Enterprise Architect Roles and Competencies Within Medium to Large Scale Organizations

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Abstract

The enterprise architect profession is a relatively young profession that came about with the inception of Enterprise Architecture (EA) in the 1980’s. As more companies adopt EA, the demand for enterprise architects to implement and manage such initiatives has been on the rise.

This study uses the grounded theory to explore and understand enterprise architect roles and competencies within medium to large scale organizations. The study finds that there are several roles that enterprise architect play. In addition, there are multiple competencies that enterprise architects must possess.

The study proposes an enterprise architect framework, which can be used by universities as a guide in formulating enterprise architect courses and curriculum. The framework can also be used by organization as a guide to build companywide enterprise architect competencies.

Keywords: Enterprise Architect, Enterprise Architecture, Competence, Role, Competency Framework.
Dedicated to:

My parents: Roy and Mercy Kumwenda
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Mwiza.

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<td>ADM</td>
<td>Architecture Development Method</td>
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<tr>
<td>CCNA</td>
<td>Cisco Certified Network Associate</td>
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<td>CEN</td>
<td>The European Committee for Standardization</td>
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<td>CISSP</td>
<td>Certified Information Systems Security Professional</td>
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<td>CIO</td>
<td>Chief Information Officer</td>
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<td>CRM</td>
<td>Customer Relationship Management</td>
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<td>DOD</td>
<td>US Department of Defense</td>
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<td>DoDAF</td>
<td>The US Department of Defense Architecture Framework</td>
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<td>DYA</td>
<td>Dynamic Enterprise Architecture Framework</td>
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<td>EA</td>
<td>Enterprise Architecture</td>
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<td>EA-CF</td>
<td>Enterprise Architecture Competency Framework</td>
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<td>Enterprise architecture Management</td>
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<td>e-CF</td>
<td>European e-Competency Framework</td>
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<td>ERP</td>
<td>Enterprise Resource Planning</td>
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<td>FEAF</td>
<td>Federal Enterprise Architecture Framework</td>
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<td>IBM</td>
<td>International Business Machines</td>
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<td>II</td>
<td>Information Infrastructure</td>
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<td>IS</td>
<td>Information Systems</td>
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<td>IT</td>
<td>Information Technology</td>
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<td>MBA</td>
<td>Master of Business Administration</td>
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<tr>
<td>MIT</td>
<td>Massachusetts Institute of Technology</td>
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<td>MSCE</td>
<td>Microsoft Certified Solutions Expert</td>
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<td>NAV</td>
<td>Norwegian Labor and Welfare Organization</td>
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<td>NIST</td>
<td>National Institute for Standards and Technology</td>
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<td>NSD</td>
<td>Norwegian Center for Research Data</td>
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<tr>
<td>OECD</td>
<td>Organization for Economic Co-operation and Development</td>
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<tr>
<td>OMB</td>
<td>Office of Management and Business</td>
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<tr>
<td>PHD</td>
<td>Doctor of Philosophy</td>
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<tr>
<td>SMS</td>
<td>Short Message Service</td>
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<tr>
<td>SOA</td>
<td>Service Oriented Architecture</td>
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<td>TAFIM</td>
<td>Technical Architecture Framework for Information Management</td>
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<td>TOGAF</td>
<td>The Open Group Architecture Framework</td>
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1 Introduction

The levels of competition in today’s business environment are high. To remain relevant and competitive, businesses need to react quickly to changing market and consumer needs (Ross, Weill, & Robertson, 2006). To be able to continuously react rapidly to these changes, parts of an organization’s Information Systems (IS), need to be altered or new ones bootstrapped altogether (Hanseth & Lyytinen, 2010; McGovern, 2004). A good dose of agility, foresight and competent professionals who can facilitate and drive business strategy is required to achieve this (Bloomberg, 2013; Fallmyr & Bygstad, 2014).

Information Technology plays a very critical role to the business success of the modern 21st century organization (Beynon-Davies, 2013; Bloom, Garicano, Sadun, & Van Reenen, 2014). However, there are many organizations in industry that are not fully aware of how they can utilize IT to drive business strategy and digitize core business processes (Ross et al., 2006). In addition to this, some organizations are still unaware of how IT contributes to value creation and competitiveness in business (Kappelman & Zachman, 2013; Mathiassen & Pries-Heje, 2006). Research suggests that; organizations struggle with the complexity of Information systems and its subsequent governance (Bygstad & Hanseth, 2016). Yet, we face a future of more complex and interconnected socio technical information systems, more generally referred to as, Information Infrastructure (Ciborra, 2000, p. 59).

There are several approaches in dealing with the challenges above. One such approach is to use management practices such as Enterprise architecture (EA) (Mathiassen & Pries-Heje, 2006). Through EA, organizations can build the necessary foundation that ensures they; remain agile, are adaptable to future change and have the capacity to drive business strategy (Ross et al., 2006). EA is holistic and pragmatic top down approach that tightly aligns the IT logic and infrastructure with an organization’s core business strategy (Hanschke, 2009). EA offers several benefits to an organization, which include: Providing a clear outline of how IT contributes to business value (Ross et al., 2006). EA also provides a roadmap or framework for driving an organization’s business strategy to be competitive (Fallmyr & Bygstad, 2014). Unfortunately, some organizations struggle with implementing and managing EA. One of the main reasons organizations struggle with EA practice is due to lack of understanding of the enterprise architect role and the required competencies (Nygård & Olsen, 2016).
The research findings of a recent study in the Norwegian Higher education sector show that, the ambiguity regarding the role of enterprise architects coupled with lack of management knowledge on EA negatively affects how the EA initiative is handled today (Olsen & Trelsgård, 2016, p. 4). Another study (Nygård & Olsen, 2016) in the Norwegian Health sector, outlines challenges in implementation of EA due to unclearly defined enterprise architect roles and non-competent enterprise architects. Elsewhere, in Malaysia, a study (Bakar, Kama, & Harihodin, 2016) on the implementation of EA in the public sector highlights several challenges, among them: lack of enterprise architect competency. There is, a need for research regarding competencies of enterprise architects to avoid current challenges that result mainly from unclearly defined roles and lack of competency (Olsen & Trelsgård, 2016).

With this background, the main aim of this thesis is to investigate the roles and competencies of enterprise architects. Professionals who are entrusted with implementing the EA practice by identifying key business process and utilizing IT to achieve enterprise-wide business objectives (Ross et al., 2006).

1.1 Problem Statement

The EA initiative provides a good approach to outline how IT contributes to broader organizational goals (Ross et al., 2006). As a result, EA has experienced wide adoption and success within some sectors, especially, the private sector (Hjort-Madsen & Pries-Heje, 2009).

One of the main reasons that organizations struggle to manage and implement EA stems from ambiguity regarding enterprise architect roles and competencies (Hauder, Roth, Schulz, & Matthes, 2013; Nygård & Olsen, 2016). For example, health institutions within the public sector still face a lot of challenges in implementing EA, and consequently approach EA with a pinch of skepticism (Hjort-Madsen & Pries-Heje, 2009; Nygård & Olsen, 2016). Some other problems that arise because of ambiguity in enterprise architect roles and competency include:

- Difficulty in hiring and assigning proper roles to enterprise architects, because organizations are not aware as to what to look for and what EA entails (Nygård & Olsen, 2016).
Organizations have trouble in realizing agility and the value that IT brings to business, which the enterprise architect office helps in facilitating via implementation of EA (Bloomberg, 2013; Ross et al., 2006)

Lack of awareness of enterprise architect role and attributes among academic institutions and professional training bodies leads to a gap in how to teach or train students for the role (Cameron, 2008).

Enterprise architects, have the primary responsibility of ensuring successful implementation and management of the EA initiative in line with an organizations business strategy (Strano & Rehmani, 2007). In addition, enterprise architects, have to ensure enterprise wide adoption of the EA initiative (Van Der Raadt & Van Vliet, 2008). The challenges presented above, bear heavily on enterprise architects. It’s a huge task to say the least. The enterprise architect role spans: complex technical IT, organizational culture, business and domain knowledge (Kappelman & Zachman, 2013). The enterprise architect role is multifaceted because, by nature EA’s are highly complex and heterogenous (Ciborra, 2000; Davoudi & Alioe, 2009).

Unfortunately, most of the research and literature regarding IT and business strategy has been much more focused on the concept of EA as a practice and the value it brings to an organization. There has been little attention paid to the people who are responsible for the enterprise architecture office, the ones tasked with building the EA vision and roadmap.

Understanding the role and competencies of enterprise architects may help organizations to fully utilize enterprise architects in facilitating adoption and management of EA. Further, organizations have the option of utilizing enterprise architects to facilitate the creation of a more centralized IT governance or implement EA to deal with complex II, as alluded to by (Bygstad & Hanseth, 2016). Without a clearly defined set of roles and competencies for enterprise architects, organizations will continue to face challenges in their EA initiatives as recent research within the Norwegian health care system suggests (Nygård & Olsen, 2016, p. 7).

1.2 Significance and purpose of study

The importance enterprise architects to modern organizations needs no further emphasis. Enterprise architects help in facilitating business value addition and predictable IT behavior,
properties that are vital to investors and decision making (Ross et al., 2006; Weill & Ross, 2004a). Enterprise architects, however, encounter different challenges in their jobs. The role and competencies that enterprise architects need to overcome these challenges have not been studied extensively.

The results of this study are beneficial to both individuals, organization and professional or academic institutions. Individuals who want to follow an enterprise architect career path will find information from this study useful by knowing what attributes and skills they can build or improve on. Organizations who want to implement or hire an enterprise architect can use this information as a guide to recruiting the right people for the job.

Considering that IT has become a critical component of modern organizations. The idea of aligning Business strategy and IT, which EA promises, is a mouthwatering prospect for many enterprises. Hence, more organization are adopting EA (Hjort-Madsen & Pries-Heje, 2009). Thus, the demand for competent enterprise architects will grow.

The greater demand for competent enterprise architects justifies the need for more understanding regarding the role to play and competencies needed. There is a need for inclusion and introduction of enterprise architecture based courses in university curriculum and professional training which is mostly lacking at present (Cameron, 2008). The results of this research can be vital for use in formulating enterprise architect curriculum based on what is currently relevant in industry.

Since the initial inception of the first enterprise architecture framework in the mid 1980’s. Enterprise architecture has experienced widespread adoption (Martin, 2012). The findings of recent research on the challenges of implementing and adoption EA in Norwegian health and education sectors, shows that the lack of understanding enterprise architect roles and competencies has a huge negative impact on implementation of the EA (Nygård & Olsen, 2016; Olsen & Trelsgård, 2016). This study will, therefore, be important in filling that knowledge gap that currently exists regarding enterprise architect role and their competencies.

The gap in industry of enterprise architect competencies can be attributed to several reasons: Gaps in current curriculum play a huge role, as McGovern (2004) puts it: “Enterprise architecture skillsets are not normally taught in university curriculum” (McGovern, 2004, p. xxi). Further the breadth of knowledge required for enterprise architects spans: IT and
business whereas most IT training tends to be specialized towards certain IT aspects only (McGovern, 2004; Tambouris, Zotou, Kalampokis, & Tarabanis, 2012).

To explore this topic, the researcher interviewed enterprise architects in Norway and reviewed a wide range of documents on both EA and enterprise architects. A document review on enterprise architect’s profiles and vacancy posting on platforms such as LinkedIn and finn.no respectively was conducted.

1.3 Research purpose and questions

There is a rise in the number of enterprises that are adopting EA and its corresponding frameworks (Hjort-Madsen & Pries-Heje, 2009; Martin, 2012). The implementation and management of EA initiative, however presents its own challenges for enterprise architects and the organization’s in which they work (Bloomberg, 2013; Nygård & Olsen, 2016). It is only inevitable that the need for competent enterprise architects for managing and implementing EA will rise.

With this background, the aim of this research is to enrich the knowledge on enterprise architect roles and core competencies. Being aware of the roles, competencies and attributes of enterprise architects is key for organizations in their quest to deploy and manage the EA initiative (Nygård & Olsen, 2016). In addition, having knowledge on the role and competencies of enterprise architects is vital for academic and professional institutions who want to include enterprise architect courses in their curriculum.

This research specifically focuses on enterprise architect roles and competencies within medium to large scale enterprises. The choice of medium to large scale organizations is because they usually have business and IT functions that are large enough to present complexities that require management practices such as EA. The aim is to investigate and understand enterprise architect roles and competences.

The main research questions that this master thesis addresses are:

1. What are the main competencies that an enterprise architect must possess to enable business and IT integration in an organization?
2. What are the critical roles that an enterprise architect must play to facilitate business process integration and standardization in an organization?

To address the research questions above, the following specific objectives were identified:

- Understand the role of enterprise architects by: analyzing job profiles of enterprise architect and compare & contrast with vacancies of the same, posted by organizations.

- Identify the appropriate competencies that enterprise architects must possess to overcome challenges that they face as perceived by practicing enterprise architects, through interviews.

This study used a grounded theory methodology to explore and understand enterprise architect roles and competencies in line with the questions raised above. To understand the context in which enterprise architects operate, the study looks at EA in more detail in the following chapter.

1.4 Structure of thesis

This Master thesis contains 7 chapters. Chapter 1 introduces the topic of this thesis, and briefly looks at the context of IT and enterprise architecture in general and finally outlines the problem area to be discussed.

Following this introductory chapter, the rest of the thesis is organized as follows:

Chapter 2 drills down on EA practice by presenting key descriptions, concepts and giving a historical background of EA. The whole purpose is to give the reader a good and comprehensive picture of EA as the context in which enterprise architects operate.

Chapter 3 presents review and synthesis of literature regarding enterprise architect roles and competencies. The chapter mainly focuses on three main problematic areas that may arise because of ambiguity regarding the role of enterprise architects, as highlighted in recent research studies. The purpose is to demonstrate current knowledge and the research gap in enterprise architect roles and competencies.

Chapter 4 provides a general introduction to qualitative research methods. The research method and approach used in this study are presented therein. In addition, the chapter details
how this research study was conducted. Lastly, the chapter presents the ethical considerations that were made pertaining to this research.

In chapter 5 the analysis and main findings of this research study are presented. Further, a proposed enterprise architect competency framework is revealed.

Chapter 6 presents a discussion on the findings that are presented in the previous chapter. In addition, the chapter highlights how the findings correspond with what is in literature.

Chapter 7 gives a summary of the study and further looks at opportunities for further research.
2 Background

This chapter presents an overview of Enterprise architecture as the context in which enterprise architects work. “Information systems are part of their social context of use, and vice versa” (Braa & Hedberg, 2002, p. 117). Thus, it is important that we understand the context and the scope at which enterprise architects operate in, within an enterprise (Klein & Myers, 1999).

Enterprise architecture can be considered to be a relatively young discipline (Schelp & Stutz, 2007). The concept of EA dates back to the mid-1980’s when John Zachman, who is considered as the founding father of EA, published an article in an IBM journal (John A. Zachman, 1982; John A Zachman, 1987). This publication was followed by another article entitled “A Framework For Information Systems Architectures” (John A Zachman, 1987). In the paper Zachman provided architecture models that were relevant to different stakeholders.

The initial aim of EA was to solve issues pertaining specifically to complex Information Systems (IS). With time, the scope has expanded to include not just IS, but the whole organization including strategy and business management (Ross et al., 2006).

2.1 Why Enterprise Architecture

If implemented and managed properly EA presents several benefits to an organization, some of which include: enabling organizations to be agile in their mode of operation (Bloomberg, 2013; Fallmyr & Bygstad, 2014). Second, EA can greatly improve decision making with regards to such critical issues like IT principles, and major IT investments and ensure transparency on the same (Hanschke, 2009; Weill & Ross, 2004b). Third, EA can ease the management of complex II (Bygstad & Hanseth, 2016). Lastly but not least, EA can enable an organization to increase revenue and reduce operational costs (Ross et al., 2006). In view of these benefits, EA has experienced wide adoption in industry. Some governments have even made EA practice mandatory in within the public sector via legislation. For example, USA and Finnish governments through the Clinger-Cohen act and an act of parliament respectively (GAO, 2012; Riihimaa & Syynimaa, 2011)

2.2 What Is Enterprise Architecture

Enterprise architecture has several definitions in literature. At present, EA still lacks a standard definition (Ross et al., 2006; Simon, Fischbach, & Schoder, 2013). To adopt an
appropriate definition that fits this study, we will first look at the two distinct terms that make up enterprise architecture (i.e. *enterprise* and *architecture*).

### 2.2.1 Enterprise

An enterprise can be defined as a social system with a specific purpose (Proper, 2013). TOGAF (2009, p. 5) defines enterprise as “any collection of organizations that has a common set of goals”. PEAF presents a more detailed definition of enterprise as follows: “The word *Enterprise* should be interpreted as a general noun – the name of something - to refer to any and all of these types of things; public and private companies, government agencies, charities, universities etc. This is not an exhaustive list but illustrates the point. In addition, the word *Enterprise* should also be interpreted to mean any name given to any of these types of Enterprises, e.g. a private company may be referred to as a Company, Business, Corporation, Conglomerate, Organization, SME, Firm, Establishment, Group, Multinational, Venture. The word *Enterprise* refers to them all” (PEAF, 2017).

Based on this definition of enterprise, the remainder of this thesis will use the term organization and enterprise interchangeably as it essentially refers to the same thing.

### 2.2.2 Architecture

The encyclopedia Britannica defines architecture as “the art and technique of designing and building ” (Britannica & King, 2009). The term is quite general and broad as it does not explicitly mention what it is, that one is designing or building. Zachman (1997) defines architecture as “that set of design artifacts, or descriptive representations, that are relevant for describing an object such that it can be produced to requirements (quality) as well as maintained over the period of its useful life(change).” (John A Zachman, 1997, p. 5). TOGAF limits its definition of architecture to systems. TOGAF (2009) defines architecture as a formal description of a system and its related components. Within EA context, architecture can be viewed as a heterogenous socio technical structure of the enterprise and its environments as summarized in the diagram below.
2.2.3 Defining Enterprise architecture

Having defined the components that make up the word enterprise architecture. We will now adopt a definition of EA that fits within the confines of this study. Enterprise Architecture is a management practice. It can be defined as: “set of processes, tools, and structures necessary to implement an enterprise-wide coherent and consistent IT architecture for supporting the enterprise’s business operation” (Kaisler, Armour, & Valivullah, 2005). Hanschke (2009) highlights that EA is important for alignment of business and IT to realize more business value. By aligning business and IT, organizations can utilize EA to build an operating model that defines how to transition from current state to a desired business strategy or target state. The main aim of EA is; to provide a long-term holistic and pragmatic view of the enterprise’s business processes, systems and technology infrastructure to enable building of enterprise-wide capabilities (Ross et al., 2006). EA is a blueprint for organizational transformation and IT modernization (McGovern, 2004).

2.3 Enterprise Architecture

The enterprise architecture practice allows organizations to form a foundation for execution. Based on this foundation, an organization can drive business strategy by ensuring that they remain agile and adaptable to changing market needs, consumer taste and future business
challenges (Ross et al., 2006). With EA, organizations are able to remain agile, increase business value and return on investment and have a transparent structure for decision making on key business assets (McGovern, 2004; Weill & Ross, 2004b).

EA helps in identifying key assets of an enterprise, such as: business processes, IT systems, key personnel, financial assets etc. EA then maps out how these assets function together to achieve enterprise-wide objectives and business goals. The goal of identifying these processes is to check on the levels of standardization and coordination across an organization (McGovern, 2004; Ross et al., 2006). For example, if key decisions on assets is uncoordinated, resources usually end up being duplicated within business units of the enterprise resulting in loss of enterprise agility (GAO, 2012; McGovern, 2004).

Through EA, an organization should be able to address some of the following questions:

- Where does the customer data reside?
- How do investments in IT equate to enabling strategic enterprise-wide business goals?
- Does our organization have an operational process model?
- Do we readily have the necessary information to make product and client decisions?

Related to EA are the concepts of defining an operating model via business process integration and business process standardization.

The diagram below describes some important aspects of EA on an enterprise-wide level.
2.4 History of Enterprise architecture

As pointed out earlier in this chapter, EA started gaining prominent traction in the 1980 after Zachman’s publications. The level of adoption and implementation has been relatively significant (Mathiassen & Pries-Heje, 2006). Literature about EA has also been on the rise in recent years, a sign of how rapidly the profession is growing.

The figure below, shows statistical figures from Google’s Ngram viewer to emphasize the growth of enterprise architecture literature since the early 1980s.
Zachman pioneered the Zachman enterprise architecture framework in the mid 1980’s. The Zachman Framework is still a very widely used EA framework to this day.

In the late 1980’s the United States department of defense (DoD) developed the Technical Architecture Framework for Information Management (TAFIM) (Hagan, 2004). TAFIM is an enterprise architecture reference model to provide guidance on the use of the US army’s evolving technical infrastructure.

In 1989 the National institute for standards and technology published an enterprise architecture model known as NIST Enterprise architecture Model (Hagan, 2004). NIST transcended from a focus on traditional IT systems to something that was a lot more generic. NIST defined the interrelation between the business, information and the technology environment(Hanschke, 2009). This mainly aimed at showing enterprise architecture as a key enabler for the transformation of business strategy to executable IT initiatives.

The Open Group Architecture Framework (TOGAF), which is widely used in many organizations at present, was developed in the year 1995 by The Open Group (Hagan, 2004). TOGAF was based on an earlier enterprise architecture framework TAFIM.

In 1996, the US government adopted the clinger-Cohen Act. In a nutshell, the act entails that the federal agency chief information officer (CIO) must facilitate the development of and or
maintenance of IT architecture. The Office of Management and Budget later clarified that by IT architecture they in essence mean Enterprise architecture (GAO, 2012, p. 4). And in 2007, the OMB introduced an EA guideline within the federal government.

From the early 1990’s to the year 2000, EA experienced huge growth because there was so much adoption by many medium to large cooperates in both the private and public sectors (Hjort-Madsen & Pries-Heje, 2009).

The timeline below summarizes the major development within enterprise architecture from the mid 1980’s to the year 2006.

![Timeline](source: https://online.ist.psu.edu/sites/ist402ea)

**2.5 Enterprise Architecture Frameworks**

This section will define and describe some of the most commonly used frameworks by enterprises and enterprise architects in implementation and management of EA.
Frameworks are tools that help in organizing concepts, knowledge and thinking. Frameworks present information in a compact form that helps professionals understand concepts easily, communicate effectively and ensures consistency (McGovern, 2004).

EA frameworks organize concepts, principles, artefacts, processes templates and reference models which in turn help enterprise architecture professionals as they work with various stakeholders (Hanschke, 2009). EA frameworks also provide standard vocabulary for discussing, writing and practicing EA. A standard vocabulary is critical in such a professional discipline because it enhances communication. Enterprise architects communicate with stakeholders from different background e.g. business, marketing, IT etc. (Hanschke, 2009; TOGAF, 2009).

EA could be daunting to learn, comprehend and implement without EA frameworks. Zachman and TOGAF are two of the most widely used enterprise architecture frameworks at present (Hanschke, 2009). Some of the other frameworks include: FEAF, DoDAF and Gartner.

Basically, an EA framework should contain some of the following features:

1. Business Value measurement metrics
2. EA maturity model
3. EA initiative model and
4. An Enterprise communication Model.

**Zachman Framework**

The Zachman framework is an EA ontology and Meta model. The framework presents a compartmentalized format of the concepts, information, processes and perspectives that are required to model EA. The framework presents information in a 2-dimensional matrix of perspective roles and critical questions. The questions help in understanding the nature of EA. Zachman provides professional enterprise architect certifications which are based on their framework.
Below is a diagram outlining the core aspects of the Zachman framework in a 2-dimensional matrix.

<table>
<thead>
<tr>
<th></th>
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<th></th>
</tr>
</thead>
<tbody>
<tr>
<td>Enterprise Model (conceptual) Business Owner</td>
<td>e.g. Semantic Model</td>
<td>e.g. Business Process Model</td>
<td>e.g. Business Logistics System</td>
<td>e.g. Workflow Model</td>
<td>e.g. Master Schedule</td>
<td>e.g. Business Plan</td>
</tr>
<tr>
<td>System Model (logical) Designer</td>
<td>e.g. Logical Data Model</td>
<td>e.g. Application Architecture</td>
<td>e.g. Distributed System Architecture</td>
<td>e.g. Human Interface Architecture</td>
<td>e.g. Process Structure</td>
<td>e.g. Business Rule Model</td>
</tr>
<tr>
<td>Technology Model (physical) Implementer</td>
<td>e.g. Physical Data Model</td>
<td>e.g. System Design</td>
<td>e.g. Technology Architecture</td>
<td>e.g. Presentation Architecture</td>
<td>e.g. Control Structure</td>
<td>e.g. Rule Design</td>
</tr>
<tr>
<td>Detailed Representation (out-of-context) Subcontractor</td>
<td>e.g. Data Definition</td>
<td>e.g. Program</td>
<td>e.g. Network Architecture</td>
<td>e.g. Security Architecture</td>
<td>e.g. Timing Definition</td>
<td>e.g. Rule Definition</td>
</tr>
<tr>
<td>Functioning System</td>
<td>e.g. Data</td>
<td>e.g. Function</td>
<td>e.g. Network</td>
<td>e.g. Organization</td>
<td>e.g. Schedule</td>
<td>e.g. Strategy</td>
</tr>
</tbody>
</table>

Figure 5: Zachman Framework
*(source: http://www.enterpriseunifiedprocess.com/essays/zachmanFramework.html)*

**TOGAF**

TOGAF is administered by The Open Group and is currently at version 9.1. It is specified in 6 core parts or dimensions namely, Architecture Content Framework, The Architecture Development Method (ADM), ADM Guideline and Techniques, Enterprise Continuum, Architecture Capabilities Framework and the TOGAF reference models. TOGAF also describes building blocks that can be used in enterprise architecture.

Like Zachman, TOGAF also provides professional enterprise architect certifications which are tailored towards its own framework.

The figure below gives a brief outline of the TOGAF Framework.
Figure 6: TOGAF Framework


The TOGAF framework can be viewed as leaning more towards the traditional Enterprise Architecture Management (EAM) approach. Within TOGAF, development and management of EA is referred to as Architecture development method (ADM). ADM is a sequence of steps in iteration for developing customized enterprise architecture that fits the needs of the organization (Hanschke, 2009). ADM also provides guidelines and techniques of best enterprise architecture practice and describes more practical considerations for using the framework.

ADM can be summarized in these steps: scope definition, identifying stakeholders, creating architecture vision and obtaining approvals. The process begins by creating an architecture vision (i.e. the future desired state of EA) and then builds the EA via iterations.

The figure below summarizes ADM
In comparison to the Zachman framework, TOGAF is generally more prescriptive and has more detail on implementation of EA. Further, because of the use of ADM, the TOGAF framework allows for more flexibility with the iterative processes. The Zachman framework, on the contrary, prescribes a precise method on how to implement an EA (Hanschke, 2009).

2.6 Scope of Enterprise Architecture in an Organization

Within an enterprise, there are often several kinds of architecture that exist. For example, IT architecture, business process architecture, information architecture, systems architecture and software architecture (McGovern, 2004). Often, EA is mistaken for these other forms of IT related architectures and vice versa (Ross et al., 2006). Such misunderstanding consequently result in confusion regarding the enterprise architect roles and competencies within
organizations. Although enterprise architects may share similar kinds of attributes with other kinds of IT related architecture, however, there are obviously inherent differences.

One of the main factors that separates EA from other IT related architectures is the scope and breadth that EA covers within an organization. EA encompasses or encapsulates all the other forms of architecture that fall within an organization.

The figure below shows encapsulating nature of EA with reference to other forms of architecture within an organization.

![Diagram summarizing encapsulating nature of EA](https://www.dragon1.com/tutorials/how-to-create-an-enterprise-architecture-framework-diagram)

EA is a holistic, high-level view of an organizations logic and process, it encompasses not only the IT aspect, but business as well (Hanschke, 2009; Ross et al., 2006). As such EA will not be bogged down with minute details. For example, EA core diagram as presented by Ross et al (2006) only focuses on high level business process and IT requirements and in turn the
other kinds of architecture will take care of the granular details (Ross et al., 2006). From the diagram, above, take for example, technology architecture which appears as part of EA. The technology architecture will then outline in detail the technology infrastructure services and standards that exist in an organization.

**Summary**

This chapter has described EA as the context in which enterprise architects work and looked at the benefits EA can bring to an organization. The chapter has also presented and looked at two of the main EA frameworks in use today. Lastly the chapter has presented the scope at which EA operates within an organization, a factor that differentiates it from other forms of IT related architectures.
3 Literature Review

Enterprise architects help in facilitating the successful adoption of EA in an organization (McGovern, 2004). Organizations struggling with complex II can also make use of enterprise architects to streamline and create governance structure and EA to enable a more manageable II, for example, a more centralized governance (Bygstad & Hanseth, 2016). Recent research reveals that; some organizations are facing challenges in implementation and management of EA because of unclearly defined enterprise architect roles and competencies (Nygård & Olsen, 2016; Olsen & Trelsgård, 2016). Without a clearly defined set of roles and competencies for enterprise architects, organizations will continue to face challenges in the EA initiative as recent research within Norwegian health care system reveals (Nygård & Olsen, 2016, p. 7).

This literature review will address three areas of research regarding the ambiguity in enterprise architect roles and core competencies. These three areas that this literature review focuses on are important because they relate to the research problem of this master thesis and will help in illuminating what has already been studied and the gaps that this study can address or further research on. The first section, will look at the multifaceted nature of enterprise architect’s role which brings about confusion for human resource recruiters and the expected roles that enterprise architects should play in an organization. In the second section, this review looks at research related to the inclusion enterprise architecture course or training in university curriculum. Lastly, the final section, will discuss some of the challenges in implementing EA, specifically within Norwegian health and education sectors.

The scholarly articles that have been used in this literature review are peer reviewed. The researcher started with more general searches and then narrowed down the of search results for the relevance of this study, some of the following key word combinations were used: enterprise architect roles, enterprise architect competencies, enterprise architect education, enterprise architect education and curriculum, challenges in implementing enterprise architecture, challenges enterprise architects face. The relevant articles were summarized and organized into an excel file see Figure 8 below.

A criterion to narrow down the search results was to limit the search to article published within the past ten years (at the time of writing). The main of articles cited in this section are
all less than ten years old except for a few. The reason behind using recent articles is because the IT landscape changes so quickly and so does its research literature (Bui, 2013).

Summary of the literature review organized and summarized in an excel file is shown in the figure below.

![Figure 9: Literature review summary organized in excel](image)

### 3.1 Multifaceted Nature of Enterprise architect role

Some of the ambiguities related to the enterprise architect role in an organization are due to the fact that the role is multifaceted and its scope transcends both business and IT (Gøtze, 2013).

A study on enterprise architect roles by Strano and Rehmani (2007) provides insight on the roles that enterprise architects can play and highlights some of the high-level competencies that enterprise architects need to possess within the US federal government departments.

The significance of the study by Strano et al (2007) to this research is threefold. Firstly, the study outlines the differences between enterprise architecture and system architecture thereby helping in clearing ambiguity regarding EA and enterprise architect roles. Second, the study
looks at some competencies that are required for organizations to maximize enterprise architect’s effectiveness in the role. Lastly but not least, the research highlights some of the gaps in university curriculum and enterprise architect with regards to enterprise architecture training.

The study (Strano & Rehmani, 2007) explores the multifaceted and changing nature of the enterprise architect roles and the value that enterprise architects bring to an organization. To explore current literature gaps and learn more about the area of study, the authors conducted a review of literature related to evolving role of enterprise architects and its relationship to such other roles as business management, systems engineering and architecting. The researchers highlight that rapid changing business environments and other challenges such as complexity and business competition have created the need for EA and enterprise architects. The study shows that EA provides the necessary foundation on which high performing organization can build to encounter future challenges and be adaptable to change. The researchers, however, found that most of the literature they reviewed regarding enterprise architect roles and competencies begged more questions than answers as most of the studies regarding the role were not analytical (Strano & Rehmani, 2007).

The study used a qualitative data analysis method to gain a deeper understanding than what was present in the literature. Grounded theory provided the structure for analyzing and identifying emerging patterns from the descriptions. For data collection, the researchers used mainly three methods: Text data from: Vacancy posts, career profiles. Observations on enterprise architects to appreciate and understand how they work in a real-world scenario. And selected interviews were made with informants to gain insights and more specific details.

A total of four observations were made for the study, notes were taken. The collection of data was concerned with some of the following attributes: key functions performed by enterprise architects, benefits the role provides to an organization, competencies most needed to be effective in the role (Strano & Rehmani, 2007).

The study findings reveal that the enterprise architect role is quite multi-dimensional, having several roles. The roles were categorized into change agent, communicator, leader, manager and modeler. The study also finds that there are different kinds of enterprise architects depending on the scope at which they are working e.g. unit architect, divisional architect and department architect as evident in the US federal government departments. The study findings
also reveal that the key people that enterprise architects are in contact with include: senior business executives and board of directors. The data analyzed however showed some variation as to where an enterprise architect should be positioned. The consensus, however, was that enterprise architects need to be positioned where they can have maximum impact within the organization (Strano & Rehmani, 2007).

The study by Strano et al (2007) give insightful details into the nature of the enterprise architects role, however the study lacks in clarifying the criteria used in recruitment the informants.

A similar study on the nature of the enterprise architect role by Gøtze (2013) reveals that the enterprise architect role is multifaceted and could comprise of at least five main roles. As EA evolves so does the role of the enterprise architect. The study identifies three possible types of enterprise architect, namely: core enterprise architects, implicit enterprise architects and applied enterprise architects.

### 3.2 Enterprise architect skillset and competency gaps emanating from gaps in university curriculum and other enterprise architect training.

The EA practice presents several challenges in implementation and management to enterprise architects (Strano & Rehmani, 2007). Research argues that one of the reason behind organizations struggling in implementing and managing EA is in part due to non-competent enterprise architects as a result of the way professionals are currently trained today (Cameron, 2008; Nygård & Olsen, 2016). Several studies on enterprise architect competencies find that current education and training is more focus on teaching specialized technical skill only, whereas EA requires diverse competencies such as: business understanding and soft skills (Cameron, 2008; Gøtze, 2013; Kappelman & Zachman, 2013; Tambouris et al., 2012).

Some of the other challenges which enterprise architects encounter and yet normally taught in schools include complex nature of the II (Bakar et al., 2016; Nygård & Olsen, 2016). The enterprise architect role itself is also itself challenging because it is multifaceted in nature and the roles can take on several faces depending on context, which also makes the role ambiguous to some extent (Gøtze, 2013).
3.2.1 Need for EA Education

To cover this competency and skillset gap to meet industry needs, there is a need to integrate EA courses in university curriculum (Cameron, 2008; Tambouris et al., 2012). Cameron (2008), further argues that there is need for a shift in IT Education from mostly focusing technical IT, to rather focus more on strategy and planning skills. Another study shows that current university IT education is layered with technical focus on for example databases, networks and application which allows for technically capable students, but rather lack the necessary competency and skills like communication and strategy, which are important for the enterprise architect role (Cameron, 2008).

It must be mentioned here that, at the moment some universities, colleges and professional bodies like Zachman and TOGAF offer education, training and certifications in EA geared towards enterprise architects (Cameron, 2008; Tambouris et al., 2012). Some institutions such as, Association for Computing Machinery (ACM) and CEN have also tried to provide a framework for EA training through MSIS and European Competence Framework respectively (Cameron, 2008; Tambouris et al., 2012). Research, however, shows that professional certification like TOGAF and Zachman are not adequate in themselves as they only focus on their own specific frameworks leading to inequality in the training and EA implementation (Tambouris et al., 2012).

A study (Kappelman & Zachman, 2013) on the challenges of EA, highlights that IS professionals tend to be inclined towards specializations that are reductionist whereas EA needs generalists. Another research agues on similar notions. Its findings show that some enterprise architects struggle to implement EA due to a lack of business literacy (Cameron, 2008). Although, the institutions highlighted above have tried to fill the gap of lack of competent and well trained enterprise architects. There is still a huge need for new curricula that is relevant to the challenges of current business environment developed from the ground up from an enterprise architect perspective (Cameron, 2008, p. 119).

The new proposed curricula ought to shift current focus from mainly concentrating on technical expertise only, to a focus on how enterprise architects can contribute to business strategy and development of systems that are dynamic and adaptable to future business requirements. Currently students are trained in design, implementation and integration of systems. The courses for these trainings are offered in layers focusing on databases, networks
and apps. Such kind of layered teaching falls short of training student for the holistic nature of EA perspective (Cameron, 2008).

By incorporating EA curriculum in IT training programs, the focus will shift from narrow specialization to a broader focus on educational goals such as: understanding how technology can be used to provide a competitive advantage, designing complex integrated systems, understanding assessment of integrated systems and finally but not least: learning how EA design is done and practiced professionally in industry (Cameron, 2008).

The drive to change EA curriculum among academic institutions especially is not without its own challenges. New courses in academic institutions usually must go through so much paperwork and committees for approval. Administratively, deans and provosts normally avoid nontraditional academic thinking hence rarely branch into unfamiliar academic tracks for student education. The other challenge is that the pace of change in industry makes it hard for academic institutions to offer education that meets industry needs. With the current gap in enterprise architects , it is also challenging to find well qualified enterprise architects who are able to teach or share EA knowledge pedagogically (Cameron, 2008).

Another challenge facing academic institutions in creating EA curriculum is that the ambiguous nature of enterprise architect roles and competencies coupled with lack of an overseeing organization often leads colleges to adopting disparate curricula as a survey in most colleges in the US shows (Cameron, 2008).

Information Technology training is an expensive venture. The cost of IT education falls mainly into the following categories: cost of equipment, instructors, and cost of training materials like books etc. Updating IT equipment to current industry standards may be too expensive which forces academic institutions to refrain from teaching cutting-edge content as a way of accommodating outdated equipment and cutting down on cost (Cameron, 2008).

The section to follow highlights some of the professional and academic training programs that are currently available.

Private organization like Zachman and TOGAF usually hold private EA courses with the possibility of certification. These courses usually teach framework specific, EA concepts. Some other organizations like IBM also provide training programs for enterprise architects. The following are some of the programs available at present: Federated Enterprise Architect
Institution (FEACI), The Open Group Certified Architect Program (Open CA), Zachman Certified -Enterprise Architect program. It must be noted that these programs do not follow any specific EA guidelines for determining competences and intended learning outcomes. The difference in training programs results in inequality between enterprise architect qualifications and EA implementation (Tambouris et al., 2012).

The available academic programs comprise of both postgraduate programs and graduate course modules in EA. The following are some of the academic institutions providing postgraduate programs: Royal Melbourne institute of Technology, Australia; Griffith University, Australia; and Brunel University, UK (Tambouris et al., 2012).

The study suggests that training institutions can make use of frameworks such as EA-CF to have standardized competency framework. The EA-CF is a model that tries to outline the skills and competencies of enterprise architects within Europe. The EA-CF model contains 10 classes, 127 concepts and 30 relationships. The diagram below summarizes the framework.

![Ontology depicting EA-CF concepts](source: Tambouris et al, 2012 p. 131)
The results of the study by Cameron (2008) and Tambouris et al. (2012) reveal that there are very limited EA trainings especially in both academic and professional institutions. The research suggests that training institutions could utilize the frameworks such EA-CF to provide lifelong training in line with the e-CF. It must be noted that the EA-CF is only a proposed framework and it has not been used in practice. The researchers call for more research regarding the use of EA-CF in a real-world scenario to build a curriculum based on it (Cameron, 2008; Tambouris et al., 2012).

From the searches conducted on major databases, there generally seemed to be lack of empirical literature regarding enterprise architect education and related curriculum as alluded to by (Strano & Rehmani, 2007, p. 383).

3.3 Challenges of non-competent and un-clearly defined role of enterprise architect in implementation of EA

Ideally, the EA practice needs to be guided by capable enterprise architects with a clearly defined role. This section looks at some of the challenges encountered in the implementation of enterprise architecture. The challenges are especially due to the lack of competent and unclearly defined enterprise architect roles. Case in point, the challenges encountered by the Norwegian health sector in the implementation of EA, because the enterprise architect roles were not clearly defined, and lack of effective communication (Nygård & Olsen, 2016).

Previous studies (Olsen & Trelsgård, 2016) also indicate the challenges that many organizations face in implementing EA, due to a lack of the necessary competency by enterprise architects for the job. An exploratory study on the Norwegian health sector also highlights some challenges in EA implementation.

The study by Nygård and Olsen (2016) on the Norwegian health sector discusses some of the challenges encountered in the implementation of EA within the Norwegian health sector. The study starts by looking at the various definitions of enterprise architecture definitions that currently exist in literature. The researchers define the EA as holistic view of an organization with emphasis on business and IT. The study further adopts Aier, Gleichauf and Winter (2011) definition of EAM, which is defined as the set of management activities to develop install and maintain the EA practice in an organization (Nygård & Olsen, 2016). Companies
with complex IT environments aiming at high levels of standardization and integration can greatly benefit from EA.

To develop and maintain EA, organizations usually follow a set of EA practices commonly known as enterprise architecture management. There are three main approaches to enterprise EAM namely: Massachusetts Institute of Technology (MIT) approach, Dynamic Enterprise Architecture (DYA) approach and traditional approach. In traditional EAM, enterprise architects carry out the following four main sequential processes of: documenting current state, developing desired future state, developing the mitigation plan and repeating all over again. In contrast to the traditional approach, the MIT approach as advocated by Ross et al (2006) places emphasis on developing a long-term vision road-map at an enterprise wide level. In DYA, EAM is viewed as rather a passive reactive response to business initiatives by an organization. It is argued that organizations rarely follow only one of these but rather that they use specific elements from these methods that fits their needs (Nygård & Olsen, 2016).

The exploratory study of the Norwegian health sector by Nygård and Olsen (2016) was conducted within the four health regions of Norway. The health regions are each headed by a regional authority who in turns reports to the government. Until 2007, the trusts operated as autonomous entities, with uncoordinated ICT systems and were restricted to share data. Later in 2013, the Digital Renewal program was initiated at regional level in a bid to standardize work processes and technology. On a national level The Nasjonal IKT (NIKT) was established, in 2014, to coordinate ICT initiatives within the specialized health sector.

The share number of actors involved in this project coupled with the digitization initiative added complexity to the project. The research was set out to investigate which challenges are most important in realizing a common EA in the specialized health care services.

Data from the interviews was recorded and transcribed. The categories from the analysis were as follows: Tools, organizational challenges, projects challenges, decision authority, enterprise architecture, communication and Governance (Nygård & Olsen, 2016). The following section discusses some of the challenges.

**Unclearly defined enterprise architect role**

The results of the study reveal that lack of clarity on the enterprise architect role is a major challenge today. The study reveals that all the organizations from which the informants came
from experienced problems of non-clearly defined roles. Due to this, there is generally also a lack of understanding as to what is expected of an enterprise architect. From the study, it emerged that sometimes enterprise architects are given assignments that are not expected of them. In some projects for example, some personnel were not aware as to when to engage an enterprise architect and what the role of the enterprise architect was within the projects. Overall, the organizations explored in the study lacked knowledge of the enterprise architect role, which negatively affected the implementation of EA. The study findings of the research attributed the lack of enterprise architect knowledge to a lack of policies and rules, and that organizations generally do not pay enough attention to EA (Nygård & Olsen, 2016).

**Lack of EA knowledge by managers**

Another challenge encountered with implementation of EA in the Norwegian health sector was the lack of senior management knowledge about EA. This resulted in EA practice not getting enough support from management. The study also reveals that most managers did not see and appreciate the value that EA could bring to the organization (Nygård & Olsen, 2016).

**Communication challenges**

The study reveals that non-competent enterprise architects faced problems in communicating, particularly with senior managers and other ICT staff in their organization. For example, enterprise architects failed to properly communicate the benefits and necessity of EA to senior managers. The study finds that the challenges in communication were due to enterprise architects using very technical IT language to non-IT business managers. The communication challenges were also between enterprise architects and other key projects stakeholders because the details being communicated by the enterprise architects was either too detailed or so technical. In some scenarios, ICT staff were not aware of EA and hence a language divide gap would exist between enterprise architects and the other ICT staff.

**Organizational challenges**

The study identified a couple of challenges in organizational level relationship with non-competent enterprise architects. The study finds that the relation between the IT vendor and the health regions was strained because of lack of trust between these organizations which negatively affected EA. As a remedy for this, it has been suggested that the EA initiative
should be enforced across all the four health regions of Norway or at the national level, to gain the required level of support (Nygård & Olsen, 2016).

**Tools challenges**

Lastly but not least, the study findings show that enterprise architects in the study found some EA tools to be difficult to use. In this case, a tool named as Troux was being used and the enterprise architect would have loved to have received proper training regarding the tool. However some of the enterprise who had used the tool for the past decade and attended several trainings on the same, also emphasized on the difficulty in using the Troux tool (Nygård & Olsen, 2016).

The findings of the study are consistent with general literature on the success factors of EA implementation with regards to enterprise architect skills, training and education. Research also shows that the enterprise architect roles is generally characterized by a level of complexity that makes it difficult to define the role. Communication challenges between enterprise architects and other stakeholders was also observed in other studies (Olsen & Trelsgård, 2016).

The research finding are also similar to a study conducted on the implementation of EA in the Norwegian higher education sector (Olsen & Trelsgård, 2016). The study shows that EA has gained more acceptance within the Norwegian public sector. However, lack of properly defined enterprise architect role and non-competent enterprise architects hampers EA implementation (Olsen & Trelsgård, 2016).

Finally, the study by Nygård and Olsen (2016) was conducted within one sector only. As such the findings of the study are limited in their level of generalizability to other sectors. The research, however, could serve as input for future studies in the health sector or public sector to see if the results can then be generalizable in such settings.

### 3.4 Summary

This literature review has addressed three main areas related to the aim of this research study. The literature used is peer reviewed and from studies conducted within the past ten years because literature changes quickly.
Several conclusions can be drawn regarding enterprise architect competencies. First, research reviewed in this section shows that there is a strong need for competent enterprise architects and more clearly defined enterprise architect role. Some of the challenges in implementation and management of EA can be attributed to the ambiguous nature of the role. The research studies reviewed in this chapter also reveal that the gap in enterprise architect competencies can be attributed to the way in which IT education is currently conducted. There is more focus on mainly technical skills whereas enterprise architects require both technical, business and soft skills. The studies also find that university curriculum and professional training institutions need to train more people for the role. Regarding the enterprise architect role, the studies reviewed show that the role is multifaceted and dynamic in nature, thus the role changes depending on the nature of the company and the EA maturity. The studies show that there is need for more empirical research regarding enterprise architect roles and competencies.
4 Research Methods

This chapter presents the research approach, methodology, data collection methods and analysis techniques that were used in this study.

The research explored enterprise architect core roles and competencies within medium to large scale organizations. The research used the grounded theory methodology for qualitative analysis of data.

4.1 Qualitative Research methods

There are several methods to research, these methods are most commonly distinguished as either being qualitative or quantitative methods (Myers, 1997). Creswell (2009), suggests that qualitative research methodology aims at exploring the meaning that individuals or groups ascribe to some social and human problem. Accordingly, qualitative research methods are meant to aid researchers understand phenomenon within certain social context (Myers, 1997). One distinct characteristic between qualitative methods and quantitative research is that: quantitative research seeks to confirm hypothesis about a phenomenon whereas qualitative research aims at exploring and understanding the phenomenon (Creswell, 2013).

Based on the aim of this study to explore and understand enterprise architect roles and competencies within EA context, the study will use qualitative methods. Qualitative methods are suited for this kind of study for their ability to produce rich, intersubjective and holistic understanding of a phenomenon and human experience (Creswell, 2013; Myers, 1997).

4.2 Why Qualitative research

The main aim of this study was to: explore and understand Enterprise architect core roles and competencies. The nature of this study was to explore and gain a deeper understanding of a phenomenon, hence it followed the qualitative research method.

This section describes some of these properties of a qualitative research, such as: its general framework, analytical objectives, question format, data format and flexibility in design.

General Framework: Qualitative research seeks to explore phenomenon and not test it, this study sought to understand and explore enterprise architect core roles and competencies (i.e.
exploring phenomenon). Qualitative methods also offer flexibility in nature of instruments that may be used: for example, categorizing of informant data into themes which does not require much resources (Creswell, 2013; Myers, 1997; Strauss & Corbin, 1997). To allow for better exploration and a deeper understanding of the phenomenon, a qualitative study may deploy semi-structured or in-depth interviews and observation groups (Glaser & Strauss, 2009).

Analytical objectives: qualitative research seeks to describe variation and not just quantify it as in a quantitative study (Creswell, 2013). In addition, a qualitative method makes it possible to view a social phenomenon through the eyes of actors that are involved. In this case, one such actor may be an enterprise architect. The interaction and relationship between actors efforts to establish change or create certain structures can be studied through experience, knowledge and the practice of the involved individuals (Silverman, 2011). The experience, knowledge and of people who have practiced EA was relevant for this study.

To allow individuals to uniquely share their experience and describe relationships, qualitative studies deploy semi-structured in-depth interviews (Creswell, 2013). In a semi-structured interview, the informant has the liberty to explain phenomenon with their own words without much fixed constraints, the interview is led by an interview guide. On the other hand, quantitative research uses close ended questions (w Creswell, 2009). Data captured in qualitative research is textual based, because normally the data is collected via: tape, video recording and supported with notes and observations that are written down. This study used semi-structured interviews, analysis of vacancy posts and analysis of LinkedIn profiles. The interviews were audio recorded and later transcribed.

Qualitative research method allows for a degree of flexibility to research design and research process. The flexibility property was appropriate for this study because of the following reasons. Firstly, a research has the ability to change data collection methods to get access to specific data (Hammersley & Atkinson, 2007). The semi-structured interviews that were used in this study allowed the researcher to ask different set of questions to the informants depending on how the interview was proceeding. Secondly, Semi-structured or in-depth interviews also has the unique feature of allowing a researcher to ask leading or probing questions depending on an informant’s reply (Myers, 1997). Lastly, the flexible nature of semi-structured interviews allowed for the researcher to refine and improve interview approach based on hiccups observed from previous interviews (Glaser & Strauss, 2009).
The diagram below, summarizes some aspects of the qualitative research approach:

![Qualitative Research Design](https://www.northumbria.ac.uk/static/images/schoolimages/ar_images/cetl/gilddavisondiagram1.jpg)

Figure 11: Summary of qualitative research method

(source: https://www.northumbria.ac.uk/static/images/schoolimages/ar_images/cetl/gilddavisondiagram1.jpg)

### 4.2.1 Research paradigm

Qualitative research can be categorized into three epistemological, paradigms namely: *Positivist, Interpretive* and *Critical research* (Myers, 1997). These paradigms have an important bearing on the kind of knowledge the research is expected to produce and the methods that are deemed appropriate. In this study, the interpretive paradigm was used. The paradigm is discussed in more detail in the section below:

**Interpretive paradigm**

The interpretive research paradigm, unlike the positivist paradigm, lacks the notion of objective reality to study and discover. The interpretive research assumes that access to reality is only through social constructions e.g. language, consciousness and shared meanings. Interpretive research is therefore primarily based on the philosophical base of hermeneutics and phenomenology (Myers, 1997). In this paradigm, researchers form an understanding mainly by interpreting the phenomena they encounter and subsequently use this
understanding to interpret similar phenomena and experiences to develop more understanding (Hammersley & Atkinson, 2007). With this approach, researchers continually and iteratively learn understandings of reality and social context. In general, interpretivism is an epistemological position that is concerned with approaches to understanding of reality and concluding that such knowledge is a social construct thus subjective (Walsham, 1993).

**Approach**

Against this background and in line with the study aims, the epistemological stance of this research is that of interpretive paradigm. This paradigm fits well with the aim of exploring and understanding a phenomenon from enterprise architect experiences which are mostly subjective. This study cannot follow a positivist approach since, enterprise architect roles and competencies cannot be necessarily quantified from individual experiences. The critical research paradigm, does not fit the nature of this study because the aim is not one of social critique and the researcher did not intend to take such a stance, rather the study aims at exploring and understanding a phenomenon.

**4.3 Research Methodology**

This study uses grounded theory approach, as developed by Glaser and Strauss (1967). Grounded theory is an inductive research methodology that allows for discovery of theory from data that explains underlying social processes (Glaser & Strauss, 1967). Methodological appropriateness is the primary criteria for judging methodological quality, because different research methods are appropriate for different research tasks (Patton, 2002). In this regard, the grounded theory is a fit, in line with this study’s aim of exploring and understanding enterprise architect core roles and competencies. The grounded research methodology properties are ideal for interpretive studies since it places much emphasis on the importance of grounding theory in empirical data (Lazar, Feng, & Hochheiser, 2010; Strauss & Corbin, 1997).

In grounded theory, the discovery of new theory can be made possible through open and axial coding, concept development, and grouping of concepts into thematic categories (Glaser & Strauss, 1967; Strauss & Corbin, 1997). The theory that is discovered by such means, however, can only be explained and clarified with regards to how it relates to specific social context, hence cannot be universally transferable or generalized to other contexts. In addition,
grounded theory enables development of a well-integrated theoretical framework for explaining phenomena under study (Strauss & Corbin, 1990). Data used in a grounded research study may come from several sources, which may include: interviews, observations, documents, tapes or video recordings, books and documents that can describe the topic under study (Strauss & Corbin, 1990).

This study deployed grounded research approach, because of several reasons. Grounded theory has been widely used for qualitative research in social sciences and other practitioner fields since the 1960s for its ability of enabling elaborate theoretical explanations (Strauss & Corbin, 1997, p. vii). Grounded research enables theory to emerge from data by iterating between data and analysis, new emerging ideas are confronted further with new data enabling new ways of comprehending existing data (Hammersley & Atkinson, 2007; Strauss & Corbin, 1990). Because of this moving back and forth between data, literature and analysis, the grounded theory ensures that a researcher approach grounded research studies with no preconceived ideas. Grounded theory has also been used extensively by studies on professional competencies (Strauss & Corbin, 1997). Clearly, this is a reaction against hypothesis testing, practiced in quantitative methods, where literature ideas are measured against the data (Hammersley & Atkinson, 2007, p. 159). Another important attribute, is that grounded research places much value on contextual settings for deeper exploration and understanding of phenomenon (Glaser & Strauss, 1967).

For this study, grounded theory was used to provide a deeper exploration and understanding of enterprise architect role and competencies from the experience practicing enterprise architects. Such an understanding of roles and competencies is essential in advancing knowledge of enterprise architects and is also important for developing academic and professional curriculum for EA training.

4.4 Data Collection

This study used qualitative methods of collecting data in-order to address the questions for the study. The data for this study was gathered through two main techniques: Semi-structured interviews with enterprise architects in different sectors, analysis of enterprise architecture related documents, analysis of vacancy posts for enterprise architects, analysis of LinkedIn profiles for enterprise architects and review of enterprise architect literature. Triangulation of data sources was important to add confidence, validity and credibility of this study and
ultimately avoid biases that could have existed from a single source of collecting data (Patton, 2002).

### 4.4.1 Semi-structured interviews

Semi-structured interviews were conducted with mostly practicing enterprise architects and a few academicians who have studied and written extensively about enterprise architecture. In a qualitative study, interviews are principle tools that help researchers understand context in which informants work in (Strauss & Corbin, 1990). Semi-structured interviews are unique in their flexibility and allow the researcher to follow up with probing questions from emerging ideas (Strauss & Corbin, 1990). An interview guide in line with the aim of the study was used for posing the questions to informants. See Appendix B for the interview guide.

A total of seven semi-structured interviews were conducted. All the interviews lasted about thirty to sixty minutes and were conducted at the office premises of the informants. The interviews initially started by getting EA background information of informant. In addition, information was gathered on frameworks and modelling tools that they use, and the challenges that they encounter on a day to day basis in their job. Information was also gathered about the kind of academic or professional training that enterprise architects ought to have. During the interviews, the researcher also took down short notes where appropriate. Lastly, post interview notes were also made after each interview to reflect more on the issues that popped up. An overview of post interview notes from the interviews is outlined in the table below.

Table 1: Post interview notes summary
Informant Recruitment

In a grounded research, participants possessing extensive knowledge and insights about the phenomena under study are targeted as informants (Strauss & Corbin, 1990). This study used two methods for identifying informants. First, the initial informants for the interviews were first identified via purposive sampling from a search for enterprise architects on LinkedIn. The results were filtered by location: in this case Norway. Second, three of the informants
were identified via snowballing method. All Seven of the interviews were recorded, six of which were transcribed. After each interview, the researcher made post interview notes to observe what was done well, and what could be improved on in the next interview. When a potential informant was identified, they were contacted via email, and all communication till the day of the interview was via the same means.

In brief, the criteria for inclusion of participants was as follows:

- Give informed consent
- English speaking
- Worked or working as an enterprise architect or CIO level
- Have IT and or management experience of at least 6 years
- Some knowledge with teaching although not a must

4.4.2 Document review

Document analysis is a form of qualitative research in which documents are reviewed by the researcher to give voice and meaning around an assessment topic (Bowen, 2009). This study also made use of specific document to understand the EA context and the roles of enterprise architects in such a context. In addition, the documents were used to understand historical evolution of EA and its main goals in an organization. Documents such as TOGAF 9.1 EA manual was very vital in understanding the kind of work that enterprise architects are involved in daily. The framework documents also highlighted major modelling tools that enterprise architect use and how best to utilize EA frameworks.

The United States General Accounting Office (GAO) also produces reports on enterprise architecture practice within the various departments of the government. The reports covered issues such as: use of EA across the federal government, assessments on how to improve EA management and how the value of EA can be measures and reported. The reports were important for highlighting good standards and practice of EA which is important for enterprise architects.
Microsoft Developer Network (MSDN) contains extensive documentation and white papers regarding enterprise architecture. The documents are available at https://msdn.microsoft.com/en-us/library/bb977468.aspx. The resources found there, proved a valuable source of enterprise architect work practices and trends. Other websites such as IBM also contained good documentation on EA and enterprise architects.

4.4.3 Job Profile review

In addition to these documents, the researcher also analyzed enterprise architect profiles from LinkedIn. The search keyword “enterprise architect” was used on LinkedIn, at least eighty thousand (80,000) were returned with this search. The search was then narrowed down by Location: “Oslo Area Norway” and Profile Language: “English”. The search now returned about three hundred (300) entries.

A total of 28 currently practicing enterprise architect profiles were analyzed. Sixteen (16) of the profiles were from Norway. The remaining twelve (12) profiles were from other countries. The following items were of interest when looking at the profiles:

- Career progression path
- Academic and professional education
- Number of years in industry (IT)
- Overall job description
- Skills competencies and endorsements

4.4.4 Vacancy Posts

A total of 24 vacancy posts of enterprise architects were also analyzed from online websites: finn.no, bayt.com and LinkedIn. The search term “enterprise architect” was used on all the three websites. In addition, the Norwegian term “Virksomhetsarkitekt” (equivalent for enterprise architect) was used as search keyword on the Norwegian site finn.no. A link to the job and a summary of it characteristics were organized in table for later reference. Further a screen shot of the job posts was also taken as a precautionary measure for broken links.
Key terms of importance in the vacancy posts were: The nature of the job description, the competencies required, personal skills and education requirements.

The figure below provides an example of two of the job post summarized in a table:

(See Appendix E for full table)

<table>
<thead>
<tr>
<th>Post #</th>
<th>Job description</th>
<th>Competencies /Skill</th>
<th>Education</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>-To develop and manage enterprise business information architecture, tech architecture &amp; standards. Facilitate SOA implementation</td>
<td>-Technical strategy</td>
<td>-Degree or Honors and above</td>
</tr>
<tr>
<td></td>
<td></td>
<td>-Good planner</td>
<td>-At least 8 years. 5 of which in senior level post</td>
</tr>
<tr>
<td>2</td>
<td>-Central in developing EA</td>
<td>-Excellent communication</td>
<td>-Master degree and strong academic records</td>
</tr>
<tr>
<td></td>
<td>-Integration of systems and security</td>
<td>-Ability to communicate via models</td>
<td>-5 to 7 Years’ IT</td>
</tr>
</tbody>
</table>

Figure 12: Summary of job posts in a table (See Appendix E for full table)

The figure below shows one such job posting from finn.no, one of Norway’s largest online market place.
**Virksomhetsarkitekter / Enterprise Architect Insurance - forsikringsløsninger**

**Arbeidsgiver:** EVRY

**Stillingskittel:** Virksomhetsarkitekt

**Sted:** Fornøbu

Forsikringsmarkedsenhet er i stor endring med nye forretningsmodeller og nye aktører. EVRY kjører to av de mest spennende prosjektene i Norge og vil sette virksomhetsarkitekter i et nytt og spennende arbeid.

**Ansvarsområder:**

- Du vil arbeide med kundeprosjekter hvor din kunnskap er sentral i å opprette og implementere løsninger.

**Kvalifikasjoner:**

- Erfaring fra tilsvarende type arkitekturfagområder i IT-bransjen
- Faglig oppdatert kunnskap om system - og virksomhetsarkitektur
- Gode presentasjonsegenskaper: skriftlig og muntlig
- Erfaring fra større IT-miljøer, gjør du ikke arbeid i eller for forsikringsselskap.
- Høyere utdannelse fra universitet eller høyskole. Relevante arbeidserfaring kan kompensere for lavere grad
- God muntlig og skriftlig fremspråkelighet på både norsk og engelsk

**Personlige egenskaper:**

- Gode samarbeidsfertigheter
- Interesse for teknologi og trenger kombinert med god forretningsforståelse
- Struktureret og analysisk

**EVRY tilbyr:**

- En spennende og utfordrende stilling i Norges største IT-selskap
- Du vil være en del av et kompetent faglig miljø som vil gi deg utfordringer og kunnskap slik at du raskest blir en del av laget!
- Arbeid med samfunnskritiske tjenester
- EVRY Academy - fortid og fremtid forfølgende

Figure 13: Vacancy post from finn.no
The table below gives an overview of the main documents that were reviews during this study.

Table 2: Document review outline

<table>
<thead>
<tr>
<th>Document type</th>
<th>Number of items</th>
<th>Source</th>
</tr>
</thead>
<tbody>
<tr>
<td>Government papers/Reports</td>
<td>4</td>
<td>Government Accountability Office (GAO)</td>
</tr>
<tr>
<td>White papers</td>
<td>6</td>
<td>MSDN, IBM</td>
</tr>
<tr>
<td>Job profiles</td>
<td>28</td>
<td>LinkedIn</td>
</tr>
<tr>
<td>Job vacancies</td>
<td>24</td>
<td>Finn.no, bayt.com, linkedin.com</td>
</tr>
</tbody>
</table>

### 4.5 Analysis

All the data that was collected for this study was analyzed qualitatively. The narrative data was transcribed and then coded and arranged into concepts and categories using grounded theory approach.

The views of qualitative research analysis as highlighted by Creswell (2013) which involves learning continual learning from data and theory acted as a guide for the qualitative data analysis in this study. Furthermore, grounded research prescribes certain procedures for data collection and analysis which were important in the analysis.

In most qualitative research, the analysis of data is done once all the data is collected whereas in a grounded research, analysis is an iterative process between ideas and data collection (Hammersley & Atkinson, 2007; Strauss & Corbin, 1990). This means that the researcher will learn from the currently collected data to guide interviews or observation to be made in future. The iterative process of data collection and analysis in the grounded includes drawing up similarities and differences from the data to other information (Jackson, Gillis, & Verberg, 2007).
Conception is at the heart of grounded theory study. In concept formation, the data collected is analyzed to identify patterns. These concepts are what form the major building blocks of theory (Strauss & Corbin, 1998). The formation of theories is through conceptualization of data and not raw data itself (Strauss & Corbin, 1990). In a grounded study, events, objects and actions or other interactions are analyzed and given the label concept. Coding is critical in this process because it is used in identifying the concepts within the data. By nature the concepts are provisional and as analysis proceeds they become more differentiated, the differentiated concepts are known as categories (Bohm, 2004). Coding of the data occurs at three levels as follows: open coding, axial coding and selective coding.

Open coding is the process through which concepts are identified and properties discovered in data, forming building blocks for the model (Bohm, 2004; Strauss & Corbin, 1998). During this initial process the researcher analyzes text line by line. To aid in the analysis, the following theory generating questions as highlighted by Bohm (2004) where asked when analyzing the data:

- What is at issue here, what phenomenon is being addressed?
- What persons or actors are involved and What roles do they play?
- How do they interact, what aspects of the phenomenon are addressed or not addressed?
- What methods, tactics and strategies are used to achieve the goal?

Axial coding proceeds the open coding. The purpose of axial coding is to rebuild the fragmented data obtained from the open coding (Strauss & Corbin, 1998). During axial coding the concepts were refined and differentiated into more concrete categories. Of importance was the development of relationships between the axial categories and the concepts that are related to them in terms of their formal and content aspects.

Finally, selective coding was used. In selective coding the theory is refined and integrated (Strauss & Corbin, 1998). During this process the categories were integrated for establishing the main phenomenon of the analysis (Strauss & Corbin, 1998).

4.6 Validity and Reliability
In qualitative case study research, validity and reliability of the evidence obtained is one of the criteria for evaluating the research (Creswell, 1994; Morse, Barrett, Mayan, Olson, & Spiers, 2002). In this study, several measures were taken to ensure the validity and reliability of the empirical material obtained for the research.

These measures included:

- Data source triangulation. Triangulation was deployed by gathering data from several sources which included: interviews, and document review.

- Seeking clarification whenever things did not appear to make sense.

### 4.7 Ethical Considerations

This study was conducted in line with the ethical guidelines as defined by The Norwegian law enforced by Norwegian Center for Research Data (NSD). To conduct the interviews, the researcher obtained ethical clearance from NSD (See Appendix C for ethical clearance form). An online application for ethical clearance to the NSD was made on 1st September 2016. The corresponding approval was received on 12th October 2016, with a copy sent to the research supervisor. All ethical procedures as defined by the UIO were also considered. The research supervisor examined the interview questions and was involved in the application for ethical clearance. During all the interviews, informants were presented the ethical clearance form that was granted by the NSD for consent on the same. In addition, verbal communication of anonymity and consent to take part in the interview was made by the researcher. A consent form was presented to the informant to append signature before the interview started.

Other ethical guidelines were taken into consideration during this study. The four ethical principles of Autonomy, Beneficence, Non-maleficence and Justice as discussed by (Beauchamp & Childress, 2001, p. 12) were used. The principles helped in ensuring that data and informant identity were kept securely and anonymous respectively, and that personal or economic harm was not incurred on the part of the informants. Upon completion of this study, all transcripts, and tape recordings will be securely shredded and deleted respectively.

The informant anonymity was achieved by not labelling interviews based on informant’s name or place of work. And that all the audio recordings that were obtained during the semi-structured interviews were kept securely on the UIO network. It must be pointed out here, that
the analysis presented in this study is based on the researcher viewpoint and interpretation of the qualitative data available for this study. No, third party or informant views and interpretations are presented in this study.

Accordingly, this study was guided by a research plan. See (Appendix D).

**Summary**

This chapter has discussed the empirical methods and approach that shaped this research study. The study was conducted qualitatively with semi-structured interviews and document analysis forming the base for analysis. The analysis of documents and vacancy posts enabled to enhance the researcher’s knowledge of the EA context and the nature of the job respectively. Grounded research approach enabled the researcher to continually learn about enterprise architect’s roles and competencies continuously throughout the study. By categorizing the data into themes made comprehension of phenomenon a lot easier and manageable. Further, data source triangulation was used to increase the confidence and validity of data.
5 Study Findings and Analysis

5.1 Introduction

This section will provide an overview of the findings in line with the aims and objectives of this study as highlighted in chapter one. Some of the details that this section covers include: characteristics of interview informants, and analyzed profiles. In addition, findings from of profiles and vacancy posts that were reviewed are presented.

5.2 Characteristics of Informants

A total of seven informants were interviewed for the study. The informants comprised of IT professionals working in both the public and private Norwegian sector. The informants were either practicing enterprise architects or former enterprise architects. All of which had a combined total of at least one hundred and fourteen years IT working experience. That’s an average of 16.3 (n=7) years’ work experience. All informants were males. Two female informants were contacted to take part in the study but did not reply to the same. It must however be acknowledged that overall, it was difficult to find and recruit female informants. Out of the first sixty results returned on LinkedIn for a search of enterprise architects within Oslo area in Norway only 3 were female. Thus, 3.3 percent (n = 60) female representation.

From the inclusion criteria of informants, there was no criteria on the level of education. As it turns out, all the informants had formal education. All the informants interviewed had post graduate qualifications: six of the informants had a master’s degree or higher i.e. 85 percent (n = 7), of these two had a PHD, i.e. 28 percent (n = 7). In addition, three of the informants also had certifications either in TOGAF or other related IT professions representing 42 percent of the participants (n = 7).

The pie chart below summarizes the educational distribution of informants:
From the profiles analyzed on LinkedIn, Oslo area had a relatively high number of enterprise architects. A search of using keyword ‘enterprise architect’ filtered by ‘Oslo area’ returned about three hundred and thirty (330) results. A similar search using keyword ‘enterprise architects’ filtered by ‘Norway’ returned about four hundred and sixty-one entries. Thus, about, one hundred and thirty-one enterprise in the entire country excluding Oslo. This represent 71 percent (n = 461) of Norway’s enterprise architects on LinkedIn within the Oslo area.

In comparison to other professions within IT, like software developers, the number of enterprise architects is relatively few. For example, a search using keyword ‘software developer’ filtered by ‘Norway’ on LinkedIn returned about five thousand two hundred entries (5200). A similar search for project manager returns several thousand entries. Compare this to the four hundred and sixty entries returned by a search of enterprise architects.

From the finn.no job posting, a total of about twelve (12) entries were retuned for the search term enterprise architect. Of these actual enterprise architects, would normally be two or
three. The rest were job titles with the term “architect” in them e.g. network security architect or system architect.

Based on the inclusion criteria for the participants as defined in the methods section, the following table summarizes the characteristic of interview informants for this study (n = 7).

Table 3: Summary of informant characteristics

<table>
<thead>
<tr>
<th>Variable</th>
<th>Frequency</th>
<th>Percentage (100 %)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Gender</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Male</td>
<td>7</td>
<td>100</td>
</tr>
<tr>
<td>Female</td>
<td>0</td>
<td>0</td>
</tr>
<tr>
<td>Work Experience (Years)</td>
<td></td>
<td></td>
</tr>
<tr>
<td>10 - 15</td>
<td>3</td>
<td>42.8</td>
</tr>
<tr>
<td>16 - 20</td>
<td>2</td>
<td>28.6</td>
</tr>
<tr>
<td>&gt;21</td>
<td>2</td>
<td>28.6</td>
</tr>
<tr>
<td>Academic Education</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Bachelor</td>
<td>7</td>
<td>100</td>
</tr>
<tr>
<td>Masters</td>
<td>6</td>
<td>85.7</td>
</tr>
<tr>
<td>PHD and above</td>
<td>2</td>
<td>28.5</td>
</tr>
<tr>
<td>Professional certification</td>
<td></td>
<td></td>
</tr>
<tr>
<td>TOGAF, Scrum</td>
<td>3</td>
<td>42.8</td>
</tr>
</tbody>
</table>

5.3 Addressing the Research Questions
Referring to the researched questions posed at the beginning of this study. The research questions will now be revisited and examined to see how the findings emerging from the data addressed these questions. The questions are recalled as:

1. What are the main competencies that an enterprise architect must possess to enable business and IT integration in an organization?

2. What are the critical roles that an enterprise architect must play to facilitate business process integration and standardization in an organization?

**Analysis**

**5.4 Interviews**

The Interviews for this study provided a wealth of rich knowledge regarding enterprise architect role and competencies. The semi-structured nature of the interviews ensured that informants deeply shared their own experiences of working with EA freely and openly. An interview guide was used for the interviews. The questions posed to informants were based on both the interview guide and how the interview proceeded in general.

After the interviews, the data for six of the interviews was transcribed. The transcribed data was then analyzed line by line via coding. In grounded theory, coding is described as interpretation of data and includes naming concepts, then defining them in more detail (Strauss & Corbin, 1998). There are three types of coding at different phases of the research process. The coding types are open, axial and selective coding. From the data analysis of transcripts, a total of 51 concepts emerged, from these concepts a total of 16 categories were identified. Further, five categories were identified for the enterprise architect roles. The concepts and categorizes represent enterprise architect competencies or attributes that characterize EA practice or enterprise architects. A code book prepared in excel was used to for organizing the concepts, categories and roles.

The main concepts and categories are summarized in the table below:

<table>
<thead>
<tr>
<th>Categories</th>
<th>Concepts</th>
</tr>
</thead>
</table>

Table 4: Categories and concepts emerging from interviews
<table>
<thead>
<tr>
<th>Modelling</th>
<th>Pedagogy, drawing, map out</th>
</tr>
</thead>
<tbody>
<tr>
<td>Business knowledge</td>
<td>Business process, business knowledge, business terms, perspective</td>
</tr>
<tr>
<td>Strategy</td>
<td>Changing, building, contribute change</td>
</tr>
<tr>
<td>Agile methodology</td>
<td>Stable, frequent releases, Dev-Ops, be able to respond, agile methods</td>
</tr>
<tr>
<td>Stakeholders</td>
<td>Relation building, developers, managers, other architects</td>
</tr>
<tr>
<td>Frameworks</td>
<td>Tools, for sharing language, TOGAF</td>
</tr>
<tr>
<td>Politics</td>
<td>Convince managers, maneuver org landscape, buying into idea, trust</td>
</tr>
<tr>
<td>Education</td>
<td>Certification, broad and general skills, strong technical IT, business, on job experience, eager to learn, challenging</td>
</tr>
<tr>
<td>Complexity</td>
<td>Simplify, flexible, legacy systems</td>
</tr>
<tr>
<td>Communication</td>
<td>Presentation skill, talk with managers, explain with stakeholders</td>
</tr>
<tr>
<td>Analytical</td>
<td>Understand problems, solution finding</td>
</tr>
<tr>
<td>Domain knowledge</td>
<td>Understand business, business perspective,</td>
</tr>
<tr>
<td>Team work</td>
<td>EA function, junior architects,</td>
</tr>
<tr>
<td>Systems</td>
<td>System interaction, system links,</td>
</tr>
<tr>
<td>Leadership</td>
<td>Holistic picture, Short term and long term business vision</td>
</tr>
<tr>
<td>Management</td>
<td>Governance, risk mitigation</td>
</tr>
</tbody>
</table>
From the concepts and categories above, some of the enterprise architect roles that emerged include: Modeler, Strategist, Communicator, Leader and Manager.

As a strategist or change agent, the enterprise architect is supposed to facilitate automation, standardization or integration of core business processes. As a communicator, the enterprise architect is responsible for ensuring that members of the team and all relevant stakeholders understand the details of the strategy above. As a modeler, the enterprise architect is responsible for representing EA relationships to his/her team and stakeholders in model form. As a leader, the enterprise architect must ensure that he/she both understands and contributes to the shared vision of the organization. In addition, the enterprise should mentor young or less experienced professionals. As a manager, the enterprise architect is responsible for ensuring that he coordinates his team and that they get the required resources for their job.

The following section will discuss the categories and concepts in relation to the roles of the enterprise architects. The categories and roles are all relevant in addressing the research questions for this study as recalled above.

**Notation:** The quotes from informants will end will the following notation (INF#, ~X Yrs). Where “INF#” refers to Informant number and the “~ X Yrs” represents the amount of work experience the informant has in years circa.

**Modelling**

From the data analyzed it was established that modelling is a very important competency that enterprise architects must possess. A majority (n =5) of the informants mentioned modelling as being key. Modelling is defined as a means of capturing complex concepts into a simpler well defined notion that is applicable to multiple domains (Pilone & Pitman, 2005). The informants pointed out that modelling is important because it allows enterprise architect to present and communicate ideas and relationships in simplified a way that is easy to grasp. Models are also a means of documenting. For example, if well modelled enterprise architects can communicate complex system interactions to both the IT team and non-IT stakeholder. It was found that: enterprise architects deal with complex interconnected systems at an organization wide level. To map out all the relations of such systems would mean an
overwhelming amount of detail but with models only the relevant level of detail is modelled to communicate what is essential at that time.

All the informants stressed on the importance of modelling to an enterprise architect. Some of the informants emphasized that modelling is one of the most basic skills that enterprise architects need to possess as illustrated in the following comments:

“... so, you need to have the skillset to be able to translate complexity into something that is understandable for the one who doesn’t want to spend 20 hours trying to understand it, that is modelling.” (INF1, ~15 Yrs.)

“I think modelling is the basic skill that every enterprise architect should have.” (INF3, ~14 Yrs.)

There are several tools that enterprise architects can use to model to clearly communicate ideas. It was found that the tools range from mental models, sketches drawn on paper, mind maps, and sketched made on white boards. The informants highlighted UML as one the modelling tools that is popular within the industry. UML models can be sketched both via computer software or simple pen and paper:

“...you can make drawings or sketches or mind maps, whatever works for different people…” (INF1, ~15Yrs.)

The modelling tools and model diagrams ought to be context dependent i.e. depending on the audience. For example, business executives and developers may need to have different representations of a concept as highlighted by this comment below:

“as an enterprise architect you should be able to communicate an information landscape both to a senior level executive in a business and to a developer. And that means you can’t use the same models for both...” (INF3, ~14Yrs)

One challenge that enterprise architects face is the level of detail to include or exclude from models. Essentially models are meant to be simple, but the informants said that there is a tendency by enterprise architects to over model i.e. include too much detail.
“If you get too much stuck in the technical details and preoccupied with things being accurate and precise you will not be able to make sufficiently simple models of the real world ... you need to have the guts to make simplifications” (INF2, ~20 Yrs.)

“I think organizations like NAV and many others fallen into the mistake of trying to document too much” (INF3, ~14 Yrs.)

In summary, models play an important part in ensuring that enterprise architects communicate concepts efficiently to different stakeholders.

5.4.1 Enterprise architect as Manager

Team Dynamics

The findings show that enterprise architect rarely work in isolation. Usually enterprise architects work within the enterprise architect function or with other teams that are involved in a project. It is therefore essential that enterprise architects are good team players.

“I believe in that you have to have an enterprise architecture function” (INF3, ~14 Yrs.)

“to avoid being bogged down by all the detail you can ask the junior architect to gather information on some details” (INF1, ~15 Yrs)

The analysis shows diversity in background experience of the team members is key when building enterprise architect teams. It helps bring about a level of diversity that is very important when it comes to problem solving and approach to issues.

“we do not go about looking for people with the same kind of competencies, then it will be a waste of money because you are paying twice the salary and you only get one type of knowledge ... so, we are better off picking someone with a totally different perspective” (INF6, ~20 Yrs.)

“…to ensure that you work in collaborative teams put together with different kinds of competencies” (INF3, ~ 14 Yrs.)

1 NAV is the Norwegian Labor and Welfare Organization
“we can improve a lot by finding people with different experience” (INF6, ~20 Yrs.)

Oversight and control

The data analysis shows that enterprise architects are involved in management in one way or the other. Enterprise architects are actively involved in IT governance and risk mitigation which require some management skills and knowledge.

“One of the aspects of enterprise architects is to provide some form of governance” (INF3, ~14 Yrs.)

The findings show that enterprise architects also need to have knowledge in project management and project methodologies. Enterprise architects are not usually involved in management of the projects themselves but understanding project management helps in tracking change progress. The informants highlighted that change in organization will usually occur via or through projects, therefore it is vital to have knowledge of what projects entail.

“You have to have to know the end to end performing of a project … because all changes and development in an organization often happens through projects or in the form of a project” (INF3, ~14 Yrs)

Complexity management

Complexity is one of the issues that popped up in all the interviews (n = 7). The complexity is concerned with: big interconnected systems, and the complex nature of the enterprise architect job itself.

The complexity of the enterprise architect job comes about because of its multifaceted nature and knowledge areas involved e.g. business domain, IT etc. Further, enterprise architects are in contact with multiple stakeholders. Someone explained their typical day in office as follows:

“…Usually it’s a lot of meetings… and you have to context switch quite a lot between business areas but also between strategy on top but also projects at the bottom ...” (INF2, ~20Yrs)
Medium to large organizations usually grapple with complex II. The analysis shows that some of the complexity that enterprises encounter emanates from integration of old legacy systems with new ones.

“I think you see that many big organizations will always have typically a complex IT landscape and this will be based on that they have different generations of technological investments and they have some core systems that they don’t dare change and they have added new ones and in the end, you have quite a fragmented picture” (INF3, ~ 14 Yrs.)

The analysis shows that there are several approaches dealing with complexity. Enterprise architects must take a ground up approach in the way systems are designed. The informants suggested that you must ensure modular architectures, for example, implementing a Service Oriented Architecture (SOA). One of the informants said,

“...so, you have to have micro services and they have to do one and one thing only which is basically having what TOGAF calls building blocks... so for example, we have one service that gives you information about inhabitant in a municipality ... one service that allows you to send an SMS to a person one that allows you to send an email to a person” (INF6, ~ 20 Yrs)

On the benefits of a modular architecture:

“In such a situation building or adding a new solution is basically reusing the components that you already have i.e. orchestration as it is called. The only actual thing you only need to do is build the GUI or interface as such you avoid complexity” (INF6, ~20 Yrs.)

For organizations, formulating the enterprise architecture function is a step in the right direction in dealing with system complexity.

“In terms of how to handle this complexity for an organization like NAV, I believe in that you have to have an enterprise architecture function. I think it is important that this function is not situated solely in IT, I think they need to have to have a function that is positioned so that they can see all the processes within NAV”
Knowledge and use of frameworks

The findings show that frameworks are important in guiding the EA practice, because they act as a guide and help in knowing what steps you have undertaken and what steps remain for you to achieve a specific goal. Frameworks also allow enterprise architects and organizations to have the basis for common terminology or language hence also simplifies communication with stakeholders. Two of the enterprise architects interviewed have TOGAF certifications. TOGAF was also the single EA framework that was mentioned by all the informants. The enterprise architects mentioned of using or having used TOGAF before.

“We have learnt that using architecture frameworks can come in very handy ...” (INF6, ~20 Yrs)

“We use TOGAF, I believe it’s a good toolbox” (INF1, ~20 Yrs.)

The findings show that most EA frameworks are usually too large and can’t be used in totality. As such enterprise architects only use parts of the framework that are relevant for the context.

“...we have recently started to use some elements from the TOGAF framework” (INF6, ~20 Yrs)

“...it’s a toolbox, where you can take some tools when you need them” (INF1, ~20 Yrs.)

5.4.2 Enterprise Architect as Strategist

Political engagement

The findings show that a large part of the enterprise architect role is about maneuvering the political landscape in an organization. Being a profession that comes from the IT function, you are naturally not the most powerful in the organization. The business people are the ones that hold power. Two of the important concepts in this political process are: First, you have to gain the trust of executives and managers. Second, the organization must buy in into your ideas, the process is difficult. Some of the enterprise informants had this to say regarding the political process:
“...its quite a lot of politics because you touch quite a lot of peoples jobs” (INF1, ~20 Yrs.)

“...and so as an enterprise architect, if you go to different parts of the company and say: ‘from now on we are going to standardize everything according to our EA. So, you will not be allowed to run the way you used to, you will now use this software and are going to do these processes etc.’ That’s pretty tough, so you need a way to maneuver the political landscape.” (INF5, ~25)

“It is definitely a political process... I find that often the business decisions are not always the most political, often the most common political ones can be: do we want to choose Oracle or Microsoft. Because when it comes to making technological choice in the IT landscape especially with IT people its religious ... so every decision is a potential political process” (INF3, ~14 Yrs.)

With regards to the political process most of the informants (n =4) said that there is a need to understand organization issues, and understand which individuals are the power brokers in the organization to build alliances with.

“... so I always start with thinking ‘ok’ ...in order to make this decision or make this happen who needs to say ‘Yes’? ... You need first to understand where the ultimate decision is going to happen and up to that point who else on that path needs to be involved and have their say until it reaches the ultimate point” (INF3, ~14 Yrs.)

**Business domain knowledge**

Enterprise architects usually work from the IT function of the organization but need to have a holistic picture of the entire business. The need for business process integration and standardization requires some knowledge of the business domain(Ross et al., 2006). The informants suggested that enterprise architects operate at an enterprise wide senior level position to be able to drive business strategy. The level at which enterprise architects operate in demands that they have: not only a strong technical background but solid business knowledge as well. All the informants (n = 7) mentioned that having good business knowledge enables enterprise architects to communicate or hold discussions with senior business managers or executives seamlessly. This necessitates for enterprise architects to be
conversant with certain business terms and concepts. Here is what some of informant them had to say:

“When u work as enterprise architect, it is about dealing with people process and technology you need to understand the business processes so that you can manage things, i.e. how do we manage a process, are there activities that are conducted manually that we can automate or are there processes that we can do without” (INF5, ~25 Yrs)

“…but I think you need some level of basic understanding of how business works, of how processes are engineered and work…” (INF3, ~14 Yrs)

It was also found that the need for business knowledge can be a challenge for some enterprise architects. The reason being that enterprise architects normally come from a predominantly IT technical background and lack knowledge in the particular business as typified in this comment:

“… the Information Technology part is very easy; it is the business part that is very tough.” (INF6, ~20 Yrs)

The aim is to understand the inner workings of the business or the field an organization operates in. Six of the informants suggested that by understanding the domain of the organization, enterprise architects can easily utilize IT to drive strategy. When queried on the importance of domain knowledge, some of the enterprise architects had this to say:

“If I were hired as an enterprise architect for a company today, I would spend six months or even one year just understanding the business domain of the organization” (INF5, ~25 Yrs)

In quest to understanding the business domain of an organization, you need to find out the values of the business and its goals and challenges to identify how to apply necessary technology. Someone commented that enterprise architect need to spend time to understand what exactly drives the organization:

“…find out: what are the organizational strategies, what is the organizational mission or goals for this organization…” (INF3, ~14 Yrs)
5.4.3 Enterprise Architect as Leader

Strategic planning and management

Strategy is about pattern and consistency in behavior over time (Mintzberg, Ahlstrand, & Lampel, 2005). The analysis shows that strategy is important because it is what essentially drives change in an organization. Enterprise architects must be able to understand and know what technology ought to be used to achieve a certain strategic objectives goals within an organization. Some of the comment regarding this change agent are highlighted below:

“... I think that enterprise architects need to understand and influence the strategy because that’s really the target state, where we are going to be ... its like all initiatives need to have a path to that goal” (INF2, ~20 Yrs)

“one of the important roles is being an enabler to make changes happen in the organizations” (INF3, ~14Yrs.)

The informants suggested that to be able to successfully drive meaningful change in organization, enterprise architects need to understand how they can utilize technology as an enabler for change:

“I believe that you have to know what technology do we need to apply, why do we need to apply it what is the goal that we are trying to achieve” (INF3, ~14 Yrs.)

The analysis shows that one of the most important aspects regarding strategy is that enterprise architect contributes in shaping the vision of the organization.

The findings show that enterprise architects bring in a level of guidance to an organizational in terms of how they can leverage and apply technology to meet strategic objectives. For example, an enterprise architect should be able to guide an organization as explained in this quote:

“for example, in the next 10 years, 70 percent of what we do now will be automated and then the challenge for organizations is: ok how can we get around that ... how do we develop so we can still provide value and still be relevant... that means you have to start focusing on these business areas, it means you need technological capability, that means we need to apply this kind of technology” (INF3, ~ 14Yrs)
Knowledge in Agile methods

All the informants mentioned that agility is a very important concept for modern organizations in the way they approach projects and conduct business in general. Agility plays an important part in how organization can respond to opportunities and threats in the market. Here are some comments regarding agility from the informants:

“it’s like when you work with enterprise architecture, the main business driver is basically the business demands, you want to make sure that the organization you are building the architecture for is able to respond to opportunities and threats in the market... and over the past few years we have moved into going more agile methods with the projects” (INF6, ~20 Yrs)

Education and training

Because of the nature of the enterprise architect job i.e. transcending both IT and business. The data analyzed shows that the education of enterprise architects ought to be broad and wide. In most graduate and post graduate studies students tend to choose the kind of course that they will study. The advice on this is: to avoid picking similar courses rather to have a portfolio of course that are different and exposes one to different concepts. One the informants emphasized on the importance of having broad knowledge as follows:

“Try to avoid to specialize too much all the time ... because for your organization and for your own development there is a lot to be gained by trying to shift in different roles” (INF3, ~14 Yrs.)

There was some variation on the informant as to whether current curriculum was enough for the enterprise architect role because some of the informant suggested that technical IT knowledge is good to prepare one for the enterprise architect role, however current IT education tends to focus too much on the technical aspect while neglecting business and soft skills.

The consensus when it comes to education of enterprise architects was that; a good amount of enterprise architect “education” is gained via hands on or on the job experience. The informants mentioned that university education provides only the very basic needs. When
asked on whether university students are learning enough to become enterprise architects
some of the informant simply put it this way:

“Education is fine, but you cannot become an enterprise architect by education, I think, you need some years of practice to become an enterprise architect” (INF5, ~25 Yrs.)

“…but that said, I believe still that there is a lot to gain in on the job training ... because 80 % of what I use is do is knowledge gained through projects or through my work in the organization” (INF3, ~14 Yrs)

Some of the enterprise architects suggested that the concepts that most students are taught in school today are enough to prepare them for a future in the enterprise architect role.

“it’s like the things we do today, I studied the same things like 20 years ago... so the basics are enough” (INF6, ~20 Yrs)

“…but there is always a basis from your university education that you need to draw upon from time to time to understand the bigger picture and to be able to go deeper into certain topics... so I believe the university education is important for mastering a lot general skills and structuring knowledge analyzing and being able to produce reports for example so that others can learn from your knowledge” (INF3, ~14 Yrs.)

Another enterprise architect who had some background education in both sociology and IT, when queried on how his education background is relevant to the work he does today as an enterprise architect, had this to say:

“well, for me I would say that education was very valuable because it helps me in understand these different perspectives, if I had solely followed organizational theory program within sociology I could have never grasped technological aspects in the way that I could and vice versa, if I had followed pure IT I could have missed out on the organizational aspects” (INF3, ~14 Yrs)

In addition to this, the data analyzed showed an emerging theme regarding enterprise architect education and training. Overall the role requires a lot of work experience. Enterprise architects also need a lot of experience working on a wide range of technical and business portfolios and understanding the business domain in which their enterprise operates in.
Evidently the enterprise architects interviewed for this thesis had an average of 16 years working experience. Some comments regarding this were:

“You need a good grasp of what goes on, and knowledge of a wide range of systems profile such as ERP, office support, transaction solution, CRM…” (INF5, ~ 25 Yrs.)

“this is not a starting job when you finish your bachelor education” (INF4, ~10 Yrs.)

Another aspect of education dealt with university curriculum for training or educating enterprise architects. Most of the architects suggested that it was relevant to include courses that would raise awareness on enterprise architecture, which lacks in most universities at present.

Some of the enterprise architects suggested that the way universities are setup with siloed systems does not set good precedence about EA practice. An enterprise architects had this to say about two Norwegian universities that tried to collaborate on a study program as a means of organizational change.

“I studied on a program about organizational change and how to make that happen and all the challenges of organizational change typically driven by technology and a case in study for this program was the university itself...and how does the university which has a culture of being organized into siloes, meaning: you have faculties and institutions with different academic disciplines... how will they be able to work together to providing a collaborative program ... and the end result was that NO, they didn ’t” (INF3, ~ 14 Yrs)

5.4.4 Enterprise Architect as Communicator

Communication

Communication is a very key competency that enterprise architects ought to possess. Communication is in two ways: First, understanding or listening. Second, talking or presenting. Enterprise architects must be good at both ideally.

When communicating with clients it is vital to understand and read in between the lines because sometimes clients aren’t sure what it is they are looking for. One enterprise architect narrated a conversation with a client as follows:
“Someone called in and they wanted an FTP server, and we told them that we can set it up for you for about kr50,000.00 and the client said: ok that’s not a problem. Then I asked: what is it exactly that you need this server for ... and the client replied: ... we want to transfer some large files ... and I said, ok, what you need is Dropbox. “...the reason they wanted an FTP server is because the files were too large for email, they basically wanted to be sharing building design files with a client for a certain project ... the Dropbox subscription cost them $50.00 a year enough for the duration of the project” (INF6, ~20 Yrs)

Most of the time enterprise architects mentioned that they normally spend their days in meetings with different stakeholders. As such, another aspect of communication is being able to present concepts and notions to the different stakeholders in a manner that they can easily grasp. See comments below:

“Communication is extremely important for enterprise architect’s role. Not only being able to talk but also understand what level of details do I communicate with the respective stakeholders in a language they can understand” (INF3, ~ 14 Yrs)

“enterprise architects need some pedagogy skills because in pedagogy the basic thing is: trying to explain complex themes and topics to students in a manner they can comprehend and relate to... this is where pedagogy comes in” (INF4, ~ 10Yrs)

Summary

In summary, the data analysis and findings from the interviews show that the enterprise architect role is multifaceted and requires a wide amount of knowledge in technical IT, business and organizational theory. The findings also show that enterprise architects need to possess a couple of competencies to effectively execute their job and lead an organizations EA practice. Lastly, the analysis shows that current education provides some of the necessary basics required for the role, however a lot of the experience is gained through hands on practice which most universities do not provide at present.

5.5 Document Review

5.5.1 LinkedIn Profiles
This section presents the findings from data analyzed of enterprise architect profiled from LinkedIn. Important attributes that the researcher looked for were; education, work experience, job description and gender. A total of 28 LinkedIn profiles were analyzed, 16 from Norway and 12 from other countries, mostly USA and UK. The profiles were selected by relevance as presented on LinkedIn.

Some of the enterprise architect characteristics from the profiles are summarized in the table below:

Table 5: Characteristic of enterprise architects from LinkedIn

<table>
<thead>
<tr>
<th>Variable</th>
<th>Frequency</th>
<th>Percentage (100 %)</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Location</strong></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Norway</td>
<td>16</td>
<td>57.1</td>
</tr>
<tr>
<td>Outside Norway</td>
<td>12</td>
<td>42.9</td>
</tr>
<tr>
<td><strong>Gender</strong></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Male</td>
<td>26</td>
<td>92.9</td>
</tr>
<tr>
<td>Female</td>
<td>2</td>
<td>7.1</td>
</tr>
<tr>
<td><strong>Work Experience (Years)</strong></td>
<td></td>
<td></td>
</tr>
<tr>
<td>10 - 15</td>
<td>6</td>
<td>21.4</td>
</tr>
<tr>
<td>16 - 20</td>
<td>9</td>
<td>32.2</td>
</tr>
<tr>
<td>&gt;21</td>
<td>13</td>
<td>46.4</td>
</tr>
<tr>
<td><strong>Academic Education</strong></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Bachelor</td>
<td>28</td>
<td>100</td>
</tr>
<tr>
<td>Masters</td>
<td>20</td>
<td>71.4</td>
</tr>
<tr>
<td>PHD and above</td>
<td>1</td>
<td>3.6</td>
</tr>
</tbody>
</table>
The certifications included: TOGAF, SCRUM, CGEIT, CISM, CCNA, MCSE, PRINCE, CISSP

<table>
<thead>
<tr>
<th>Professional certification</th>
<th>12</th>
<th>42.9</th>
</tr>
</thead>
</table>

The findings of data analysis from LinkedIn profiles are as follows:

**Educational qualification**

The data analysis shows that most all the enterprise architects had an academic education of Bachelor’s degree and higher. The bachelor’s degrees were mostly in: Computer Science, Software Engineering, Information Systems, and Computer Engineering. Only two (1) of the twenty-eight-enterprise architect from LinkedIn had a PHD.

In addition to a bachelor’s degree, most of the enterprise architects had a master’s degree. A total of twenty (20) out the 28 had a master’s degree, representing about 71 percent (n = 28). Some of the common master’s degree were: Masters in information systems and Master of business administration (MBA).

Apart from academic education, a good number of the enterprise architects possessed a professional certification. A total of twelve of the enterprise architects had a professional certification. Thus, 42 percent (n = 28). It was found that, seven (7) of the eight (8) enterprise architects that didn’t possess a master degree had at least one professional certification. The certifications were not only EA related. The certifications were either in EA, networking, project management, and security as follows: TOGAF, CCNA, CISM, CISA, CGEIT, Scrum, Prince2 and MCSE.

In summary, the data analyzed shows that higher education is one of the basic competencies that enterprise architects ought to possess.

The pie chart below shows the educational distribution from the LinkedIn profiles
Work Experience

The findings from the profiles reviewed shows that enterprise architects generally have a high numbers of work experience. On average the work experience for the enterprise architects was 17 (n = 28). None of the profiles reviewed had less than 10 years’ work experience, this is similar to what was observed from the interview informants.

From the data analyzed, none of the enterprise architects had enterprise architect as their entry level job. Which is similar to what was observed and suggested by the interview informants.

The prior work experience of the enterprise architects was broad and wide. But mostly technical IT. The experienced ranged from system development, IT consulting, project management, network administration, system architecting etc.

The graph below shows enterprise architect work experience distribution:
Roles and competencies

The roles of the enterprise varied from one enterprise architect to the other: overall most of the responsibilities included: IT governance, IT architecting, Enterprise network security etc.

The comments below show how some of the enterprise architects typically defined their roles, knowledge areas and experience:

“An accomplished IT Enterprise Architect / Project Manager specializing in program / project management, enterprise engineering, enterprise network security, continuity of operations and disaster recovery planning, virtualization, systems engineering, cloud engineering, data analysis and complete IT infrastructure design, engineering, implementation, and accreditation. Over 25 years of experience ...” Profile 19

“I have a strong technical background with a deep interest in technology and how to exploit it to support business in a pragmatic and cost effective way. In my current position, I am leading a transformation program where the goal is to provide the business side with consistent
enterprise wide management information, Business Intelligence and a good analytical platform” Profile 7

Summary

Overall, the data analyzed shows that enterprise architects generally have a wide and broad experience from technical IT. The posts that most enterprise architects worked in prior to taking up the enterprise architect role was either junior or senior management post, for example: system architect, project manager etc. The data also shows that there are few number of practicing female architects, from the profiles, only 7.1 % (n = 28) were females.

5.5.2 Vacancy Posts

The following section will present findings from the vacancies that were analyzed. A total of 24 vacancies were analyzed. The vacancies were from the following sites. Finn.no, bayt.com and LinkedIn.com.

The vacancies mostly started by defining the roles to be played by the enterprise architect. In addition, the vacancies described the general competencies that were required by the enterprise architects.

The roles required of the enterprise architects ranged from leading in strategy to guiding the enterprise. Here are some of the requirements from one of the vacancies:

“Want to contribute to a more efficient and clever use of technology, so that our customers get the best experience online and in-store, and the employees become easier and more productive life? Our new Enterprise Architect will be a key resource in the structure of the department of strategic IT and be an important sparring partner for technology director” Voice Norway As. source: finn.no

All the vacancy posts stressed on the need for a work experience of at least 5 years and on higher qualification needs. Below are some of required attributes from a vacancy post:

“TOGAF certification and certification or practical experience with PRINCE2 and ITIL methodologies. The ability to handle complex architectural projects, solutions and technical architecture with a particular focus on infrastructure” (Crayon AS, source: finn.no)
“Must have 7+ years of IT and at least 3+ years working as Enterprise Architect”
(Managed Health Care Associations Inc, source: linkedin.com)

5.6 Paradigm model

To gain a conceptual abstraction, axial coding was used. During this process the paradigm model was used for further analysis of the data by establishing relationships and contextualizing the phenomenon (Strauss & Corbin, 1990). From these relationships, one category takes central focus and it is labeled core phenomenon (Bohm, 2004; Strauss & Corbin, 1990). The other categories form a network of relationships around it, which comprise of: casual conditions, action strategies, context & intervening conditions and consequences.

The coding paradigm as described by Strauss and Corbin (1998 p. 127) was used in creating the relationships between the network of categories and the phenomenon. As evident from the several concepts that have emerged in this study, there were several ideas that popped up in this study. All ideas were related and revolved around the core phenomenon namely: developing enterprise architect competencies. The rest of network of ideas were classified into four paradigms per their properties and dimension in reference to the main phenomenon. The following example, in which ‘pain’ has been selected as the phenomenon, illustrates the coding paradigm: ‘When I have (condition) arthritic pain (phenomenon/axial category), I take an aspirin (strategy). After a while, I feel better (consequence)’ (from Strauss and Corbin 1990 p. 98).

The figure below shows the network of relationships around the core phenomenon developing enterprise architect competencies. The details of the paradigm diagram presented are discussed in more detail in the proceeding sections.
5.6.1 Phenomenon

The phenomenon that is denoted in the axial coding can be an event or a fact. Phenomena are the central ideas emerging from data and is represented as concepts (Strauss & Corbin, 1990). For this study the phenomenon is: developing enterprise architect competencies within medium to large scale organization. For this, a framework enterprise architect competency matrix has been proposed. It emanates from combination of the categories with the core theme.

5.6.2 Causal conditions

In grounded theory, causal conditions are the events and variable that contribute to occurrence or development of phenomenon. The variables that influence or necessitate the development of enterprise architect competencies are as follows: Challenges in communication, difficulty in implementation and management of EA, problems with modelling EA and system interconnections, lack of clear strategy for business, stakeholder management problems, difficulty in navigating the political landscape and tools challenges. The causal conditions presented here are some of the obstacles that non-competent enterprise architects face. From
an organizational point of view, here are some factors that can contribute towards competent enterprise architects. Having technical IT personnel means that organizations have the fundamentals on which to develop enterprise architect competencies. Given proper education and training coupled with experience the IT personnel can become competent enterprise architects. On another note, some organizations have tried to implement EA practice with little success, the lessons learnt are valuable in gaining experience for the enterprise architects. Thus, can be building blocks for future EA implementations.

### 5.6.3 Contextual conditions

Contextual conditions are such as social and political factors that mostly are associated with the place, time, environment individual conditions, cost and tech socio conditions (Bohm, 2004). The contextual conditions included such things as the enterprise environment in which the enterprise architects work. Which includes: Technical and Infrastructural landscape, unclearly defined EA, lack of business strategy, lack of organizational agility and in-ability to answer critical questions about client data. The conditions highlighted in this section may have either a direct or indirect effect on enterprise architect competencies.

Lack of awareness of enterprise architect competencies and EA practice among top managers in an organization presents several challenges too. First, enterprise architect competencies are hard to properly define in such contexts. This leads to problems when recruiting or hiring for right candidates for the job and has a bearing on organizational expectations of enterprise architects.

Among universities and academic institutions, there is generally a lack of enterprise architect courses or training. One of the factors that affects implementation of enterprise architect curriculum is the cost of training. From the findings, it shows that academic institutions usually lag in technology because of the high cost of some IT hardware and software. As such, universities are usually forced to educate within the resource constraints. This usually leads to a gap in the way enterprise architects are being trained contra industries expectations.

### 5.6.4 Intervening conditions

Intervening conditions alter or minimize the impact of causal conditions (Strauss & Corbin, 1998). The intervening factors mostly deal with cost and individual biographies. Some of the
intervening factors include enterprise budget, personal attributes as defined in some of the
vacancy posts and technical IT and business skills. Having a very technical background with
business and domain knowledge prevents enterprise architects from being competent for the
role. The other aspect to this is the attitude that employees within an organization view the
EA practice in general. Enterprise architect role is a lot about bringing change in an
organization which some people are resistant to. In addition, management must buy into the
idea of EA if enterprise architect competencies are to be developed and enterprise architects
given the support they need.

5.6.5 Action strategies

Action strategies are processes that have a sequence and are generally performed with a
specific goal in mind. Some of the strategies include: adopting management practices such as
EA, and governance.

Education and training has a direct bearing on enterprise architect competencies. This is a role
that demands for high level of education and training. Education provides the base to equip
enterprise architect with technical knowledge and working with systems. Further to this
professional certification provide more framework centered approach to EA which is valuable
when working with a specific EA framework.

A bit related to education is the working experience of enterprise architects. Due to the nature
of role, there is a need for experience working in a senior level position and knowledge or
understanding of a lot of IT portfolios within an organization which education alone cannot
provide. Therefore, having the right kind of experience has a direct bearing on the
competencies that one gathers up.

5.6.6 Perceived Consequences

Consequences are the byproducts of phenomenon and the action and interaction strategies,
whether intended or unintended. The intended effects of competent enterprise architects on an
individual level include: better communication with stakeholders, competent to play the
different enterprise architect roles, ability to maneuver the organizational politics. On the
downside, informants suggested that enterprise architects must be able to maneuver the
organizational political landscape. The unintended result may be rise in tension between
enterprise architects and executives or other people within the organization. On an organizational level, some the perceived effects include: high competence in implementation and management of EA, which can translate to increased organizational agility, and better II landscape.

### 5.7 Proposed competencies framework

From the foundations of the paradigm model presented above and given the categories, concepts and roles that emerged from the data analysis. A proposed matrix can be plotted for the enterprise architect competencies and how they can be fit into each of the roles.

It has been found that the enterprise architect can take up several roles depending on: the level of maturity of the EA in an organization, and the nature of the organization. The following enterprise architect competency Matrix is proposed.

Table 6: Enterprise architect competency framework

<table>
<thead>
<tr>
<th>Competencies</th>
<th>Roles</th>
<th>Strategist</th>
<th>Communicator</th>
<th>Leader</th>
<th>Manager</th>
<th>Modeler</th>
</tr>
</thead>
<tbody>
<tr>
<td>Modelling</td>
<td></td>
<td></td>
<td>x</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Experience</td>
<td></td>
<td>x</td>
<td>x</td>
<td>x</td>
<td>x</td>
<td>x</td>
</tr>
<tr>
<td>strategy</td>
<td></td>
<td>x</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Interpersonal relations</td>
<td></td>
<td>x</td>
<td>x</td>
<td>x</td>
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<tr>
<td>Analytical skills</td>
<td></td>
<td>x</td>
<td>x</td>
<td>x</td>
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<tr>
<td>Business acumen</td>
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<td></td>
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<td>x</td>
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<tr>
<td>Technical IT skills</td>
<td></td>
<td>x</td>
<td></td>
<td></td>
<td></td>
<td>x</td>
</tr>
<tr>
<td>Visionary</td>
<td></td>
<td>x</td>
<td></td>
<td></td>
<td></td>
<td></td>
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<tr>
<td>Domain knowledge</td>
<td></td>
<td>x</td>
<td>x</td>
<td>x</td>
<td>x</td>
<td></td>
</tr>
</tbody>
</table>
Summary

This section has discussed the characteristics of informants and enterprise architect profiles for the study interviews and from LinkedIn respectively. The section also presented findings from the interviews and documents such as enterprise architect vacancy posts and profiles that were reviewed. From these the findings, several concepts and categories emerged. A network of the relationships between these categories was established and built around the core phenomenon: *enterprise architect competencies*. A coding paradigm model was used for further analysis of data. By contextualizing the core phenomenon with action strategies, consequences were mapped out. Thus, the consequences of enterprise architect competencies were identified. The benefits of competent enterprise architect are both to the individual and the organization.
6 Discussion and Contributions

6.1 Summary of the research process

This study aimed at exploring and understanding enterprise architect core roles and competencies because of the current gap that exists in literature. Against this background, the study sought to contribute to new knowledge and understanding of enterprise architect roles and competencies. The work has been inspired by several factors. Firstly, there is a rapid rise in the number of companies that are adopting enterprise architecture practices within their structures. Secondly, evidence from literature suggests that there are a couple of challenges that organizations face in the adoption and management of EA. Among the most common reasons for these challenges is: the lack of knowledge on enterprise architect roles and competencies. Thirdly, because of the increase in adoption of EA and digital strategies, there is a corresponding demand for competent enterprise architects in industry. Unfortunately, academic institutions and professional training organizations haven’t yet fully integrated EA courses or trainings in their curriculum hence, there is a gap for competent enterprise architects.

Having understood and identified core roles and competencies, the researcher proposes a framework or guideline that can easily be adopted and used by students or professionals who want to advance a career in enterprise architecture. In addition, the guideline can be used by academic or professional training institutions to streamline course material for enterprise architect role.

6.1 How the proposed framework fits with literature findings

The literature review discussed some of the challenges encountered due to unclearly defined enterprise architect roles and competencies. There is limited empirical literature and research conducted on enterprise architect roles and competencies. The proposed framework in this study is compared to what is currently available in literature to assess how it fits with other studies on enterprise architect roles or competencies.

Communication challenges as discussed by various studies posed a challenge to enterprise architects (Nygård & Olsen, 2016; Olsen & Trelsgård, 2016). From the findings communication was identified as one of the key competencies that enterprise architects need
to possess. Communication skills are vital because enterprise architects are in contact with many stakeholders, hence must be able understand requirements and presents concepts and ideas reasonably well. Other studies on enterprise architect competencies and roles also highlight communication skills as critical for enterprise architects (Gøtze, 2013; Strano & Rehmani, 2007). Another study on how organizational context affects EA implementation mention communication as being the driver for any initiative within an organization (Iyamu & Mphahlele, 2014). In the proposed framework, problems in communication are identified as one of the causal conditions for developing enterprise architect competencies.

Implementation of EA practice presents several benefits to an organization as evident from the findings in this study. Studies on the implementation of EA within the Norwegian health sector and Higher education also point out several implementation challenges due to non-competent enterprise architects (Nygård & Olsen, 2016; Olsen & Trelsgård, 2016). Although enterprise can have challenges in implementing EA, it is very important that lessons be drawn to avoid the challenges in future implementations. In the proposed framework, EA implementation challenges were identified as one of the causal conditions for enterprise architect competencies.

The study findings from this research also show that enterprise architects need a lot of years’ work experience. In addition, they need to have general knowledge in several areas such as project management and leadership all of which can contribute to successful EA implementation and adoption. To gain this experience and knowledge means practical hands on work in different roles such as project management, system architecting etc. prior to taking up the enterprise architect role.

There are several studies that were conducted that suggesting the need for standardization and flexibility within the health sector (Braa & Hedberg, 2002; Hanseth, Monteiro, & Hatling, 1996). One way of bringing in standardization is through use of EA (Ross et al., 2006). Recent studies in the health care also reveal that there is a lot of II complexity within the health care sector that presents challenges to EA implementation (Bygstad & Hanseth, 2016; Gebre-Mariam & Bygstad, 2016). During this study, the issue of complex II popped up in many of the research interviews. Accordingly, complex II was identified as contextual conditions within organizations in the proposed framework.
During the study, it was found that there is a gap in competent enterprise architects in industry. One of the reasons for this is because most of the university curriculum has not integrated enterprise architect’s education into their curriculum (Gøtze, 2013; Strano & Rehmani, 2007). Current education in IT is more technical focused and therefore lacks in equipping students on business skills or complexity of II (Cameron, 2008; Nygård & Olsen, 2016). The findings show that apart from the basic technical knowledge IT students need to have an awareness of organizational context, business skill and knowledge of II. In the proposed framework, lack of enterprise architect courses and training in university curriculum was identified as one of the contextual conditions within academic setting. This is one of the challenges to be overcome in developing enterprise architect competencies.

During this study one of the focus areas was the challenges that enterprise architects encounter. There were several challenges highlighted, one of them was problems in navigating the organizational landscape. As a strategist, the enterprise architect is usually involved in bringing some form change to the organization. However, the informants mentioned people are usually resistant to change. Therefore, the enterprise architect must ensure that there is a buy in of EA practice across the organization to minimize this resistance change. One way of ensuring buy-ins, is to broker relationships people who hold power in the organization or those that influence decision making. A study by Proper et al. (2011) reports on some cases of tension within organizations regarding EA. For example, struggles on whether enterprise architects were better off reporting to the CIO or other parts of the business. Another problem identified in the study by Proper et al (2011) was the struggle in agreeing and deciding on what framework or methodology to use. In another study by Bygstad and Hanseth (2016) they mention that one of the motivating factors for better health service in developed economies comes from political and public pressure. All these factors can result in tension to a certain extent, hence requires that enterprise architects be able to navigate such political landscape. In the framework, one of the unintended consequences enterprise architects may bring in an organization is the political tension.

The Enterprise architect competencies identified in some literature can be broadly categorized as either interpersonal or strategic. In addition, there are several enterprise architect roles mentioned in literature, they include: modeler, change agent, communicator and leader and manager(Gøtze, 2013; Steghuis & Proper, 2008; Strano & Rehmani, 2007). To be able to play these roles demands for specific competencies from enterprise architects. The proposed
framework in this study identifies being able to play these roles as the consequence of being a competent enterprise architect.

### 6.2 How the proposed framework compares with other competence frameworks

The concept of competency frameworks is not totally new. There are other studies that have looked at general competencies of employees and others that have focused on job specific competencies e.g. enterprise architect competencies (Gøtze, 2013; Steghuis & Proper, 2008; Strano & Rehmani, 2007; Wagter, Proper, & Witte, 2012). This section compares both general competency frameworks and enterprise architect specific frameworks to the findings of this research.

One of the more general competency frameworks that exist is the Civil Service Competency Framework. The framework was established by the UK government to support civil service reform and its performance management system (Civil-Service, 2012). The framework has three clusters, namely strategic cluster, people cluster and performance cluster. The strategic cluster involves having a broad vision and setting the direction by understanding how a person’s role fits into overall organizational objective (Civil-Service, 2012). Another area of strategic focus is decision making, which is key for predictable behavior in an organization. The people cluster involves such attributes as team play and team building. Leadership is also mentioned as being a key component of the people cluster. And ensuring that members within a team continuously learn to become effective in their roles. Lastly, the performance cluster aims at checking effectiveness of value addition and service delivery for the different roles.

The competency framework by the UK civil service is targeted towards all civil servant within the UK government. Although, the framework tries to categorize employee competencies by their work grade or rank of office, it is rather too general and broad. Take for example, two individuals, working within IT and finance departments. Even though they may have a similar job grade, the competencies for their specific jobs will be inherently different. Similar to the Civil service competency framework is a framework by OECD. The framework also categorizes competencies in three clusters of interpersonal relationships, strategy and delivery or performance related (OECD, 2014). One unique feature about these two competency framework is that they have a performance attribute for measuring effectiveness of an individual in a role which most competency framework in literature lacked. The
The framework proposed in this study also lacks this attribute. The drawback however on performance measurements is that, the framework targets many job roles hence measuring job effectiveness might need to be tailored to specific roles or jobs. In summary, the people cluster and strategic cluster from the civil service and OECD competency frameworks are like some aspects of the framework proposed in this study.

The study by Strano and Rehmani (2007) provides several enterprise architect competencies and roles. The study findings point out that; the enterprise architect role is multifaceted. A total of five main were identified and categorized as; change agent, communicator, leader, manager and modeler (Strano & Rehmani, 2007). A matrix mapping these roles against interfaces is provided to show how the enterprise architect roles can be applicable for different contexts. The study, however, does not map enterprise architect competencies against the roles. A similar study on enterprise architect competencies and roles by Gøtze (2013) also mentions the multifaceted nature of the enterprise architect job. In addition, to this the study looks at specific enterprise architect competencies that are necessary for the roles. Similarly, a study by Steghuis and Proper (2008) looks at the different enterprise architect roles and competencies. Like the other studies, Steghuis and Proper (2008) find that enterprise architects play several roles which require different competencies.

Steghuis and Proper (2008) gives several mappings of enterprise architect roles against competencies. In the study (Steghuis & Proper, 2008) categorize enterprise architect competences as either professional or personal. Professional competencies include such things as knowledge within certain areas e.g. business or IT. The study describes personal competencies as natural abilities that are hard to be leaned. They include persuasion, analytical skills and communication. A total of thirty-five (35) competencies are identified in the study. The study identified the following enterprise architect roles for the EA process: Creating the EA, applying EA by ensuring stakeholders are informed, maintaining the EA and organization or coordination of the EA process. A matrix of EA process roles against competencies is then mapped (Steghuis & Proper, 2008, p. 100). Further to this, the study identifies personality type roles such as: change agent, modeler, communicator, manager and leader. Accordingly, a matrix of roles against competencies is mapped. The framework proposed by Steghuis and Proper (2008) is like the other literature in that it highlights how different roles require different competencies depending on context. The proposed framework for this study is also consistent with the frameworks above, because it also highlights the
multifaceted nature of the enterprise architect role and gives a mapping of this against competencies.

Finally, The European Committee for Standardization (CEN) also has an enterprise architect competency framework (EA-CF), which is derived from the European e-Competency Framework e-CF. The e-CF is geared towards ICT competencies hence a bit general and broad. The EA-CF framework is more specific and geared towards development of enterprise architect competencies within Europe. The framework, has a total of thirty-six (36) competencies which are then categorized into classes and subclasses such as skills, attitude, knowledge areas etc. (Tambouris et al., 2012). The competencies identified are similar in many aspects to the ones in the proposed framework for this study.

In summary, most of the competency frameworks available in literature focus on building competencies within an individual. Although the framework proposed in this study can be used for building individual competencies. Ideally, the enterprise architect competencies must be built and shared across several individual in the organization. More on this in the contributions section below.

6.3 Contributions

The findings show that there are a lot of competencies and roles associated with being an enterprise architect. In addition to this, the enterprise architect role demands knowledge in several areas such as: business, domain knowledge and technical IT. To perceive that any single individual would be able to master all these competencies and play these roles very well seems a lot to ask for. Simply put, the enterprise architect role is quite challenging.

From the findings, it was evident that most organizations had only one enterprise architect. The vacancy posts analyzed listed several competencies and roles to be played by an individual enterprise architect. However, a comparison of the vacancy posts to enterprise architect profiles shows some discrepancy. Most of the vacancy posts usually listed more competencies or roles than most of the enterprise architects possessed.

This study proposes an enterprise architect framework but rather than focusing on developing all the proposed competencies and roles on a single individual, there should be a shift in focus to building these competencies across the entire enterprise architect team or at an organization.
level. This way the proposed framework can act as a guideline to the organization in identifying the right individuals who may be experts within a certain domain but also have general knowledge in other areas such as business or IT and can thus contribute to the EA initiative.

From the findings, it shows that the enterprise architect job cannot be learned from school or via training alone. The high average working experience of the enterprise architects from the interview and profiles gives further evidence that this is not an entry level job. Therefore, this study proposes that young professionals or fresh graduated should be integrated into the enterprise architect team under mentorship of more experienced individuals. This way, organizations can also build capacity in the young professionals.

The idea of building enterprise architect competencies among several individuals within an organization is also one area that future research can focus on.

### 6.4 Limitations

The paradigm from which this research was conducted requires that the researcher disposes as much as possible any preconceived ideas and notions in approaching the research (Strauss & Corbin, 1997). This being the case, the research was conducted with the knowledge that the researcher’s prior IT background and work may to some extent influence the study of the phenomenon and the people involved. The fact that the researcher has never worked as an enterprise architect or in a senior level position meant that much of preconceived notions and ideas had minimal influence in this study.

One of the limitations in this study is that none of the interview informants worked within Human resources or such posts as CIO or CEO. In retrospect, it could have been good to interview a few CEO’s or CIO’s to understand what they expect from their enterprise architects in terms of roles and competencies. It could have also been nice to learn the awareness of EA practice from non-enterprise architects. Therefore, this poses a limitation, as the research did not get to appreciate what other stakeholders within an organization expect of enterprise architects or their views regarding EA in general.

Another limitation for this study was the sample size of interview informants. The number of informant’s interviews was rather small. Tentatively, a total of about 10 to 12 interview
informants were to be interviewed. However due to other unforeseen circumstances only 7 informants were interviewed.

Related to the interviews, the other limitation was on the scheduling of the interviews. Most of the interviews were conducted within a short period. As such the spacing between some of interviews was either a day or two in some cases. Considering that this research was conducted within the grounded theory paradigm which advocates for the researcher to analyse, reflect and learn from the previous interviews. This was simply not feasible in case due to the scheduling of some of the interviews.

**Generalizability**

The interviews for this study were all conducted in with enterprises architects in Norway. Although some of the profile and vacancy posts were from other countries, the majority of these documents also came from Norway. The organizational context from which the study was conducted within medium to large scale organizations. Further the sample size on which data was collected may not be large enough. Although the results of this study are in tandem with what exists in literature, the findings from this study may not be generalized to any other organization, country or other regions. This studies credibility is established through triangulation of data collection and analysis methods. Interviews, documents analysis and literature review were all conducted.

In summary, From the findings of this research several key issues emerged, the following observations are made:

Enterprise architect roles and competencies require a broad range of knowledge that spans IT, business, organizational issues and interpersonal skills. For students willing to pursue an enterprise architect profession, it is important that they take up a wide range of courses. The courses should have a mix of business, management and Technical skill.

From the proposed framework and indeed the literature review. It is evident that the enterprise architect requires a broad range of knowledge which can be gathered over a long period of working with technical IT in different portfolios.
The study also revealed that, although education provides a good base for the enterprise architect role, although a lot of knowledge is gained on the job. The many competencies and roles are evidence of why the job demand broad experience and knowledge in different areas.
7 Conclusion

This thesis set out with the aim of exploring and understanding enterprise architect core roles and competencies to clarify some ambiguities regarding the same. To explore the subject: literature review, interviews and document review were conducted. This last chapter presents: areas for future research and concluding remarks in line with this studies aims and based on the study findings.

In summary, the findings of this research reveal that there are several roles that enterprise architects play. These roles demand for competencies such as technical knowledge, domain knowledge and an understanding of business. Accordingly, an enterprise architect competency matrix framework has been proposed to aid our understanding.

7.1 Future Research

Based on the results of this study, there are several recommendations for future studies on enterprise architects.

The Norwegian health sector has had its fair share of challenges with regards to implementation of EA. Among some of the challenges identified was unclearly defined and non-competent enterprise architects (Nygård & Olsen, 2016). There is, however, little or no literature regarding the enterprise architect competencies in Norway. Most of the research has been on EA practice itself. Evaluation studies would be critical to identify whether the benefits of having clearly defined enterprise architect roles and competencies would have a positive effect on EA practice.

Given that there are multiple roles that enterprise architects play depending on context. It would be interesting to investigate how the role of the enterprise architect evolves with corresponding evolution of the enterprise and its information infrastructure over a long time. Some of the things of interest would include: First, to explore what changes or factors within the organization trigger changes in enterprise architect roles. Second, to explore what kind of influence the competency and experience of an enterprise architect has, in the evolution of II.

During the study, it was found that university education does provide a good base to some extent on which enterprise architects can build their career on. The results also show that
education or training alone is not enough to equip someone for the enterprise architect role. Therefore, there is need for further exploration on how organizations can train fresh graduates on EA practice as a way of building enterprise architect competencies within the organization.

From this study, it was found that there are relatively few practicing female enterprise architects. The researcher did not manage to recruit any female informants for the research interviews. Two of the female informants contacted did not reply to take part in the study. From a random list of sixty potential informants in Norway only about three were females representing only 5% of the enterprise architects (n = 60). From the twenty-eight random LinkedIn profiles analyzed only 2 were female representing 7%. There is need for research regarding this gender gap in the number of female enterprise architects. Interviews with female architects to identify some of the challenges they face in the role based on their gender would be one way of approaching the research.

7.2 Concluding remarks

The study findings show that there are multiple roles that enterprise architect play depending on context and maturity of EA in an organization. Further there are several competencies that enterprise architects need based on the role they should play. Following the findings, an enterprise architect competency matrix has been proposed to clearly define enterprise architect roles and competencies. The proposed matrix framework further enhances our understanding and knowledge of enterprise architect roles and competencies.

Understanding enterprise architect roles and competencies is important for several reasons: Currently there are few universities that offer enterprise architect courses in their curriculum. Understanding the roles and competencies can go a long way in the formation of university curriculum and training courses that are geared towards enterprise architect training. Thereby help in narrowing for competent enterprise architects in industry. In addition, aspiring enterprise architects can be easily guided on how and what competencies to build on for the role.

Second, organizations wishing to recruit for enterprise architects can use the matrix to clearly define the role and competencies required hence help in recruiting for the right competent candidates for the role. Current ambiguities in enterprise architect role and competencies have made it hard to recruit for the right personnel. Thus, some organizations have faced
challenges in EA practice. Most importantly, organizations can also use the framework as a guide in building enterprise architect competencies across individuals within the entire organization. Lastly but not least, the researcher believes that the enterprise architect competency matrix proposed in this study helps in clearing ambiguities surrounding enterprise architect roles and competencies.
References


Bloomberg, J. (2013). The agile architecture revolution: how cloud computing, rest-based SOA, and mobile computing are changing enterprise IT: John Wiley & Sons.


PEAF. (2017). Definition of "Enterprise".


Appendices
Appendix A : Consent form

Master thesis: Enterprise architect core roles and competencies

The main aim of this study is to be able to derive the core competencies and roles an enterprise architect has to play in an organization. This study will assist in identifying the gaps that currently exist with regard to what is expected of an enterprise architect in their job, and the required level of training that they may need to shape a career in industry.

Procedure

The interview will take approximately 30 to 45 minutes of your time.

Please Note that the interview will be digital recorded. The information that you provide during the study will remain confidential and stored on a secure password protected computer. Only the primary researcher can have access to the audio recordings and transcripts. All recorded information will be destroyed upon completion of this study, August 2017 tentatively.

Voluntary participation

Participating in this study is voluntary and you have the right to withdraw your consent.

Should you agree to take part in the study, there is a chance that I will contact you again to re-interview in order to clarify any information which you might have given me in the initial interview.

Consent for participation in study:

I agree to take part in this study as described above and I am aware that:

- I have the right to withdraw from the study without providing a reason.
- The researcher promises to follow ethical procedures according to Norsk Senter For Forskningsdata (NSD) guidelines.

Participant signature: ___________________________ Date: ___________________________

Researcher’s signature: ___________________________ Date: ___________________________

For further queries, do not hesitate to contact my supervisor or the researcher as below:

Supervisor: Mikael Hailu Gabre-Mariam
Cell: +47 40 60 38 39 Email: mikaelge@ifi.uio.no or mikaelhailu@gmail.com

Researcher: Mwiza Kumwenda
Cell: +47 96 70 73 65 Email: mwizak@ifi.uio.no or mwizak@gmail.com

Address: Gaustadallén 23B, Ole-Johan Dahls hus, 0373 OSLO.
Appendix B: Interview Guide

Meeting Place: ……………………..  Date: …………………………..  Start Time: ……………………..  End: ……………………..  Language: ………………………………..

Interviewee:
Post: ………………………………..
Duration in current Post…………………………………………………………………..

1. Getting to know the interviewee
   1. How long have you been working in industry?
   2. Could you please tell me about your professional/career background?

2. Education and training
   3. What is your academic background like?
   4. To what extent has your education background been relevant to the job you do now?
   5. How useful are EA certifications e.g. TOGAF to equipping architects for their work **Probe:** what are the advantages and shortcomings of these certifications
   6. From your experience, what is the value of an enterprise architect to the organization?

3. Attributes and responsibilities
   7. Could you tell me a bit about your work routines on a daily or regular basis?
8. How is the role and responsibilities of the enterprise architect different from the business analyst or project manager?
9. How are the core competencies different from the business or system analyst?
10. Could you name 3-4 skill sets that are crucial for enterprise architects?
11. Would an individual with a technical background or management background be most suited for the architect role? Why?
12. How much is domain knowledge necessary to be effective in this role?
13. To what extent are you involved in change management or strategy shift PROBE: what skills are relevant such situations?
14. To what extent are models and architecture frameworks important in your job?
15. Many studies have identified that one of the main challenges of EA practice is that it is a political process e.g. ensuring compliance, buy in EA vision. Is this true, what skills are need for this?
16. How much of the change management in EA involves negotiation, conflict, management and consensus building?
17. There is a lot of complexity in all this, how do you handle it?
   To what extent are you involved in coaching, mentoring or leading team members?
Appendix C: Ethical Clearance Form

Mikael Gebre-Mariam

Institutt for informatikk Universitetet i Oslo

Postboks 1080 Blindern

0316 OSLO

TILBAKEMELDING PÅ MELDING OM BEHANDLING AV PERSONOPPLYSNINGER

Vi viser til melding om behandling av personopplysninger, mottatt 12.09.2016. Meldingen gjelder prosjektet:

49915 Enterprise architects roles and core competencies

Behandlingsansvarlig Universitetet i Oslo, ved institusjonens øverste leder

Daglig ansvarlig Mikael Gebre-Mariam

Student Mwizak Kumwenda

Personvernombudet har vurdert prosjektet og finner at behandlingen av personopplysninger er meldepliktig i henhold til personopplysningsloven § 31. Behandlingen tilfredsstiller kravene i personopplysningsloven.
Personvernombudets vurdering forutsetter at prosjektet gjennomføres i tråd med opplysningene gitt i meldeskjemaet, korrespondanse med ombudet, ombudets kommentarer samt personopplysningsloven og helseregisterloven med forskriver. Behandlingen av personopplysninger kan settes i gang.


Personvernombudet vil ved prosjektets avslutning, 31.08.2017, rette en henvendelse angående status for behandlingen av personopplysninger.

Vennlig hilsen

Katrine Utaaker Segadal

Belinda Gloppen Helle

Kontaktperson: Belinda Gloppen Helle tlf: 55 58 28 74

Vedlegg: Prosjektvurdering

Kopi: Mwizak Kumwenda mwizak@gmail.com
INFORMATION AND CONSENT

The sample will receive written and oral information about the project, and give their consent to participate. The letter of information is well formulated.

VIDEO RECORDING AND USE OF CAMERA

According to the notification form personal information will be gathered by using cameras or/and video recordings. We cannot find any information about this in the rest of the notification form or the letter of information and we presume that this is wrong.

INFORMATION SECURITY

The Data Protection Official presupposes that the researcher follows internal routines of Universitetet i Oslo regarding data security.

THE END OF THE PROJECT

Estimated end date of the project is 31.08.2017. According to the notification form all collected data will be made anonymous by this date.
Making the data anonymous entails processing it in such a way that no individuals can be recognised. This is done by:

- deleting all direct personal data (such as names/lists of reference numbers)
- deleting/rewriting indirectly identifiable data (i.e. an identifying combination of background variables, such as residence/work place, age and gender)
- deleting digital audio files
Appendix D: Research Plan

<table>
<thead>
<tr>
<th>Task</th>
<th>Time frame</th>
<th>Milestone</th>
</tr>
</thead>
<tbody>
<tr>
<td>• Project plan</td>
<td>June – September 2016</td>
<td>Project plan</td>
</tr>
<tr>
<td>• Literature review</td>
<td>Jan 2016- October 2016</td>
<td>Literature review</td>
</tr>
<tr>
<td>Planning of fieldwork</td>
<td></td>
<td></td>
</tr>
<tr>
<td>• Obtain ethical clearance from University of Oslo</td>
<td>September 2016</td>
<td>Ethical clearance</td>
</tr>
<tr>
<td>• Identification of candidates to interviews</td>
<td>August - September 2016</td>
<td>List of candidates to be interviewed</td>
</tr>
<tr>
<td>Data collection and analysis(simultaneous)</td>
<td></td>
<td></td>
</tr>
<tr>
<td>• Interviews and Data analysis</td>
<td>October -November 2016</td>
<td>Recordings, Transcripts, notes and Memos</td>
</tr>
<tr>
<td>• Document analysis</td>
<td>Dec – April 2016</td>
<td>Draft chapter: Analysis and findings</td>
</tr>
<tr>
<td>• Defend Master Thesis</td>
<td>Jun 2017</td>
<td></td>
</tr>
</tbody>
</table>
## Appendix E: Vacancy Posts Summary

<table>
<thead>
<tr>
<th>Post #</th>
<th>Job Description</th>
<th>Competencies /Roles</th>
<th>Education /Experience</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>-To Develop and manage enterprise business information, tech architecture &amp; standards. Facilitate SOA implementation</td>
<td>-Technical strategy -Good planner</td>
<td>-Degree or Honors and above -At least 8 years, 5 of which in senior level post</td>
</tr>
<tr>
<td>2</td>
<td>-Central in developing EA -Integration of systems and security</td>
<td>-Excellent communication -Ability to communicate via models</td>
<td>-Master’s degree and strong academic records -5 to 7 years IT Experience</td>
</tr>
<tr>
<td>3</td>
<td>-Key in the structure of strategic IT -Connect business needs with opportunities in IT solutions</td>
<td>-Analytical and structured -Curious about technology’s new possibilities</td>
<td>-Higher IT education -Broad experience in IT architecture -project experience with major infrastructure or solution deliveries</td>
</tr>
<tr>
<td>4</td>
<td>-Responsibility and role can vary depending on experience and role. Can be typically tasks within strategic consulting</td>
<td>-Lead digitization, automation and high delivery rate -At forefront in exploring new technologies and</td>
<td>- Higher education -software experience in java or .NET -Advantage If you know cloud based solutions /API management</td>
</tr>
<tr>
<td>5</td>
<td>-Mid to senior level manager -support business growth</td>
<td>-Ability to lead architecture white board sessions -Excellent written and verbal -must be both self-starter and team player</td>
<td>-minimum 15 Years of IT industry -Extensive knowledge in solution design</td>
</tr>
<tr>
<td>6</td>
<td>-Facilitate development of IT system architecture to support business strategy</td>
<td>-assist in enterprise wide research, evaluation design -Develop, maintain &amp; improve architecture artifacts</td>
<td>-Bachelor’s degree in technical field - 7 Years’ experience in IT &amp; 3+ years as enterprise architect</td>
</tr>
<tr>
<td>7</td>
<td>-Take architectural ownership -Provide technical leadership -Management level</td>
<td>-Excellent communication -translate business vision to be supported by IT -Create roadmap of program implementation -Knowledge in EA frameworks, e.g. TOGAF, Zachman</td>
<td>-Minimum 15 Years’ experience</td>
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<tr>
<td>8</td>
<td>-Responsible for leading in tech specification and system integration -management consulting</td>
<td>-understand business requirements and convert them into agnostic solutions -aptitude for analytics -strong presentation ability -collaborate in team</td>
<td>-undergraduate or masters, have 3 years work experience after completing undergrad -7 to 10 years’ extensive experience</td>
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<td></td>
<td>Environment</td>
<td>-5+ years of professional IT experience on infrastructure in a senior hands on role -Experience with automation tools</td>
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<tr>
<td>9</td>
<td><strong>Mid-senior level post</strong> -build enterprise cloud strategy -develop enterprise strategy</td>
<td>-work with cloud providers and vendors</td>
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<td>10</td>
<td><strong>Ensure that enterprise systems are envisioned, developed and implemented to meet business needs</strong></td>
<td>-Ensure alignment of IT strategy with company goals -Develop strategic utilization plan of company’s IT systems -design systems that cross multiple business environments -Experience with MDM technologies -Knowledge with global data privacy laws and regulations</td>
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<td>11</td>
<td><strong>Drive development of future IT landscape</strong> - ensure enterprise level IT projects implement strategy</td>
<td>-set strategy direction of Enterprise -Establish, maintain EA principles -direction on design of solution aligned to EA principles -BSC or Master degree in IT -Minimum 15 Years’ experience designing deployment architecture</td>
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<tr>
<td>12</td>
<td><strong>Develop, maintain and govern EA</strong></td>
<td>-Excellent communication &amp; organizational skills -Excellent project management, planning skills -Master Data management MDM -Bachelor’s degree in computer science, engineering, systems analysis -minimum 7 years’ experience</td>
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<tr>
<td>13</td>
<td><strong>ensure systems are in alignment with tech, roadmap and standards</strong></td>
<td>-Work with various business &amp; IT stakeholders -Alignment of cross program IT strategy -MDM experience</td>
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<td>14</td>
<td><strong>Drive cross functional collaboration</strong> -build technical solutions in a highly strategic &amp; consultative framework</td>
<td>-help align customer business strategies -work closely with senior leadership &amp; technical people -Ability to influence C-Level tech decisions in fortune 1000 organizations -10 years’ experience -Bachelor’s degree -Certifications in AWS or Azure highly desired. -Requires broad tech knowledge with emphasis on public &amp; private cloud computing, deep expertise with AWS or AZURE</td>
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<td>15</td>
<td><strong>Lead implementation of clinical trial platform</strong> -Demonstrate tech architectural leadership</td>
<td>-Decide communicate &amp; maintain long term strategic architecture -design, develop architecture standards -mentor &amp; help develop architecture, engineering standards -bachelor’s degree in computer science or related -10+ years’ related work experience -knowledge of big data, hbase, noSQL -Strong verbal &amp; written communication</td>
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<tr>
<td>16</td>
<td><strong>Senior thought leader in firm</strong></td>
<td>-Knack at picking up new technologies - Experience: Associate</td>
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<td></td>
<td>Lead in architecture design for fortune 500 clients</td>
<td>Mentor others on proper development pattern &amp; techniques</td>
<td>Undergraduate degree or equivalent combination of education &amp; work experience Requires 5-7 relevant experience</td>
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<td>17</td>
<td>Conversion of requirements into an architecture &amp; design that will become blueprint of solutions being created Document project lessons into architectural best practices</td>
<td>- Strong knowledge of system development - Exceptional organization &amp; time management skills - Mentor less experienced members</td>
<td>- 5 to 7 Years’ experience in enterprise/infrastructure architecture - Experience with public, hybrid cloud strategies</td>
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<td>18</td>
<td>Ensure complex architecture decisions are implemented consistently across organization Leading architectural &amp; engineering efforts</td>
<td>- Develop a culture of innovation - Define &amp; maintain complex target architectures - Ensure software projects align with strategic capabilities</td>
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<td>19</td>
<td>Define, design, implement enterprise solutions</td>
<td>- Operate in senior technology advisory capacity - Partnering with QA manager - Articulate execution strategy</td>
<td>- Bachelors in computer science or equivalent - 10 years of relevant software development experience</td>
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<td>20</td>
<td>Overall responsibility of developing strategy &amp; managing the architecture of information components of company</td>
<td>- Develop organization information model - Develop roadmap for implementation of information model - Modelling: extensive experience - Strong organizational and interpersonal skills</td>
<td>Degree in computer science or related - 17 years’ relevant experience with at least 5 in multi entity complex environment</td>
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<td>21</td>
<td>Focusing on digitization, cloud transformation</td>
<td>- Ability to handle complex architectural projects - Strong oral and written communication - Process &amp; stakeholder management</td>
<td>TOGAF certification or practical experience with PRINCE2</td>
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<td>22</td>
<td>Lead digitization work in municipality</td>
<td>- Contribute to portfolio management - Contribute architecture expertise in all project phases - Establish advanced architecture with a focus on system, service division &amp; information modelling</td>
<td>Higher school university - Minimum 3 Years’ experience - Experience from project management</td>
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<tr>
<td>23</td>
<td>Lead in implementation of change projects</td>
<td>Prepare roadmap &amp; IT strategy - Architecture consulting &amp; design of integrated systems - Good communication skills</td>
<td>5 years’ minimum work experience - Experience with relevant frameworks e.g. TOGAF, Lean</td>
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<tr>
<td>24</td>
<td>Develop, manage and maintain EA</td>
<td>- Master Data management MDM - Excellent communication - Excellent leadership - Strong analytical skills</td>
<td>Bachelor’s degree, higher Diploma - Minimum 7 years work experience</td>
</tr>
</tbody>
</table>