rather inefficient and distant by the interviewees. Ways to solve the struggle of municipal autonomy and cross-municipal process-standardization should be actively and collaboratively seeked. The past way of guiding and training has, unfortunately, not produced the desired impact, at least from the municipality's perspective.

8.4 Evaluation of the study

This study was a qualitative single-case study (Yin 2009). In this chapter the limitations of the study as well as the suggestions for future research are discussed.

8.4.1 Limitations

The main limitation of this study is its inability to generalize the empirical findings to other organizations in public or private sectors. Particularly, since the public sector organizations differ dramatically across countries, many of the findings cannot be directly applied to, for example, municipalities in other European countries. Also, it may well be that in the national government the issues are seen differently. These

limitations are due to the single-case nature of study, and could be overcome by adding cases from other countries as well as from both local and national government levels.

Secondly, as a cross-sectional study, only a snapshot of data was collected and analyzed. Consequently, the empirical data represents ideas and thoughts that were collected during a three-month period in a changing organizational situation.

8.5 Suggestions for future research

While conducting this study it has appeared that both the public sector digitalization and enterprise architecture have areas in their body of knowledge that should be further researched. Current research research on public sector digitalization seems to emphasize on one hand the digital participation of citizens and on the other hand broader instutional and organizational distribution of public power. As Dunleavy et al. (2006) criticizes, ICT has been rather neglected in public management research. This research aimed to structure the ICT-enabled process redesign in a public sector organization and it is likely to gain even more significance as digitalization progresses. As a result, it is suggested that this theme is further researched in the future, sheding light on the success factors of technology-enabled radical process improvement in public sector organizations.

Also, during the research it appeared that the meaning, content, definiton, scope and value-creation logic of enterprise architecture vary across literature and scholars. In this research steps were taken to build a holistic view of those aspects. However, these issues should be further studied to raise discussion also in the professional and communities. This would probably help build conceptual unambigiousness and thereby strengthen the identity of enterprise architecture.

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Appendices

Appendix A: The interview structure

Background

1. Who are you?
2. In which organization do you work and what is your role?
3. How long have you been in your current position?
4. How long have you been in working life?
5. Please, describe your work briefly.
6. What are the most important stakeholders and organizations in your work?
7. Have you been developing either information systems or processes?
    a. Have you led development programs?
    b. What is the largest development program you have been involved in?

Digitalization

8. How familiar is the term "digitalization" to you? 5 = very familiar, 1 = not familiar at all)
9. What comes to your mind when you hear the word "digitalization"?
10. How would you define the concept "digitalization"?
    a. From the case organization's point of view?
    b. From the citizen's point of view?
    c. From the employee's point of view
11. Does digitalization differ from traditional electronic services? If yes, how?
12. What have been the greatest challenges related to digitalization in the case organization?
13. What are the services of the case organization like in 2020 or 2025?
14. What needs to happen in development work in order to reach that vision?
    a. On city level?
    b. On business unit level?
15. What are the factors hindering digitalization?

Enterprise architecture

16. How familiar is the term enterprise architecture to you from one to five?
17. What comes to your mind when you hear the word "enterprise architecture"?
18. How would you define "enterprisea architecture"?
19. Have you participated in EA work in the case organization?
    a. If yes, what has been your role?
20. Why is enterprise architecture important?
21. Why is enterprise architecture not important?

22. What have been the benefits of enterprise architecture work in the case organization this far?
23. What potential benefits could be got in the future?
24. What are the greatest challenges of enterprise architecture work?
25. Who should be responsible for enterprise architecture? Why?
26. How have you experienced national EA steering?
27. How have you experienced the EA steering in the case organization?

Enterprise architecture and digitalization

28. How do enterprise architecture and digitalization impact each other?
    a. What challenges does the digitalization trend pose to enterprise architecture?
    b. How does enterprise architecture currently support digitalization?
    c. How could enterprise architecture support digitalization in the future?
    d. What is your estimate about the expertise level of enterprise architecture and digitalization in the case organization?
    e. What's your estimate about the apprecition of enterprise architecture and digitalization in the case organization?
29. Can you come up with examples of services that could be fundamentally redesigned with the help of digitalization?
    a. What needs to happen in order enable such change?
    b. What is currently hindering radical change?
    c. What would be the role of enterprise architecture in such change?