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Enterprise Architecture Implementation

A qualitative study in opportunities and obstacles of EA implementation

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Abstract

Enterprises of today need to be able to innovate and adapt their business quickly to remain competitive and seize new business opportunities in a fast changing environment. Enterprise architecture (EA) is an emerging approach, which promises to provide means to manage such complexity in the form of business-IT alignment, improved communication, reduced costs and better change management. Concisely defined, EA is the architecture of the system, which in this case is the enterprise, especially its business processes, technologies and information systems (IS). Despite huge interest, investments and stated values of EA, there are sadly several examples of EA implementation failure. We believe that the complexity, transparency and lacking understanding of EA and its purpose, together with being viewed as a one-time project, pave the way for a problematic implementation of EA (EAI). Something that has not gained enough attention in prior research. This is alarming considering the huge importance of the implementation phase for any information system (IS) project.

Our research is conducted through a case study at a global manufacturing company, in which we combine existent research with insights from stakeholders. We present an own model, based on a literature review of critical success factors (CSFs) of EAI, that can be used to highlight the most common opportunities and obstacles for EAI. We hope to contribute to the existing research of EAI and its CSFs, partly by pointing out that EA investments and achieved values can be undermined if important implementation factors are overlooked.

Keywords: Enterprise Architecture, Enterprise Architecture implementation, Implementation, Critical Success Factors, Diffusion of innovation

Abstrakt

I dagens allt mer föränderliga miljö behöver företag snabbt förnya och anpassa sig för att bibehålla konkurrenskraft och kunna fånga nya affärsmöjligheter. Enterprise Arkitektur (EA) är ett växande tillvägagångssätt, vilket lovar att tillhandahålla medel för att hantera sådan komplexitet. Detta i form av business-IT-alignment, förbättrad kommunikation, minskade kostnader och bättre förändringsledning. Kortfattat definierat är EA en system-arkitektur, vilket i detta fall utgörs av verksamheten och särskilt dess affärsprocesser, teknik och informationssystem (IS). Trots det stora intresset, investeringar och utlovade värden av EA, finns det tyvärr flera exempel på misslyckade fall av EA-implementeringar (EAI). Vi tror att komplexitet, transparens och bristande förståelse för EA och dess syfte, tillsammans med att EA ibland ses som ett engångsprojekt, banar väg för en problematisk implementering av EA. Detta är någonting som vi menar inte har fått tillräckligt stor uppmärksamhet i tidigare forskning. Vi ser det som oroväckande med tanke på den stora betydelsen av implementeringsfasen för varje IS-projekt.

Vår forskning består av en fallstudie genomförd på ett globalt tillverkningsföretag, där vi kombinerar tidigare forskning med erfarenheter från intressenter. Vi presenterar en egenskapad modell, vilken bygger på en litteraturstudie av kritiska framgångsfaktorer för EAI. Modellen kan användas för att identifiera de vanligaste möjligheterna och hindren för EAI. Vi hoppas kunna bidra till den befintliga forskningen inom EAI och dess kritiska framgångsfaktorer. Detta genom att bland annat påpeka att EA-investeringar och utlovade värden kan undermineras om viktiga faktorer inom implementeringsfasen förbises.

Nyckelord: Enterprise Arkitektur, Enterprise Arkitektur implementering, Implementering, Kritiska framgångsfaktorer, Innovationsspridning

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1. Introduction

1.2 Background

Business environments are today characterized by a high degree of change (Veit et al., 2014). Digitalization has contributed to redefining the game rules in the form of enhanced competition and an accelerated pace of technological change. The importance of information technology (IT) have in that sense increased, even in traditionally analog-based areas where IT traditionally only been serving an administrative purpose. Organizations have to decide whether to use IT as a basic service, keeping the company running without providing any extra value, or if IT should be aligned with the business strategy, boosting innovation for competitiveness. Organizations aiming to use IT as an enabler for business opportunities face different kinds of requirements. It is about how to incorporate information and interaction in their traditional everyday business, in which cost and complexity rapidly increase (Veit et al., 2014).

Enterprise Architecture (EA) is a management concept that can be used to deal with such issues. A primary goal of EA is to align business with IT (Roeleven & Broer, 2008). EA can provide business values such as better management of change, improved decision-making, reduced cost and business-IT alignment (Tamm, Seddon, Shanks, and Reynolds, Peter 2011). EA can be viewed as an architecture, where the system in question is the whole enterprise with a focus on business processes, technologies and information systems (IS) (Sessions, 2007). A structured EA approach provides support for change processes and increases the flexibility of the organization (Roeleven & Broer, 2008). This flexibility and capability to manage change is highly relevant in the digitalisation era of today, where industry after industry are disrupted by new technology.

One company, which apply Enterprise Architecture, is the Swedish global manufacturing company SKF. EA has come to play an important role in a major SKF business transformation program called UNITE. The purpose of the program is to reinvent and develop business processes across the company, deploy an end to end Enterprise Resource Planning (ERP) system and to globally integrate and align ways of working. A major EA effort has been conducted where the architecture of the organization has been defined, modeled and documented. As for today, SKF are on its way to move forward to implement EA and the architecture repository, GEAR, throughout the whole organization. As a part of SKF's EA implementation journey, we received the opportunity to investigate how SKF can succeed with the implementation of EA and their architectural repository.

1.3 Problem statement

In an ideal world, an implemented and well-defined EA would, among other things, give the organization a better position in facing the challenges of digitalization. The ability of EA to align strategic goals and business requirements with IT solutions also makes it a vehicle for

transforming IT into a business enabler (Bernard, 2012). EA takes the broader principles, capabilities and goals of the organization, defined in the strategies, and turns them into systems and processes that allow the organization to achieve these goals. However, documentation and management of the application landscape often involve thousand business applications and interconnections within medium and large enterprises. For that reason, EA can be considered an advanced topic (Buckl, Ernst, Lankes, Matthes & Schweda 2009). One of the fundamental issues architecture departments face today is how architecture is viewed as a mystery for stakeholders. This results in question such as “*what is architecture, and why are we doing this?*” (Burke, 2004).

Despite huge interest and investments in EA, there are sadly several examples of EA implementation failure (Morganwalp 2004). EA is sometimes considered as a one-time-project and most of the effort lies within the development stage. For that reason, Boster, Liu and Thomas (2000) argue it is unpleasant that organizations assume that EA will automatically add business and technical value: “*They see the effort as a one-time activity - we make a big push up the hill, then we can relax and coast down. Unfortunately, downhill is exactly where the EA goes with this attitude. An EA is only a precondition for creating architecture value. It is not a guarantee of long-term reward*” (Boster et al., 2000).

Ylimäki (2008) states that earlier research within EA mainly has been focusing on the development and modeling of the EA. In addition, Rogers (2003) concludes that getting new ideas and innovations adopted in an organization is a widely acknowledged problem. Based on above arguments, we believe that the implementation phase of EA has not gained enough attention in prior research. This is alarming concerning the importance of implementation for any IS project and the risk of big efforts being wasted on unused EA material if the actual implementation process is neglected. EA is sometimes seen as a one-time activity where the post development phase is neglected. Meaning, the challenge of getting EA material together with a raised EA awareness, established in the operational work of the organization. Because of the sparse research of EA implementation, we are exploring another implementation related field to gain additional knowledge, namely Diffusion of Innovation (DOI). DOI theory deals with answering the questions of how, why and at which rate new ideas and technology spread (Rogers, 2003).

1.4 Purpose and research question

The purpose of this study is to develop further knowledge within the area of EA implementation (EAI). This knowledge can be important in order to help organizations succeed with EAI. With the use of our own model of Critical Success Factors of EAI, we are identifying possible opportunities and obstacles which may arise during EA implementation. Additionally, we suggest possible solutions for leveraging respectively mitigating these. This study aims to answer two research questions (RQ).

- **RQ1:** Which opportunities and obstacles can be identified within the Critical Success Factors of EA implementation?
- **RQ2:** How can these opportunities and obstacles be leveraged respectively be overcome?

The first research question identifies opportunities and obstacles of EAI. The emerged findings will thereafter be further analyzed with the support of DOI theory in order to propose possible solutions for leveraging respectively overcome opportunities and obstacles of EAI.

2. Related Research

This chapter highlight prior research within the areas of Enterprise Architecture (EA) and Enterprise Architecture implementation (EAI) that we consider relevant to this study.

2.1 Enterprise Architecture

A number of researchers discuss the current state of Enterprise Architecture, both in research as well as in practice. The scopes of the reviews are however of different character (Simon, Fischbach & Schoder, 2013). There are those who focus on EA framework (EAF), other deals with EA literature and practice, or either one of them. For instance, Schekkermann (2003) and Schöenherr (2004) provide a detailed summary of existing frameworks. Odongo, Kang, & In-Young Ko (2010) are comparing different EA frameworks, highlights their complexity and provides insights in organization's choice of EA Framework. Leist and Zellner (2006) evaluate features and quality of existing EA frameworks, that should be taken in consideration when choosing an EAF. EAFs should meet requirements for developing, describe and maintained Enterprise Architecture. The authors conclude that well known frameworks hold different strengths. However, there are room for methodology improvements. In a fairly recent published article by Simon et al., (2013), the researchers are investigating different bibliometric methods, complemented by an extensive qualitative interpretation of the existing research field. It is shown to be a growing interest of management of the Enterprise Architecture from both the business and the IT side. However, there have not yet been developed any consistent understanding or methodology of EA (Simon et al., 2013)

Aier, Riege and Winter (2008) provides an examination of the EA literature, existing EA frameworks and EAF adoption. They are putting these different approaches against each other and compared them through different criteria, such as understanding and representation. Based on their extensive research, it was found that the EA function is not commonly integrated in business management, instead it is located in the IT organization. Elements that often are present within Enterprise Architecture in organizations are applications, data structure, projects, interfaces, business goals, software, network and hardware components. What seems to have minor role in the Enterprise Architecture of organizations seems to be

the fundamental elements of a company's business model. These can for instance be distribution channels, market segments and interaction with suppliers. Similarities in the study from Aier et al., (2008) have been found in Schöenherr (2008). Schöenherr (2008) have conducted an extensive literature review and concludes that certain layers of EA have a more mature body of knowledge than other layers, such as the organizational layer, or the business architecture, which among other elements constitutes of business processes and organizational structure. There is also widespread research within the application layer, or application architecture. In addition, Schöenherr (2008) highlights the "*horrible mess looking at the usage of the term Enterprise Architecture*" and suggest that the only way for improvements is through establishing a common structure and to develop one core theory. There are other authors among Schöenherr (2008) who are pointing out the lack of understanding and the lack of a commonly accepted definition of Enterprise Architecture (Langenberg & Wegmann, 2004; Buckl et al., 2009; Simon, et al. 2013).

Kappelman, McGinnis, Pettite, and Sidorova (2008) aimed to capture the main function and benefits of Enterprise Architecture through a survey by IT professionals. The majority of the respondents state that EA is considered to give a blueprint of the organization. In addition, EA was considered as a tool for organizational planning. In a more recent article by Winter, Buckl, Matthes, and Schweda (2010) it is rather argued that the major number of those who practice EA, only documented the as-is Enterprise Architecture. The goal of EA management was discovered to be business-IT-alignment. A similar investigation made by Schmidt and Buxmann (2011) rather show architecture governance to be the most important factor. Less important factors are stakeholder participation and communication.

Other researcher evaluating the EA research is Langenberg and Wegmann (2004), which analyzed 80 papers, referring explicitly to Enterprise Architecture. The authors conclude that the interest of Enterprise Architecture is growing. However, the focus lies mainly on the adoption rather than on frameworks and modeling issues. According to Simon et al., (2013), Zachman (1987) was among the most cited until 2004. Today it is however stated by Buckl et al., (2009) that the "The Open Group Architecture Framework" (TOGAF) is the most common approach for practitioner.

2.2 Enterprise Architecture Implementation

Research within the area of EA implementation is well-debated and referred to, usually in the context of different EA frameworks and methodologies (Session, 2007). However, its main focus lies on implementation in the earlier stage of developing an Enterprise Architecture, rather than on how to get the organization to utilize the developed EA artifacts and methods in order to achieve a long-term EA success.

Implementation research within information technology (IT) and information system (IS) have been widely conducted during the past 20 years, without any common accepted definition and theory of the term implementation (Myers, 1995). In addition, existing models mostly highlight some of the many aspects of an IS implementation, which according to

Myers (1995) is alarming. We have found similar issue regarding EA implementation. The term is used differently depending on the contexts and lacks a commonly accepted definition. Several EAFs are viewed as implementation methodologies for EA. They are proposed in earlier research; however, the methodologies are presented as communications models and as a mean of how to offer support in the early stage of the development of an Enterprise Architecture (Sessions 2007; EACOE, 2010; Schekkerman, 2003; Avison & Fitzgerald, 2002). As a consequence, implementation rather refer to various steps in the development or maintenance stage, focusing on the development and governance of EA, for instance the content of EA and its underlying architectural layers (Nikpay, Selamat, Rouhani & Nikfard 2013; Rouhani et al., 2015). This view is supported by Ylimäki (2008) who states that earlier research within EA mainly has been focusing on the development and modeling of the EA.

Nikpay et al., (2013) provide an overview of EAI research, comparing what they consider to be the five most common EA implementation methodologies (EAP, TOGAF, DODAF, Gartner, and FEA) against each other. The research concludes that these five EAIMs are the most popular in EA projects and several others EAIMs are derived from these EAIMs. In addition, it is stated that none of the methodologies cover all demands of an EA implementation. Similar statement has been found in Sessions (2007), EACOE, (2010), Schekkerman, (2003) and Avison & Fitzgerald (2002). Nikpay et al., (2013) does however claim that certain EAIMs, such as TOGAF, cover more demands for EAI.

3. Theoretical Framework

This section describes our theoretical framework. Initially, we describe important concepts concerning this study. These concepts are Enterprise Architecture (EA), Enterprise Architecture Management (EAM) and Enterprise Architecture implementation (EAI). We also will provide our own definition of EAI. Thereafter, we will present *critical success factors* that are of importance during EAI. Finally, *Diffusion of Innovation* will be presented and later on used in the analysis to leverage the analysis and contribute with additional insights of the field of Enterprise Architecture implementation.

3.1 Enterprise Architecture

Depending on organization, institute and researcher, the term Enterprise Architecture (EA) are defined differently. The various definitions of EA are partly a result of the discipline's short history which stems from Zachman's first paper in 1987 (Sessions, 2007; Lapkin et al., 2008; Land, Proper, Waage, Cloo & Steghuis, 2009). The EA definition of the well-known research institute Gartner states that EA is "*the process of translating business vision and strategy into effective enterprise change by creating, communicating and improving the key requirements, principles and models that describes the enterprise's future state and enable its evolution*" (Lapkin et al., 2008). Land et al., (2009) has analyzed the EA definition of several leading organizations within the field, such as The Open Group, ArchiMate, Capgemini and Gartner. What these definitions agree upon is that EA refers to the organization's structure and relationships combined with applicable governing principles that provides guidance and

support for directions and decisions. EA is about shaping and governing the design of the future state of the organization, and while doing this, being based on principles and models to specify and visualize this future state (Land et al., 2009). A more concise definition is that EA is the architecture of the system which in this case is the enterprise and especially its business processes, technologies and information systems (IS) (Sessions, 2007). Sessions (2007) definition will be used to define the EA term in this paper due to its conciseness and pedagogical qualities.

EA can achieve value for the business in many different ways (Tamm et al., 2011; Land et al., 2009). The most mentioned values according to Tamm et. al (2011) are *better management of change* due to a full understanding of the organization and the business and IT coherence, *improved decision-making* where EA acts like a compass for management and stakeholders and *improved communication and collaboration* as a result of a shared organizational vision of the future state. Other acknowledged values are *reduced costs* through elimination of redundancy and the use of standardization and shared services as well as *business-IT alignment* that ensures projects and efforts within the two domains are in line with each other (Tamm et al., 2011; Land et al., 2009). Primary value aspects of EA are often long term and it is therefore a challenge to demonstrate the short time value of EA (Bricknall, Darrell, Nilsson & Pessi, 2006). The amount of value an organization gain through EA is linked to its EA maturity which can be determined through the use of Enterprise Architecture Maturity Models (EAMM) (The Open Group, 2011; Ylimäki, 2008). The idea of maturity models is how to evolve from one current level to one idealistic ultimate state, without skipping the developing states. A higher level of maturity results in more business value and a high integration with the business, while a low level of maturity results in less value and EA that is restricted to the IT function of an organization (Burton & Blosch, 2014). Ylimäki (2008) argues for the use of an EA quality management system in association with EAMMs.

One of the primary purposes of EA is the ability to align strategic goals and business requirements with IT solutions, the so called business-IT alignment (Bernard, 2012; Buckl, 2010; Roeleven & Broer, 2008; Sessions, 2007). It is important to mention that alignment is not an end state, instead it is a temporary state that needs to be maintained (Pessi, Hadzic, Saarikko & Magoulas, 2013). Today, researchers state that the alignment between business and IT is not enough to guarantee success, management of alignment within the complex area of EA requires a richer concept (Land, 2009; Pessi et al., 2013). Pessi et al., (2013) propose four different types of alignment and argue for the need of alignment between *IS and decisional rights and responsibilities*, *IS and business value and mission* and *IS and stakeholder knowledge*.

EA is implemented through the use of Enterprise Architecture Frameworks (EAFs). An EAF can be described as a communication model for developing an Enterprise Architecture. An EAF generally provides models, principles, services, approaches, standards, design rules, concepts, visualizations and configurations which provides guidance for the development of specific architectures (Schekkerman, 2003). Frameworks can also include methods, tools and documented processes (Schekkerman, 2003). The use of an EAF generate architectural

artefacts, also called EA artefacts, which are documentation products such as documents, diagrams, spreadsheets, slides or videos (Bernard, 2012). It is commonly agreed that no single EAF can offer an organization complete guidance to an EA effort. Instead, an organization should combine parts from existing EAFs in an organization specific EAF that utilize their needs (Sessions, 2007; Schekkerman, 2003; Odongo et al., 2010). This approach is sometimes called *blended methodology* (Sessions, 2007; Schekkerman, 2003)

Usually, EA frameworks consist of a number of hierarchical architectural layers which maintains design consistency, structure and reduces the number of handled artifacts at a time. The business architecture layer is typically specified first, before being followed by the IS related layers (Winter & Fischer, 2006). According to Winter and Fischer (2006), most EAFs distinguish between the following five layers, Business Architecture, Process Architecture, Integration Architecture, Software Architecture and Technological Architecture¹. Pessi et al. (2013) means that EA often is divided in three or four layers, referencing to the structure of the widely known TOGAF and to The United States Office of Management and Budget (2007). These layers are, Business Architecture., Application Architecture, Data Architecture and Technical Architecture². While Winter and Fischer (2006) and Pessi et al., (2013) provides a somehow differentiated result in their research of the common layers of Enterprise Architecture, they both agrees on the constantly occurring layer of business architecture. Burton and Blosch (2014) further highlights the importance of business architecture as a mean to clearly define and make the business strategy of the organization actionable. Business architecture also provides deepened insights into the business strategy and can e.g. be used to formulate measurable business outcomes. Burton & Blosch (2014) also emphasizes the role of business architecture when it comes to quickly addressing opportunities and adoptions in ways of working and in business capability requirements. This is highly relevant in the fast changing business environment of today. Business architecture provides linkage to the IT function and enables a shared vision and shared execution plans for business and IT (Burton & Blosch, 2014).

Despite the obvious benefits of EA (Tamm et al., 2011; Land et al., 2009), there are many examples of failed EA projects (Sessions, 2007; Roeleven & Broer, 2008). Two of the major reasons for this is the lack of EA awareness in the organization and that it takes longer time than planned to set up an architecture. This may depend on the challenge in establishing the business connection of EA. It is also argued that a gap between the initial intentions for EA and the actual realization of the architecture often exists. Other reasons are lack of support from C-level managers (such as CIO and CFO) and limited commitment from other employees and stakeholders to follow new routines and comply with agreements (Roeleven & Broer, 2008). It is essential that the organization commits to the changes that are required

¹ *Business Architecture*: Represents the fundamental organization. *Process Architecture*: Represents the service development, service creation and service distribution in the organization and focuses on effectiveness and efficiency. *Integration architecture*: Represents the organization of information system components and their integration with each other. *Software architecture*: Represents the organization of software artifacts such as software services and data structures. *Technological architecture*: Represents the organization of computing/communication hardware and networks (Winter & Fischer (2006).

for an EA transformation project, if the promised value of EA should be achieved (Sessions, 2007). The implementation of EA and an EAF is a long-time commitment that requires investments in the organization, technology, education and a change of the organizational culture (Kaisler et al., 2005; EACOE, 2010).

3.2 Enterprise Architecture Management

Enterprise Architecture Management (EAM) is about the management of EA, and therefore also deals with the implementation of EA (Aier, Gleichauf & Winter, 2011). EAM can increase the likelihood of the produced EA material being used by the employees by ensuring it is up-to-date and that the correct parts of the architecture are modelled (Abraham, Aier & Winter, 2012). It is also a way to make sure that the strategic potential of EA is realized (Löhe & Legner, 2014). We consider EAM important for a successful EA implementation because of its role in ensuring purposeful EA material and that it, without a good EA material, would be much harder to demonstrate the advantages of an EA methodology. Formal and visible EAM can also make sure EA rules and processes are followed within the organization (Löhe & Legner, 2014), which is a critical success factor for EA implementation. Furthermore, EAM supports planning and transition to the target architecture (Löhe & Legner, 2014) which are elements of importance in an EA implementation.

EAM deals with the establishment and continuous development of EA. EAM is about the management task of planning and controlling business changes from an architectural perspective (Aier, Gleichauf & Winter, 2011). While EA focus on what to architect, i. e. what to model and notate, EAM focus on how these EA concepts should be used (Löhe & Legner, 2014). It focuses on the stringent management of an Enterprise Architecture and is therefore a continuous management process of EA as the management objective (Abraham et al., 2012; Hauder, Roth, Schulz & Matthes, 2013). EAM is a mean for the organization to achieve the benefits of EA such as business-IT alignment and better management of change (Abraham et al., 2012; Löhe & Legner, 2014). EAM captures the current state of the organization's EA and makes sure it's up to date. It also provides ways to present the overwhelming information of an Enterprise Architecture and present it in a manageable way (Abraham et al, 2012). EAM methods presents processes for things such as designing an architectural vision, development and maintenance of as-is and to-be architecture models, migration planning, implementation of EA and for analysis of EA based on architectural models (Aier et al., 2011).

Common challenges of EAM is the ivory tower syndrome where the developed EA material and EA artefacts are created by the architects in isolation from the rest of the organization. This lead to EA material not being used and delivered EA products that do not match the requirements of the stakeholders. Other common challenges are unclear EAM demands, a fast changing enterprise environment and a lack of experienced architects (Hauder et al., 2013). There is a common lack of acceptance for the EAM function in the IT organization, since employees having hard to see its benefits, and because of the architect's often limited role in IT management. To gain the benefits of EAM, organizations must establish the EAM concept

as a new form of governance. This governance includes management of the EA life cycle and support of the IT management in developing, implementing, integrating and operating complex application portfolios (Löhe & Legner, 2014).

3.3 Defining Enterprise Architecture implementation

This study aims develop future knowledge within Enterprise Architecture implementation, hence it is of great importance to define the term *EA implementation* and how it will be used in this study. Related research within “EA implementation” have shown to be well-debated and cited, usually in the context to different frameworks and methodologies (Session, 2007). However, its focus is mainly on implementation in an early stage of a development of an Enterprise Architecture, rather than how to get the organization to utilize the developed EA artifacts and methods. It is argued by Myers (1995) that the term implementation, in relation to IS, lack a widely accepted definition, despite its frequent use in research. As a consequence, the term has different definition, depending on the context. Implementation is defined by (Myers, 1995) as “*a step in the systems development life cycle*”. Implementation in this context refer to all those activities involved when IT is introduced in an organization, at a particular stage of development (Myers, 1995). A similar view has been found in Rogers (2003), which state that implementation “*occurs when an individual (or other decision-making unit) puts an innovation to use*” (Rogers, 2003). Deriving from these definitions, this study defines EA implementation as: *Getting EA artifacts, such as models, process models, capability models and the new way of working, together with an EA awareness, established in the organization.*

3.4 Critical Success Factors for EA implementation

There are several factors involved when successfully implement EA. Nikpay et al., (2013) has made a comprehensive literature review of a number of articles investigating such factors, so called critical success factors (CSF)³. The literature review is based on an investigation of earlier CSF theories of prior research⁴. Nikpay et al., (2013) concludes that fundamental CSFs for EA implementation are planning, governance, management, communication and support. Documentation, stakeholder participation, processes and EA skills are other well documented factors. Nikpay et al., (2013) further explain that despite all factors influencing the EA implementation, one should consider that each EA project has its special characteristics, in which certain factors are of more importance than others. A statement which is supported by Aier and Schelp (2010), which argues that there is no best way to implement EA. Instead, an organization need to find its own combination of factors that are of relevance to its own needs and maturity (Aier & Schelp, 2010).

³ “One of the most important things that a company or organization must do well in order for its business or work to be successful” (Cambridge dictionary, 2017).

⁴ Aier & Schelp, 2010; Kamogawa & Okada, 2008; Schmidt & Buxmann, 2011; Van der Raadt, Slot & Van Vliet, 2007; Ylimäki, 2008.

Our model of CSFs for EA implementation is built on research in CSFs of EA in general (Kaisler et al., 2005; Kamogawa & Okada, 2008; Schmidt & Buxmann, 2011; Ylimäki, 2008), of EA implementation (Aier & Schelp, 2010), and of IS implementation (Aladwani, 2001). The model is inspired by the literature analysis of CSFs in EA implementation conducted by Nikpay et al., (2013). However, we argue that some of Nikpay's (2013) factors are overlapping each other. We have also chosen to include additional research which we consider important in addressing EA implementation. We present a somewhat shorter list of EA implementation CSFs, then Nikpay et al., (2013), although with more comprehensive definitions of each CSF. In order to visualize our CSFs for implementing EA, the CSFs are presented in six different categories, which will be presented below. Each CSF includes a number of indicators. An indicator is a part of a CSF that should be present for successful EAI. The model (figure 1) of our identified EAI CSFs will be presented further below.

3.4.1 EA material, Tools and Methodology

1.1 EA scope and coverage: This success factor is describing if the EA initiative is clearly formulated and if it covers all relevant aspects of the organization. Does the organization have a clear definition of EA? Clear mission and goals of the EA are essential to specify the direction (Schmidt & Buxmann, 2011; Ylimäki, 2008). Clear goals also make it easier to measure the implementation success (Schmidt & Buxmann, 2011). What benefits are to be achieved? Are the objectives and importance of EA and its benefits understood and approved by the organization (Ylimäki, 2008)? Are key EA stakeholder groups defined and documented and is the EA rooted in the business strategy (Schmidt & Buxmann, 2011; Ylimäki, 2008)? Is it decided how much of the organization the EA should cover and how deep and detailed the EA should be (Ylimäki, 2008)? A larger EA coverage increases the chances that a business unit can use the EA artifacts (Aier & Schelp, 2010). More important, the EA should cover the most essential parts of the organization (Schmidt & Buxmann, 2011).

1.2 EA Models and Artifacts: Models are important when communicating the architecture to different stakeholders and it is therefore needed to take models in consideration. Are the business requirements of the architecture defined? Are all essential level or views of architecture modeled? Is there traceability between business and IT (Ylimäki, 2008)? Abstract models such as domain models and capability models, have relations to both the IT and the business side, and are often appreciated and can therefore be used as a mean of communication (Aier & Schelp, 2010).

1.3 Tools and Methodology: It exist several requirements for methods in order to develop and maintain an EA. Methods should be structured, well-defined and documented (Schmidt & Buxmann, 2011; Ylimäki, 2008). They should specify processes, guidelines, best practices and drawing standards which characterize a high-quality architecture. Methods should also support the tracking of architectural decisions and changes. Furthermore, the architecture process should be business and practice oriented and model based (Ylimäki, 2008).

Appropriate tools can also foster EA communication. The tools should support for modelling and handling of decision processes (Aier & Schelp, 2010). Descriptions and models can be stored in an integrated repository for increased accessibility (Schmidt & Buxmann, 2011).

3.4.2 EA Governance

2.1 EA Governance and management: Governance deals with the management and organizational aspects of architecture as well as decision-making. Aspects included are: established structure of EAM, effective processes, effective change management, risks and integration into organizations business processes (Ylimäki, 2008). EA governance should be well anchored in the organization to ensure EA has a strong formal power. The EA function of an organization should be strategically positioned in order to have enough impact, in example, the EA function can be placed on the business side instead of the IT side of the organization (Aier & Schelp, 2010). An EA board where stakeholders representing different business units should be established (Aier & Schelp, 2010; Kaisler et al., 2005).

2.2 EA Project Management: Project management skills play an important role in the EA development (Kaisler et al., 2005; Ylimäki, 2008). Issues connected within this area is program management, which include how coordination between different EA project is managed. It does also include milestones, checkpoints, best practises, realistic budgets and schedules (Ylimäki, 2008). Dedicated EA transformation projects often result in higher success (Schmidt & Buxmann, 2011). EA should be involved in projects by default. Quality gates that projects, especially IS projects, need to surpass by fulfilling strict architecture requirements, can be established. Projects should, during their lifecycles, be supported by EA expertise in order to ensure they are in line with the architecture (Kaisler al., 2005; Aier & Schelp, 2010). Active EA support of projects is a major success factor according to Aier and Schelp (2010).

2.3 Rules and EA process: The EA function establish rules and processes that should be followed. They also define the implementation process (Ylimäki, 2008). These rules and standards need to be clearly formulated in order to be followed by employees and project management. Regulation can however be overdone, with the risk of employees finding it impossible to stick to it, this would lower the acceptance. Regulations are dependent on extensive communication (Schmidt & Buxmann, 2011). Kaisler et al., (2005) believes that the organization's compliance with EA fails when changes to the IS landscape occur. Project teams do not know that the EA exists, or do not understand EA. Project teams do not follow the EA standards and do not collaborate with the architects, they also get allowance to skip the EA guidelines.

2.4 EA Planning: Schmidt and Buxmann (2011) mean that planning is a coordination mechanism that uses description of a target state to achieve a desired outcome (Schmidt & Buxmann, 2011). It is therefore important to have specific goals of the implementation and to know what is to be achieved by EA. Architectural plans should be established and used

during the implementation project (Ylimäki, 2008). A good change management or configuration management plan should also be established (Kaisler et al., 2005).

2.5 Assessments and Evaluation: The EA assessments and evaluation are a part of the EA governance. Consequences of architectural decisions should be measured and evaluated and the results should be used to support future decisions. This may be challenging because it will take years before the effects of certain architectural decision shows (Ylimäki, 2008). The implementation process can be measured and evaluated during its ongoing, in order to find possible improvements (Aladwani, 2001).

3.4.3 Communication

3.1 Communication: In order to achieve a common understanding and agreement of the EA scope and objective, as well as its content, effective communication is essential (Aier & Schelp, 2010; Schmidt & Buxmann, 2011; Ylimäki, 2008). To facilitate communication, architectural concepts needs to be defined and documented. They should also cover the viewpoints of all stakeholders. System development methodology concepts and other used practices in the organization needs to be related to the EA. A communication plan or a strategy for architectural communication should be defined and documented. Various communication channels and possibilities of communication should be used. The architectural communication can be analyzed to find improvements. The timing of the communication should be considered and be frequent and proactive (Ylimäki, 2008). Communication is dependent by EA tools providing easy up-to-date access to models and other EA artifacts (Aier & Schelp, 2010). Communication can be harder and therefore more demanding in large companies. Aier and Schelp (2010) stress the importance of communication between the architects and the business units and the communication skills of the architects. There is a general lack of communication skills of architects that should be increased (Aier & Schelp, 2010).

3.4.4 Stakeholder Commitment and Skills

4.1 Commitment and stakeholder involvement: Long-term top management commitment is essential in order to succeed with EA efforts (Kamogawa et al., 2008; Ylimäki, 2008). Top management should have a desire in establishing good EA. Other stakeholders, such as software developers, project managers and people representing different business units, should also be committed to the EA success and not chose to stay outside the process. Involvement in the implementation process can increase their commitment (Schmidt & Buxmann, 2011; Ylimäki, 2008). If the stakeholder participation is high and organization wide, there is less risk for the EA decisions to simply be viewed as top-down decisions. This will lead to higher acceptance (Schmidt & Buxmann, 2011).

4.2 Training and Education: EA team members and other key stakeholders must have sufficient knowledge in architectural work. This often means they need to be trained

(Ylimäki, 2008). Aier and Schelp (2010) states that the impact of EA is mostly defined by the architectural skills of non-architects and their perception of architecture (Aier & Schelp, 2010). Therefore, architects should consider training other stakeholders (Ylimäki, 2008). EA education and training of employees outside the EA department plays an important role in the success of EA implementation. Well trained employees increase the acceptance of architectural issues and reduces barriers (Aier & Schelp, 2010; Kaisler et al., 2005). Training can be supported by a structured training plan. Training should be a continuous process with specific material targeted to different stakeholders based on their individual needs (Ylimäki, 2008).

3.4.5 EA Pressure

5.1 Economic pressure: If the organization or specific business units are under cost pressure, there are increasing incentives for embracing EA. Respectively, if the business units have infinite resources, there may be less incentives for using EA to streamline operations. Having a dedicated architecture budget also increases the chances of a successful EA implementation (Aier & Schelp, 2010).

3.4.6 Organizational culture

6.1 Organizational Culture: Organizational culture is important and may have an impact on the success of EA (Kamogawa & Okada, 2008; Ylimäki, 2008). Cultural change such as the employee's attitudes towards change is in many cases inevitable. Key issues one should have in mind are the following; attitudes towards architecture approach, attitude towards changes, trusting environment (both socially and politically) and open communication combined with organizational constraints (Ylimäki, 2008). Employees view of EA and the IS/IT department is also of importance. Is EA grounded in the organizational culture and do employees have a belief in architecture? Is the IS/IT function viewed as a cost center, a supporter or as an enabler of the business? The willingness to adapt to architecture depends on its visibility and perception outside the EA department. EA team members can work with spreading the concept outside their own department to make sure architectural attention and awareness are high (Aier & Schelp, 2010).

3.4.7 Model of Critical Success Factors for EA implementation

Based on our literature review of EAI, the model below summarizes our identified CSF categories, their including CSFs and the indicators of each CSF.

CSF Category	Critical Success Factor (CSF)	Indicators
1. EA material, Tools and Methodology		
	1.1 EA scope and coverage	Clear definition of EA
		Clear mission and goals of EA
		Objectives and importance of EA understood
		EA that cover essential stakeholders and parts of the
		EA rooted in business strategy
	EA Coverage and detail level decided	
	1.2 EA Models and Artifacts	EA reflecting business requirements
		Clear traceability between business and IT
		Essential level and views of architecture modeled
1.3 EA Tools and Methodology	Sufficient quality of EA methods	
	Specified processes, guidelines and best practices	
	Sufficient quality of EA tools	
2. EA Governance		
	2.1 EA Governance and Management	Established structure of EAM
		Strong formal power of EA
		Strategically positioned EA department
		EA board exists
	2.2 EA Project Management	EA program management
		EA involved in projects
		Established EA quality gates for projects
		Projects supported by EA expertise
	2.3 Rules and EA process	Established EA rules, standards and processes
		Communicated EA rules, standards and processes
	2.4 EA Planning	Defined goals of EA implementation
		Architectural Plans
		Change management plan for EA
	2.5 Assessments and Evaluation	Architectural decisions measured and evaluated
		EA implementation measured and evaluated
3. Communication		
	3.1 Communication	Communication plan or strategy for architectural communication
		Various communication channels for EA
		Architectural communication is analysed
		EA communication is frequent and proactive
4. Stakeholder Commitment and Skills		
	4.1 Commitment and Stakeholder Involvement	EA commitment from top management
		EA commitment from other stakeholders
		EA implementation involvement of other stakeholders
	4.2 Training and Education	Non-architects trained in EA
		Architects trained in EA
		Training plan established Training material targeted to different stakeholders
5. EA Pressure		
	5.1 Economic Pressure	Stakeholders feels a need/pressure of working with EA
		Dedicated EA budget
6. Organizational Culture		
	6.1 Organizational Culture	Employees have a good attitude towards EA change
		EA is visible outside its own department
		View of IT and EA function (cost center, support, enabler)

Figure 1: Model of CSFs within EA implementation

3.5 Diffusion of innovation

Diffusion of innovation theory is a generally applicable theory and have been used within IT and IS research a number of times to understand the adoption or non-adoption of technology and information systems (Bradford & Florin, 2003; Fichman & Kemerer, 1999; Premkumar, Ramamurthy & Nilakanta, 1994). However, it does not seem to have been used in the case of EA or EAI. DOI has in this study been used to understand underlying aspects that are of relevance when an organization is adopting a new idea and way of working. DOI will later on be used to analyze the empirical material in order to suggest solutions for handling EAI obstacles and opportunities.

Based on Rogers (2003), the process which take place when a new idea or an object shall be spread, summaries the meaning of *diffusion of innovation*. Diffusion is the process by which an innovation is communicated to individuals, through different types of communication channels, within a social system. Diffusion is viewed as a sort of communication, which is involved when a message is to be spread and considered to be the new ideal. Communication is viewed as the process when participants create and share information with one another in order to reach a common understanding. The term *innovation* is defined as an object, idea or perception, which for an individual is new or is to be accepted for adoption. The innovation does not necessarily have to be considered as new, it rather lies in the eyes of the viewer. Today, the majority of all innovations have a technical character which is based on both hardware and software. Unlike an invention, an innovation requires an area of use and a general acceptance by researchers and organizations (Rogers, 2003). Based on Rogers (2003) arguments, we thereby consider EA as an innovation that is to be adopted and accepted by an organization and its individuals.

3.5.1 Elements of diffusion

There are certain elements in the diffusion process which are crucial for the success of diffusion of an innovation. These elements are *the attributes of innovation, communication channels, the social system* and *time*. The element of *time* will however be excluded in this study due to practical limitations. However, we will add *risk*, which also is a factor of relevance within the process of diffusion (Rogers, 2003).

3.5.1.1 Attributes of innovation

According to Rogers (2003) an innovation has different characteristics. These are perceived by the individuals of a social system, who determine its rate of adoption. Five attributes are of relevance for the adoption of an innovation. The five attributes for success of an innovation are *relative advantage, observability, compatibility, complexity* and *trialability*. These attributes define how the innovation is perceived by the individuals and therefore have a major impact on the diffusion of the innovation. *Relative advantage* defines the degree of which the innovation is perceived as better than prior innovation and methods. A better innovation generally achieves a higher innovation rate. A better innovation can also be an innovation that is cheaper and/or has a higher status than prior innovations. An innovation

can also be adopted with the purpose of preventing future issues, a so called preventing innovation. A preventing innovation is characterized by a lower adoption rate. According to Rogers (2003), this depends on the difficulty of showing the relative advantage of preventing innovations. The advantage of preventing innovations is, most of the time, not immediate. Instead their advantage shows over time. Preventing innovations often lead to something not happening, such as preventing future errors, instead of making something happen. This also obstructs the possibilities of showing the values of the innovation. The *compatibility* of an innovation states the degree to which the innovation is in line with the existing ideal, experience and the needs of the adopter. An innovation that conforms to these have better chances of achieving a high rate of diffusion. The *complexity* of an innovation specifies how easy to innovation is to understand and use. The perception of complexity is subjective and differs between individuals since people have different backgrounds and knowledge. An intuitive innovation will however be easier to use and increases the chances of successful adoption. The *trialability* of an innovation specify the degree to which it is possible to test the innovation in order to reduce the eventual uncertainties an individual can experience with the innovation. If an adopter has the chance of testing the innovation, the adopter can form a view of the innovation and find out if it fulfills the needs (Rogers, 2003). *Observability* of an innovation defines the degree to which the innovation is visible to other potential adopters. If the advantages of the innovation are visible and the innovation can be easily demonstrated, this will increase the adoption rate of the innovation (Rogers, 2003).

3.5.1.2 Communication channels

Communication is a two-way-process where information is transmitted from one point to another. Communication is of great importance within an organization and can be seen as a key function of management. Without communication between levels, departments and employees, an organization cannot operate (Rogers, 2003). The diffusion of innovation begins when information about a new idea reach an individual, which previous did not know about the innovation (Rogers, 2003). This information is spread by an individual or group, which already possesses knowledge about the innovation. The messenger is connected to the receiver through a communication channel. Different communication channels for information spreading exist, which holds different advantages. For instance, information through mass media (e.g. TV and radio) is a fast and effective method to reach a high number of receivers and create an awareness about the products availability and purpose. It does not however imply any human interaction. Interpersonal communication channels facilitate interaction between two or several individuals. However, informal communication often reaches less individuals than mass media. Informal communication creates strong opinions among individuals that can increase the chances of adoption. Therefore, the use of informal communication channels can constitute an effective method of changing individual's attitudes towards a new idea. An individual's attitude are many times shaped by the formulated attitudes of other individuals who previously adopted the innovation. The impact of communication between different individuals depends on several attributes of the individuals, such as education, social status and values. It is however stated by Rogers (2003) that

individuals with similar views and thoughts have greater possibilities to reach effective communication (Rogers, 2003).

3.5.1.3 The social system

What Rogers (2003) call the social system, is the society where the innovation is diffused or spread. Different actors with different relations to one another are represented in the social system. The chances of an actor adopting the innovation depends on the two factors of internal influences and external influences. The question of who transfer messages to whom and the structure of this transfer can be mapped out through network analysis (Rogers, 2003).

In general, the human communication (exchange of ideas) occurs more commonly between those individuals who are alike or similar to one and each other, in other words, homophilous individuals. Homophilous individuals share certain attributes, for instance beliefs and education. According to Rogers (2003) communication is more effective between homophilous individuals. Mutual understanding and effective communication is more likely achieved when individuals share common meanings and beliefs. Furthermore, individuals feel comfortable when interacting with similar individuals. When individuals are different to each other, the communication between them becomes more demanding and harder to keep effective. The individuals can be defined as heterophilous individuals. Communication between individuals which are different to each other are more likely to include messages which are contradictory to existing beliefs. A situation which Rogers (2003) call “*an uncomfortable psychological state*”. According to Rogers (2003) differences, such as technical competence or beliefs, can cause disparity. As a result, messages can go unheeded. Like minded network groups are often connected with each other, within a system. These connections, also called “bridges”, are of importance when information about an innovation spread (Rogers, 2003).

Although communication between homophilous individuals can be more frequent and many time easier for individuals, it may not play a role as important as the less frequent communication between heterophilous individuals within DOI. The diffusion process is accelerated by homophily but homophily also limits the spread of the innovation to the parts of the network where individuals are closer connected. For that reason, there need to be links connected between heterophilous individuals in order for the diffusion process to occur. Homophily can even emerge as a barrier. Rogers (2003) states that it is more common that new ideas enter a system through members of higher status and innovativeness, where there is a high amount of homophily. That would mean that there are only elite individuals interacting with one another. As a consequence, the non-elites would not get in contact with the innovation. According to Rogers (2003) diffusion patterns caused by homophily are spread horizontally in a system, whether the heterophilous are spread vertically. In this sense, homophily can slow down the diffusion in a social system. Rogers (2003) suggest that if a system are slowed down by homophily barriers, change agents⁵ can try to solve this issue and

⁵ Change agent: “*A person or thing that encourages people to change their behavior or opinions*” (Cambridge dictionary, 2017)

work with several different sets of opinion leaders. Opinion leadership describe in which degree an individual, informally, is able to influence other individual's attitudes in order to change their behaviors. As stated earlier, individuals with higher status rarely interact with individuals with lower status. The same situation can be seen with Rogers (2003) adopter categories where early adopters less frequently converse with later adopters. Rogers (2003) suggest that followers within an interpersonal network seeks opinion leaders of a higher status, for instance individuals with a higher competence or a better contact with change agents. Based on this argument, Rogers (2003) argues that individuals tend to follow opinion leaders that are perceived as more technical competent with the aim of seeking information and advices regarding innovations. When this situation occurs between heterophilous individuals, it is about seeking greater competence.

3.5.1.3 Risk

The diffusion process involves individual's uncertainties and perceived risks. If the adopter is afraid to lose things such as time, money, self-esteem or if the innovation possesses a risk for the health for the adopter, the innovation is less likely be adopted (Roselius, 1971). There are methods for reducing the adopters experience of risk. Factors such as expert knowledge and personal similarities are of great importance in this matter (Rogers, 2003). In addition, individuals obtaining of more information will also reduce risks. Information is therefore seen as a great opportunity in those situations when uncertainty and risk are perceived (Rogers, 2003). Word-of-mouth (WOM), or informal communication between individuals, have a major impact on the experience of risk during an adoption (Roselius, 1971). The concept of WOM is based on individuals talking with other individuals about their perception of an innovation. This may affect their common perception of the innovation (Arndt, 1967; Roselius, 1971). WOM has been shown to occur especially when there is uncertainty about innovation (Engel, 1969; Zappa, 2011). The emergence of Internet-based media has facilitated the development of WOM on the internet. The so called electronic word-of-mouth (eWOM), can occur on several different online channels, such as blogs, emails, consumer review websites and forums, virtual consumer communities (Hennig-Thurau, Gwinner, Walsh and Gremler, 2004)

3.5.2 The process of adopting an innovation

The innovation-decision-process starts when an individual has received information regarding an innovation. The process either lead to adoption, the decision to make full use of the innovation, or rejection, which imply that the innovation not will be adopted. According to Rogers (2003), the innovation-decision process is, to a high degree, an information-seeking and information-processing activity where individuals seek to reduce uncertainties surrounding the advantages and disadvantages of the innovation. Each stage in the innovation decision process is a possibility for the individual to actively or passively decide not to adopt the innovation. The five stages of the innovation-decision-process are illustrated in figure 2, followed by a description of its five stages.

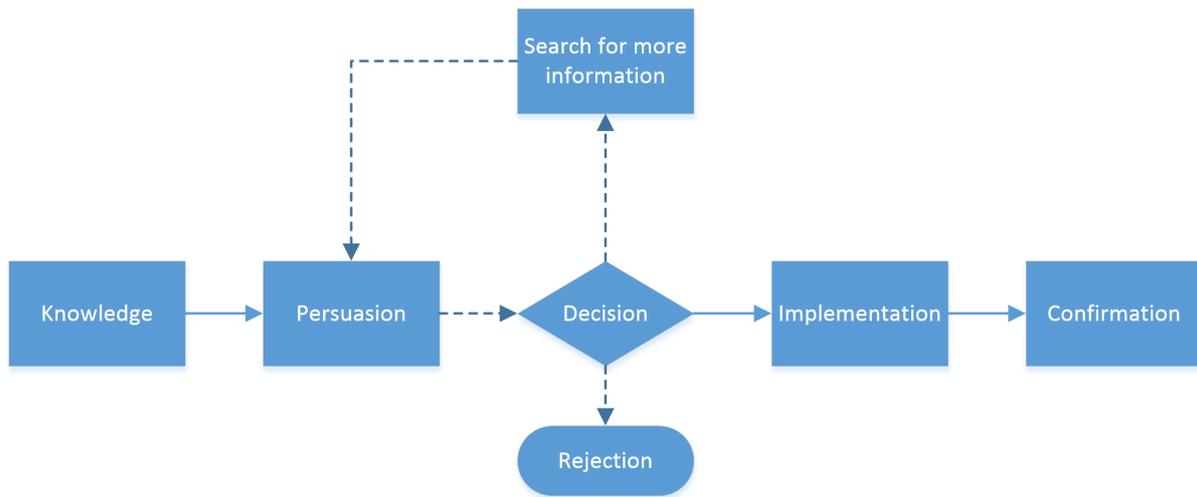


Figure 2: Model of the innovation-decision-process, interpreted by (Rogers, 2003).

3.5.2.1 Knowledge stage

The first stage in the innovation-decision-process is the *knowledge* stage. This stage represents the start of the process and occurs when an individual or decision maker first becomes exposed to the innovation and forms an understanding of its function. Three types of knowledge related to an innovation can be distinguished: *awareness-knowledge*, *how-to knowledge* and *principal-knowledge*. *Awareness-knowledge* is the knowledge about the innovations existence. In the establishing of *awareness-knowledge*, individuals play a relatively passive role. However, individuals which have an own interest in the innovation search *awareness-knowledge* more actively. Additionally, individuals may gain *awareness-knowledge* from peers within their social network. Individuals in general do not expose themselves or pay attention to information about an innovation if they do not feel a need for the innovation and understands how the innovation can be valuable for them. Sometimes, a need can be created simply by getting individuals aware of the innovation. Needs can also be created by change agents which convince other individuals that there exists a need for the innovation and for new ideas. However, Rogers (2003) state that a perceived need is far from the complete answer of why individuals begin the innovation-decision process. Individuals do not always feel a need for the innovation before they adopt the innovation.

If an individual has obtained the *awareness-knowledge* of an innovation, this might motivate the individual to obtain the next two types of knowledge, the *how-to knowledge* and the *principles-knowledge*. *How-to knowledge* is the knowledge of how to use an innovation properly. In the case of complex innovation, the amount of *how-to knowledge* needs to be increased in order to achieve successful adoption. Additionally, change agents can play an important role in the innovation-decision process if they focus on creating *how-to knowledge* for other individuals, particularly in the decision stage (Rogers, 2003). *Principles-knowledge* constitutes of knowledge regarding the underlying principles of how an innovation works. (Rogers, 2003).

3.5.2.2 The Persuasion stage

The persuasion stage describes the stage where individuals form an opinion through evaluating the advantages and the disadvantages of using the innovation. During this stage, individuals are actively searching information from different sources, often within the own space, in order to form an opinion. Preventing innovations are characterized by a higher degree of uncertainty which can lead to less chances of a successful adoption. Within organizations, attitudes consist of individuals' beliefs about an object that impacts his or her actions. Within this stage, individuals are more affected by their own emotions and feelings by becoming more psychologically involved with the innovation. With other words, it is in this stage where the general perception of the innovation is developed. The attributes of the innovation, such as relative advantage, compatibility and complexity, are of importance.

In this stage, individuals are thinking forward and hypothetically. Questions such as, "what if I adopt to this innovation", are common. According to Rogers (2003) this is due to how all innovations carry some degree of uncertainties and for that sake, an individual wants to know if the new idea is functional while seeking social reinforcement from others. Individuals seek messages which might reduce uncertainty and consequences. Individuals might evaluate obtained information and ask themselves about the advantages and disadvantages of the innovation. Individuals normally search such answers from near peers, with a subjective opinion of the innovation. The main outcome of this stage is the attitudes and the acceptance or lack of acceptance about the innovation. However, attitudes and actions are not always aligned. Good attitudes towards an innovation does not necessarily lead to the action of adopting the innovation (Rogers, 2003).

3.5.2.3 Decision stage

The third stage in the innovation-decision process is individual's decision of adopting, making full use of the innovation or rejecting, choosing to not adopt the innovation. Individuals' insecurity of adopting an innovation can be reduced through letting individuals try the innovation for a shorter period. Usually, individuals choose to reject the innovation if they have not been provided with the possibility of trying it in order to determine its values for their own situation. If the innovation can be tested by the individual or by change agents, it can be more quickly adopted. Change agents can therefore accelerate the innovation-decision process by providing demonstration of a new innovation and idea that will convince other individuals of using it. If the innovation has an obvious relative advantage over prior ways of working, methods for facilitating trial of the innovation will most likely speed up the adoption process. In addition, if the individual's peers have tried the innovation, the individual will be more confident in using it. However, the innovation-decision process can also lead to the decision of rejecting the innovation. An innovation can be rejected during the knowledge state due to the cause of individuals forgetting about the existence of the innovation. Two different types of rejections can be distinguished. *Active rejection*: the individual takes the active decision of not adopting the innovation and *passive rejection*: The individual never really considered to adopt the innovation (Rogers, 2003).

3.5.2.4 Implementation stage

The fourth stage of the innovation-decision process is the implementation stage. Implementation takes place when an individual puts an innovation to use (Rogers, 2003). When a new innovation is put into practice, it involves different behavioral changes. According to Rogers (2003) it is a major difference in deciding to adopt a new idea and putting the idea in use. Within the implementation stage the issue of how the innovation are to be used, will appear. Active information seeking occurs within this stage and questions from individuals that still experience uncertainty. Individuals want answers of questions regarding where they obtain the innovation, how they should use the innovation and which operational problems can occur during the use of the innovation and how these problems can be solved. Change agents can be used for providing individuals with assistance regarding how to use the innovation. Implementation in an organization is more complex due to the presence of many different individuals with different roles and decisional authority. Organizational structure can also hinder the spread and implementation of an innovation. The implementation stage ends when the innovation has been institutionalized in the operational work of the organization. For many individuals, the implementation stage would constitute the end of the innovation-decision process, although a fifth confirmation stage may occur for others (Rogers, 2003).

According to Rogers (2003), an innovation is under constant change. During the diffusion process the innovation changes and evolves by how it spreads from adopter to adopter. For this reason, the *re-invention* quality of the innovation is of relevance. *Re-invention* describes to which degree users in the diffusion process can change or modify the innovation. Within the implementation stage, it is more common that re-invention emerges. Rogers (2003) states that a higher degree of re-invention leads to a faster adoption rate - a flexible innovation which accepts re-invention will suit a greater number of adopters. This flexibility may reduce risks such as mistakes and encourage organization to better assimilate the innovation through customization. Furthermore, a higher degree of re-invention can lead to a more sustainable innovation that survives for a longer time. However, the innovation may have a design structure that prevents changes (Rogers, 2003).

3.5.2.5 Confirmation stage

The last stage in the innovation-decision-process is the confirmation stage which constitutes the final stage in the process. Individuals seek information regarding the innovation even after the decision to implement has been taken. In this stage individuals or decision-makers want to strengthen the adoption decision. If messages of the innovation are in conflict with prior beliefs, the decision might be reversed. During this stage, individuals try to avoid the so-called dissonance. Dissonance can be described as a state of uncertainty and uncomfortableness which an individual wants to leave or reduce by changing his or her knowledge, attitude or actions. Individual tries to avoid the state of dissonance by seeking information that will confirm and support a decision that already has been made. *Discontinuance* is the decision of rejecting an innovation after adopting it. It is therefore important to reduce the rate of *discontinuance* in order to make individuals stick to their

decision of adopting the innovation. Two types of discontinuance exist, according to Rogers (2003). *Replacement discontinuance* is the decision of rejecting an innovation for replacing it with another, better, innovation. *Disenchantment discontinuance* is the decision of rejecting an innovation based on negative experience of its performance. *Discontinuance* can also be a result of that the individual has misused the innovation and therefore not achieved the relative advantage of the innovation. The risk of *discontinuance* can be reduced by making sure to formally routinize the innovation in the organization. During this stage, individuals prefer to receive supportive messages which can prevent dissonance to occur (Roger, 2003).

4. Research Design

We have been conducting an interpretive in-depth case-study (Walsham, 1995) of EA implementation at the global manufacturing company SKF. Interpretive case study is a common direction within IS research. The approach considers that knowledge about the reality is a creation through social constructions and its focus lies in the complexity of human sense making (Rolland & Dingsøyr 2009). A case study explores a phenomenon in its natural setting, using multiple methods of data collection from one or many sources (Benbasat, Goldstein & Mead, 1987). It provides an in-depth understanding of a phenomena and its context (Darke, Shanks & Broadbent, 1998). The case study is suitable when a natural setting or a focus on contemporary events is needed (Benbasat et al., 1987). It is also well suited for understanding the interaction between IT and the organization, particularly for studying IS implementation. (Darke et al., 1998). We argue that a natural setting is essential to investigate an EA implementation in an organization, to get a good picture of the everyday work conducted by the architects, legitimacy for interviewing relevant stakeholders, access to data sources such as internal documentation and ISs and to get a fair perspective of the organization and its culture. The Unite project and the ongoing EA effort at SKF are examples of contemporary events. These two aspects, the need for a natural setting and the focus on contemporary events make our research suitably for a case study (Benbasat et al., 1987). An overview of the research design is provided in the Figure 3.

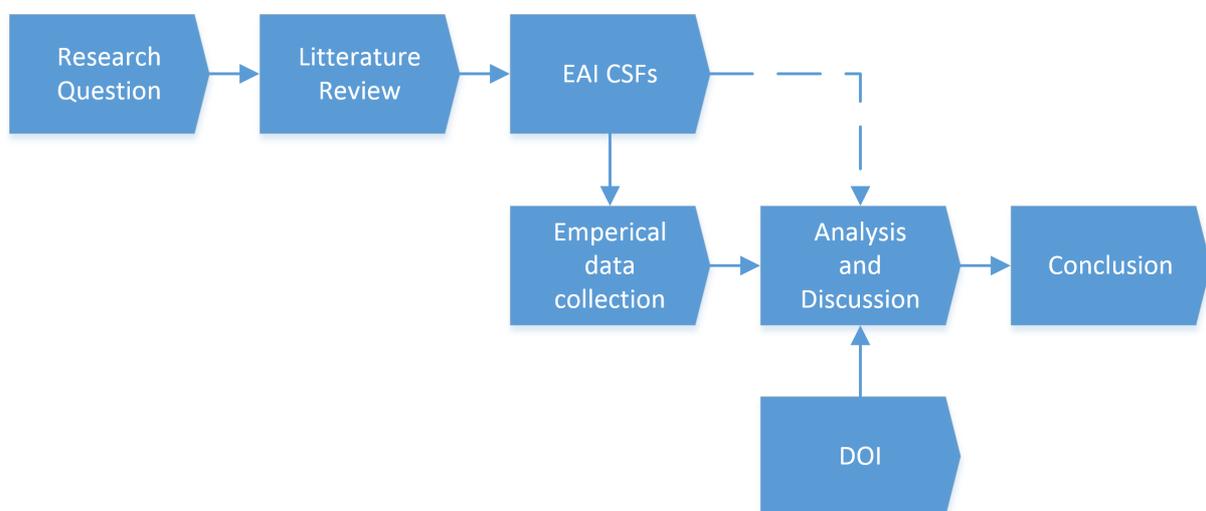


Figure 3: Model of the research design

4.2 Literature review

Walsham (1995) argues for the use of theory at an early stage in interpretive studies to construct a theoretical framework that take previous research and knowledge in account. This theoretical base increases the chance of relevant and suitable approaches for the empirical work (Walsham, 1995). Benbasat et al., (1987) means that case studies should be based on clear objectives and that the research question therefore is defined prior to the study. These advices of Benbasat et al., (1987) and Walsham (1995) have been taken into account. We conducted a literature review of the field of Enterprise Architecture implementation due to a lack of existing holistic and clearly defined theories. The literature review can therefore be seen as a descriptive study of current acknowledged CSFs of EAI.

The identified CSF were categorized in six CSF categories. Each category includes CSFs that are related to a specific area within EAI. For instance, CSF category 1. *EA material, tools and methodology* includes the three CSFs; EA Scope and coverage, EA Models and Artifacts and EA Tools and Methodology. All related to their CSF category of EA Scope and coverage. The same structure of categorization is applied to the other CSFs, which can be viewed in figure 1. Additionally, CSF categories 3. *Communication* and 6. *Organizational culture*, do not include any underlying CSFs, this is because they are treated as separate CSFs by prior research and because we could not find any obvious relation to any other CSFs. All CSFs was given a number to represent their CSF category. For instance, 1.2 *EA Models and Artefacts* representing CSF two within category 1., *EA material, tools and methodology*. Each CSF includes a number of indicators. A higher degree of *present* indicators translates into an opportunity for EAI, likewise, a high degree of *absent* indicators translates into an obstacle of the CSF.

Based on the above structure, the research was compiled in a conceptual model for EA implementation CSFs (figure 1) which was used as a foundation for our empirical data collection. The conducted literature review that forms the model was conducted through the use of university library search engines and Google Scholar. The search engines provided journals, e-books and (if not digitally available) pointed out physical books and papers. The search engines provide practical access to third party sources in the form of well-known publishers, research institutes and universities. Examples of our used search terms are: Enterprise Architecture, Enterprise Architecture Implementation and Enterprise Architecture critical success factors. The internal material of SKF consisted of the SKF *Architecture Handbook*, the architectural repository *GEAR* (Group Architecture Enterprise Repository) and various internal documents. Empirical data was gathered through interviews. Additionally, our theoretical framework includes Diffusion of innovation (DOI) theory. DOI has been chosen to understand and underlining aspects of how to implement a new way of working in an organization, in our case EA and GEAR and how to make this new way of working adopted, accepted and spread. We believe that DOI provide important social aspects to consider during such events. DOI have been used in the second part of our analysis, in order to provide an additional perspective for EAI. We also hope that DOI can assist us in our aim of expanding the insufficient body of knowledge of EAI.

4.3 Data Collection

The data collection of this study relies on a qualitative approach. Based on the arguments by Holme and Solvang (1997) this approach supports, rather than a quantitative one, our research question due to our interest in collecting the empirical material in form of experiences and lessons learned from different roles. In that way, the qualitative approach offered us a greater way to develop and analyze the empirical material collected (Holme & Solvang, 1997). With that said, the empirical material was collected by a number of semi-structured interviews. Semi-structured interviews, also called focused interviews, refers to how the researcher combine *specific questions*, in order to bring planned information, and *open-ended questions*, in order to embrace unexpected information (Hove & Anda, 2005). The semi structured questions are presented in an interview guide (appendix A & B), which the respondents received before the interview.

Our interview questions (appendix A & B) are based on the theoretical framework of this study, in other words the research we consider related to Enterprise Architecture implementation. The questions are built on our six presented groups of CSFs for Enterprise Architecture implementation, with the aim of getting the interview person's view on if indicators of each CSF are present, divergent or absent during the EA implementation. Two different sets of interview questions have been used, one for architects (appendix A) and one for business representatives (appendix B). The questions have been formulated depended on the respondent's background and EA knowledge, resulting in more straightforward questions for *architects* and more explanative questions for *business representatives*, resulting in more explanations of EA and its concepts in relation to the questions. Explanations of question of underlying concepts have been conducted when insufficient understanding have been noticed, in order to get fair answers. The architect questions are focused on the quality of the developed EA material and if essential views and level of architecture are defined and modelled. The business representative questions are focused on the business's view of the usability of the EA material and the EA tool, GEAR. Many questions are overlapping the two sets of questions such as questions regarding communication, EA awareness and cultural aspects.

4.4 Case Selection and Sampling

When studying Enterprise Architecture implementation, we consider it relevant to choose an organization that is considered large, due to that smaller companies often are lacking a clearly formulated business and IT strategy and thereby an assumed lack of applied EA (Devos, Landeghem & Deschoolmeester 2013). We wanted to ensure to shed light on the holistic complexity of an EA implementation by choosing a large global company. SKF was chosen because of academic relations between the researcher's institution and SKF stakeholders and through the company's geographical position, located close to the institution of the researchers. The Unite project and the implementation of GEAR at SKF offered a unique opportunity for a first-row case study of the implementation of an EA effort in a global organization, an opportunity that may not come around too often. At SKF, EA is to a high

degree dependent on the implementation and usage of the architectural repository, GEAR. GEAR acts like a portal where EA material, in other words EA artefacts and models can be accessed by architects and other users. In addition, GEAR provides functionality for modelling. Therefore, the term *EA and GEAR implementation*, will we used in this thesis to describe SKF's implementation of Enterprise Architecture.

As suggested by Benbasat (1987) a determination of unit of analysis need to be conducted (Benbasat, 1987). In our case, the unit of analysis consists of the two groups architects and business representatives which will be further explained below. The respondents were selected through a discussion between us and the Enterprise Architecture team at SKF, bearing in mind to fairly represent both sides of *architects* and *business representatives*. The respondents were also selected based on the criteria of having a responsibility and a high degree of influence on the everyday work within their business units or project teams. The respondents should also have had a solid experience of the everyday work before the Unite project and the EA effort, to capture the difference between prior and after the EA effort. This type of sampling can be traced to *critical case sample*, subjects with specific experience and *key informant sample*, subjects with special expertise (Marshall, 1996).

11 interviews were conducted, four with *architects (ARC)* and seven with business representatives (BR). The interviewed architects had one of the following roles: Enterprise architect, business architect (analyst) or solution architect. Seven interviews were conducted with *business representatives (BR)*. The *business representatives* had one of the following roles: project manager, process manager, IT operational manager or CIO. The respondents were divided into two groups, *architects* - the producers of the Enterprise Architecture material and *business representatives* - the employees intended to use the produced EA material. In this study, *business representatives* are defined as representatives of core IT functions in different business units, such as human resources and logistics.

Business representatives	Architects
Represents employees intended to use the produced EA material. Roles include: Operational manager, project manager, process manager and CIO	Represents the producers of the Enterprise Architecture material. Roles include: Enterprise architect, business architect (analyst) and solution architect
Business representative 1 (BR:1)	Architect 1 (ARC:1)
Business representative 2 (BR:2)	Architect 2 (ARC:2)
Business representative 3 (BR:3)	Architect 3 (ARC:3)
Business representative 4 (BR:4)	Architect 4 (ARC:4)
Business representative 5 (BR:5)	
Business representative 6 (BR:6)	

Business representative 7 (CIO)	
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Table 4: Represent stakeholders interviewed at SKF.

The respondents were initially invited for interviews by the SKF supervisor of the researchers through an internal email. The email included a short presentation of this master thesis together with an interview guide including question and expected results of the research. The communication was then handed over to the researchers which communicated with the respondents through internal emails. In total 14 were contacted. The ambition was to interview eight people, four business representatives and four architects. Due to positive response, three business representatives were added to get a better insight of the perspective of the business. However, four additional interviews were canceled due to time-pressure. All interviews were scheduled and conducted shortly after the first initial contact. Two interviews were conducted through Skype (BR:5 & BR:6), due to geographical reasons. The remaining nine interviews took place in SKFs meeting rooms. The interviews were structured and planned in advance. All interviews were said to take one to one and a half hour in order to cover the planned questions. Some of the interviews lasted for a shorter period of time due to the length of the answers. During the interviews, the researchers took two different roles in order to avoid confusion among the respondents. One researcher had the responsibility to open the meeting with a short presentation. This presentation included an explanation about the background of the researchers, the aim of the study and how the interview was going to be conducted. This researcher then took a background role during the interview, asking clarifying question and took notes in order to facilitate the transcription. The other researcher had the responsibility of asking the respondent the prepared question.

When researchers use an interpretive approach for case studies, which this study rely on, it is important to view our own role in the complex human process (Walsham, 1995). It is, according to Walsham (1995), a difficult task to manage other people's interpretations, filter them and create a version of their events which then can be shared for others. This has taken in consideration when conducting this study. It is argued by Walsham (1995) that two different roles can emerge through participant observation, namely the outside observer and the involved observer. For this study, the researchers had an outside observer- standpoint. Walsham (1995) argues that regardless of the observer's standpoint, the role should not be viewed as an objective reporter because of the researcher's own subjectivity in the material, such as collection and analysis of data. Additionally, when conducting in-depth case studies during a longer period of time, a so called "double hermeneutic" occur. This means that the researchers inevitably influence the material collected from those who have been researched. In that sense, researchers are in a way evolved in the creation (Walsham, 1995). As stated by Geertz (1973) "*What we call our data are really our own constructions of other people's constructions of what they and their compatriots are up to*".

4.5 Analytical Method

The empirical material was analyzed through a thematic analysis. The first step was the transcription of the recorded interviews. The interviews were transcribed in their original language (English or Swedish), with the support of notes from the researchers, within 48 hours of their conduction, to make sure that our understanding of the material has not been compromised through the passing of time (Benbasat, 1987). Coding of the data was made using the data analysis software NVivo. Thematic analysis is a method for identifying, analyzing and reporting patterns, or *themes*, within data (Braun & Clarke, 2006). We have used Braun and Clarke's (2006) 6-phase guide for conducting our thematic analysis to ensure the quality of our analysis. That means that we, after transcription and read-throughs, generated initial codes of the material based on our interview questions derived from our theoretical framework of EAI. This initial generation of codes was made during discussions between the two researchers of this study. The research question and the theoretical framework was kept in mind and reflected in our theory driven coding (Braun & Clarke, 2006). We thereafter combined to codes into relevant themes, also reflecting the research question and theory, which later were reviewed with minor changes. The themes were named and assigned with a short explanation of their role in the research. At last, the themes and their relations, was used in the analysis part of this essay were the themes was recognized and important similarities and differences between the respondents was presented in suitable way.

The analysis of the empirical material was conducted in two parts, based by the use of our theoretical framework, consisting of critical success factors of EA implementation and theories of Diffusion of innovation (DOI). In part 1, we analyze our descriptive results in order to create a holistic picture of which indicators that are *present*, *divergent* or *absent* within the ongoing EAI at SKF. The analysis is based on our prior defined categories of CSFs and their underlying indicators. Based on these indicators, we analyze if the CSF category have a positive respectively negative impact on the EAI of SKF. *Present* indicators translate into an opportunity for the EAI and *absent* indicators translate into an obstacle for EAI. We also suggest possible solutions for leveraging opportunities and mitigating obstacles. These possible solutions are based on our own thoughts and on our theoretical framework.

In part 2, we analyze the EAI from the DOI perspective, based on Rogers (2003). In this part, we have structured the result within Rogers (2003) five stages of the Innovation-Decision-Process. In addition, important elements of DOI has been added to this process as a mean to understand how individuals manage a new innovation. This DOI analysis has been conducted in order to find additional possible solutions to support the EAI at SKF during Rogers (2003) stages of the adoption of a new idea or invention. By applying DOI theory, we were also hoping to find additional CSFs of EAI and to strengthen our arguments from the first part of the analysis. The second part of the analysis is targeted for the most emerging opportunities and obstacles of EAI at SKF. This selection of most emergent opportunities and obstacles has been made through a discussion with enterprise architects in our studied organization. This selection was also made through practical reasons and can be supported by EAI theory (Nikpay et al., 2013).

4.6 Research criticism

It has been questioned whether the results of case studies can be considered generalizable. Walsham (1995) argues that case studies can be generalizable in some ways. In addition to the contribution of new theory, interpretive case studies can be used to provide specific implications in a narrow domain and to provide rich insights within a specific situation or case (Walsham, 1995). We believe that our research can provide rich and detailed insights in the Enterprise Architecture implementation of global company and also provide specific implications in the EAI domain. It was kept in mind that interviewed architects and certain business representatives could have had a bias view of the developed EA material and the implementation, based on their involvement and responsibility in the process. For that reason, we are aware that this study's outcome could have been another if stakeholders, with other experience and/or background, was interviewed. Furthermore, Diffusion of innovation is a generally applicable theory that do not highlight all aspects within the specific theory of EAI, this may result in certain aspect of EAI being more discussed than others.

5. Case

This chapter will present our case, consisting of the Swedish global manufacturing company, SKF and their EA implementation (EAI). A presentation of the company will be made, followed by an introduction to the ongoing change program of Unite. Additionally, this chapter includes a presentation of how SKF define and view EA together with the scope of this thesis.

5.1 Introduction of SKF

SKF is a Swedish global manufacturing company, headquartered in Gothenburg, Sweden. SKF is one of the leading suppliers of products and services in the field of bearings, seals, mechatronics, services and lubrication systems. SKF has manufacturing facilities in more than 100 locations, retailers in 70 countries and 15,000 distributors who are serving the company's customers worldwide. The company's turnover for 2014 was: SEK 70 975 million (SKF Group, 2017).

5.2 The Unite program from an EA perspective

In order to meet both current and future customer demands, SKF constantly needs to improve their processes, systems and ways of working. Today, one major transformation journey for SKF is the implementation of SAP as a global ERP system. In order to manage the transformation, the Unite program was established in 2012. Its purpose was to reinvent and develop business processes across the company, deploy an end to end ERP system solution for all key business processes and to globally integrate and align ways of working. As for today, the Unite program is one of SKF's largest investments (SKF Group, 2016). Enterprise architecture came to play an important role in the program because of its ability to provide a holistic approach and deal with architectural design and documentation at an overall

landscape level. In 2013 the Unite Enterprise Architecture team, in this report called the EA team, was founded as a consequence of the program's magnitude. The skillset of the team is based on the architecture practitioners skills framework from TOGAF. Since its start, the team has actively been working on steering, governing and participating in the development of various architectural work products in the Unite program. As a result, they have established a number of design authorities to govern architectural decisions within the program. Many of these decisions implied changes on the existing architectural landscape. Furthermore, changes of Unite affected the legacy governance bodies which resulted in an effect on co-existence and the overall architecture. This resulted into shadow structures in terms of governance bodies, design bodies and organizations, all of which are detrimental to maintaining control over co-existence and overall architecture. To successfully address a long-term architecture governance, a standard in architecture practices was set in order to establish a baseline for practitioners, define skills and knowledge and employ architects. The plan to achieve an organization wide architecture management standard was created in collaboration with the IT Architecture Council (ITAC) and was approved in 2015. The plan aims to move away from an informal working practices and documentation to a standard set of working practices and a single standard content repository. This content repository got the name Group Enterprise Architecture Repository (GEAR) and was implemented on the ARIS platform. In ARIS, members of the Unite program, representing different business units, can document their requirements and processes, with support from the EA team. This work is carried out in line with the Group architectural framework (GAF).

GAF is SKF's own EAF which is developed by the EA team together with other expertise. Its goal is to manage the data and processes defined within the Unite program. GAF is an EAF that provides a structural foundation for developing architecture, including both methods and content aspects. Among other things, GAF provides a formal and common taxonomy for architectural assets, a meta-model for architectural content, a method for architectural development and a governance process for architecture content management (SKF Group, 2016). In addition to GAF, the Architecture Handbook has been created as a mean to provide an overview of the group-wide standard for the practice of Architecture Management. Its purpose is to describe the approaches, governance structures, tasks, roles, underlying competencies, tools and techniques to support the effective performance of architecture management in detail. These methods and techniques are to be used to translate SKF's strategic objectives into SAP solution roadmaps, to map SKF's strategic objectives and business requirements into SAP solution concepts (SKF Group, 2016).

5.3 Enterprise Architecture at SKF

As stated in the architecture handbook, EA plays an important part when aligning IT outcomes with business ambitions (SKF Group, 2016). For SKF, EA is all about aligning business and IT, which is well demonstrated in their guidelines for EA; "*Enterprise Architecture is a key enabler to accomplish this mission as it ensures alignment of IT outcomes with business ambitions*". From an SKF perspective, EA represents a structured approach, including three main objects, in which EA: 1) "*Integrates all relevant stakeholder*

perspectives”, 2) “*Facilitates understanding and transparency of business footprint*” and 3) “*Benefits change control and project execution*” (SKF Group, 2016). EA at SKF is viewed as the architecture of an enterprise and is considered to embrace all properties of an enterprise which are necessary and sufficient to cover all of its requirements (SKF Group, 2016). The concept of EA includes several different aspects which are represented through framework, methods, models and views, principles, strategies and standards. In order to steer transformation towards the desired business outcome, these parts restrict design and generate structure. Without this structure in place, it would be difficult if not impossible to describe the business reality from different stakeholder perspectives. The establishment of Business architecture is highlighted as an important factor for successful EA and forms a major focus-area for the organization. According to SKF’s architecture handbook (SKF Group, 2016), organizations which support business architecture as an integral part of EA receive higher ability to execute on their business strategy. Business architecture provide the organization with a clear understanding of the strategy and its impact on business and IT. For SKF, business architecture has an important role because of its ability to provide innovative and value-adding solutions to the business. Based on the arguments above, SKF Group view EA as consisting of two sub-architectures; *IT architecture* and *Business Architecture*. IT Architecture includes the three views; application, information and technology. Business architecture includes the three views; strategy, capability and process (SKF Group, 2016).

5.4 Scope

When presenting the SKF EA approach outside Unite to different business units in the organization, the EA team face challenges. Stakeholders in other business units need to align to new methods and business processes. The stakeholders recognize the need for the new framework but may reject the EA framework and the architectural repository if it interferes with their current way of working. Therefore, the scope of this study is to identify and investigate critical success factors and obstacles for EAI at SKF, in order to present possible solutions for how these can be leveraged respectively mitigated.

6. Results

This chapter present our empirical results, based on the interviews made with stakeholders at SKF. The interviews consist of two different groups, the architects (producers of the EA and its material) and the business representatives (the consumers of the EA and its material). The results are presented by a structure in line with our six categories of CSFs. It should be mentioned that these results are generalized and might paint a less nuanced picture. A more detailed presentation can however be found in appendix C.

1. EA material, tools and methodology; When talking about an understanding of EA, there is a clear and common understanding between architects. Even if the business representatives got an idea or a certain understanding of EA, they believe, together with the architects, that there is a common lack of understanding of EA and its benefits in the business. The developed EA material, is according to the architects, mature, even though some parts and

models are missing content wise. However, the business lacks knowledge to understand it. The EA is rooted in the business strategy but rather describe a to-be state than the as-is state of the business. There is a clear traceability between business and IT in the models, even though they are complex. Methods for developing and maintaining EA are structured and well documented. The tool GEAR, based on ARIS, provides good functionality for handling EA. However, it lacks usability and are many times too complex for both architects and the business.

2. *EA Governance*; The structure for EAM is currently being developed and is soon completed. The formal power for EA in the organization is not very strong and sometimes business decision can overrule EA decisions. Respondents believe that the EA function can be more strategically positioned between the IT and the business functions. However, a re-organization is currently taking place. An architectural board exist in the form of ITAC but, according to the respondents, they do not always pay enough attention to EA in relation to EA rules and standards. EA is considered to be an aspect in projects within Unite. Other business projects are often neglecting the EA aspects. Sticking to EA rules and standards are not mandatory within many projects, something that is requested by the business representatives. Projects receive good support from EA-expertise when they request it. EA rules and standards are established but do not seem to be clearly communicated to the organization. Some business representatives are aware of EA rules and standards, some are not. Complexity and time pressure makes the adherence to EA rules and standards less prioritized. There have been goals and milestones for developing EA and GEAR. There are no documented goals of raising EA awareness or of increasing the use of GEAR. No change management plan in association with the EA-effort exist. Architectural plans do however exist. Assessment and evaluation of EA-implementation is present but informal.

3. *Communication*; The general opinion of communication regarding the implementation of EA is negative due to lack of regular contact between the EA team and the business. It does not seem to be proactive nor frequent communication. Several communication channels are used. However, information does not seem to reach many of those whom it concerns. No communication plan or formal consideration of architectural communication seem to exist.

4. *Stakeholder commitment and skills*; Stakeholders directly involved in the implementation are generally committed to the success of EA. A number of stakeholders do not have an understanding for the purpose and the values of EA and have therefore less commitment. Management seems to have an interest and a commitment to EA. Training and education for non-architects are conducted. This training seems to be given on request and is not mandatory. There seems to be a general lack of knowledge about the possibilities of EA training. Training for architects might be conducted but not in a structured and planned way.

5. *EA Pressure*; Business representatives recognize the need of EA in general. This recognition is dependent on the understanding and communication of EA. There is no pressure in working with GEAR and EA, which makes it possible to neglect or even ignore. A dedicated EA budget exists.

6. *Organizational culture*; There is a willingness to adapt to EA methodology. This willingness is compromised by time and cost pressure. In addition, a lack of awareness and understanding regarding EA and GEAR also affects the possibility to be willing to adopt it. A critical point seems to be getting closer were the EA team are passing forward the maintenance of GEAR to the business. The future success may in this reasoning be dependent on the businesses view of the importance of EA and GEAR. EA do not seem to be visible outside the EA-department. Culture and attitudes towards IT and EA might have an impact on the EA and GEAR implementation. IT and EA as organization functions are viewed as both a support- and cost centers. Not as business enablers.

7. Analysis and discussion

This chapter present our analytical discussion, which is based on the theoretical framework and the empirical results. The chapter is structured in two different parts. Part 1 aims to identifies opportunities and obstacles of EAI at SKF. The emerged findings from Part 1 will be future analyzed in Part 2, with DIO theory, in order to propose additional solutions for leveraging respectively overcome opportunities and obstacles of EAI.

7.1 Part 1: Critical success factors when implementing EA

Based on our empirical results, we have summarized indicators that are *present*, *divergent* and *absent* (figure 5). From this model, *present* indicators are translated into an opportunity for EAI in the organization. They constitute a part of a successful implementation, according to our theoretical framework. *Absent* indicators are translated into an obstacle for EAI in the organization. They constitute a missing part of successful EAI, according to our theoretical framework. Not every indicator can be viewed as *present* or *absent* based on our empirical material. Those indicators, which have these in-between characteristics, because of various answers from the respondents, have been translated into *divergent*.

CSF Category	Critical Success Factor (CSF)	Indicators	Present	Divergent	Absent
1. EA material, Tools and Methodology					
	1.1 EA scope and coverage	Clear definition of EA		✓	
		Clear mission and goals of EA	✓		
		Objectives and importance of EA understood			✓
		EA that cover essential stakeholders and parts of the	✓		
		EA rooted in business strategy	✓		
		EA Coverage and detail level decided		✓	
	1.2 EA Models and Artifacts	EA reflecting business requirements		✓	
		Clear traceability between business and IT	✓		
		Essential level and views of architecture modeled	✓		
1.3 EA Tools and Methodology	Sufficient quality of EA methods	✓			
	Specified processes, guidelines and best practices	✓			
	Sufficient quality of EA tools	✓			
2. EA Governance					
	2.1 EA Governance and Management	Established structure of EAM		✓	
		Strong formal power of EA			✓
		Strategically positioned EA department		✓	
		EA board exists	✓		
	2.2 EA Project Management	EA program management		✓	
		EA involved in projects		✓	
		Established EA quality gates for projects	✓		
		Projects supported by EA expertise		✓	
	2.3 Rules and EA process	Established EA rules, standards and processes	✓		
		Communicated EA rules, standards and processes			✓
	2.4 EA Planning	Defined goals of EA implementation			✓
		Architectural Plans	✓		
		Change management plan for EA			✓
	2.5 Assessments and Evaluation	Architectural decisions measured and evaluated		✓	
		EA implementation measured and evaluated			✓
3. Communication					
	3.1 Communication	Communication plan or strategy for architectural communication			✓
		Various communication channels for EA	✓		
		Architectural communication is analysed			✓
		EA communication is frequent and proactive			✓
4. Stakeholder Commitment and Skills					
	4.1 Commitment and Stakeholder Involvement	EA commitment from top management	✓		
		EA commitment from other stakeholders		✓	
		EA implementation involvement of other stakeholders		✓	
	4.2 Training and Education	Non-architects trained in EA		✓	
		Architects trained in EA	✓		
		Training plan established	✓		
		Training material targeted to different stakeholders		✓	
5. EA Pressure					
	5.1 Economic Pressure	Stakeholders feels a need/pressure of working with EA			✓
		Dedicated EA budget	✓		
6. Organizational Culture					
	6.1 Organizational Culture	Employees have a good attitude towards EA change	✓		
		EA is visible outside its own department			✓
		View of IT and EA function (cost center, support, enabler)		✓	

Figure 5: Table of present, divergent and absent CSF indicators, based on the empirical material.

7.1.1 EA material, tools and methodology

Based on the results from the empirical material, we have identified a number of opportunities and obstacles. These are presented in the table below and are discussed in the following text. The tables are independent of each other.

Opportunities
Essential parts of the organization and stakeholders defined and documented
Mature EA material
Sufficient functionality of EA tool
Clear traceability between business and IT in EA models
EA is rooted in the business strategy
Established methods for developing and maintaining EA
Obstacles
Lack of EA awareness and knowledge
Lacking usability of EA tool
EA material explain a to-be state rather than an as-is state of the business

Figure 6: Table of identified opportunities and obstacles from CSFs.

The first category of CSFs, EA Material, Tools and Methodology consists of the CSFs of EA scope and coverage, EA Models and Artefacts and EA Tools and Methodology. These CSFs states, among other things, that an organization should have a clear definition of EA. Additionally, the importance of EA and the knowledge of what is be achieved by EA should be understood and agreed upon (Schmidt & Buxmann, 2011; Ylimäki, 2008). For that reason, we have identified the first obstacle, which is the lack of EA awareness and knowledge. We believe this obstacle has emerged for several reasons. To begin with, we already know from the empirical material, that a common understanding and knowledge of EA do exist among the respondents. However, it was communicated both by the architects as well as the business representatives that there is a lack of this knowledge within the business, especially outside Unite. The lack of awareness might depend on insufficient communication from the EA team. This insufficient communication hinders EA knowledge to reach outside the EA team. As a result, this may limit EA awareness throughout the organization. We support this argument based on that the architect's statements of that they rarely have any direct contact with the business. Another reason is how the business representatives claim to only come in contact with the EA team when they reach out for support or due to their own interest in EA. We therefore believe that SKF need to work on the EA awareness outside the EA team. In order to increase the awareness, we suggest that a better communication between the EA team and

the business should be initiated. However, there should also be mentioned that the lack of EA awareness in an organization may depend on several other aspects (Tamm et al.,2011; Land et al.,2009).

Indicators within the CSF category of EA Material, Tools and Methodology are emerging as an opportunity for SKF, since essential parts of the organization and its stakeholders are defined and documented. This speaks, according to Ylimäki (2008), for a successful EAI. Based on our empirical material, existing EA material in SKF can be considered as mature, even if some respondents argue that material within their part of the organization is missing. However, the EA effort within Unite has resulted in an ambitious material, which is visible throughout GEAR and the architecture handbook. This category of CSFs (EA Material Tools and Methodology) also deals with the quality of the EA tools. Even if GEAR as an EA tool has the qualities needed for a successful EAI, stated by Aier and Schelp (2010) and Schmidt and Buxmann (2011), the missing and not yet developed content in GEAR seems to have a downside. Due to lack of content, the material loses much of its purpose for some users, which affect whether the business use the material or not. What contributes to our believes is how some business representatives express that GEAR is not modeled to the extent that makes it profitable for them to use it. However, they also state that if GEAR was completely finished and maintained, it would be a great tool for them to use. In addition, the empirical material shows that GEAR many times is too complex for both architects and business users. We therefore state another obstacle for EAI at SKF, namely lacking usability of EA tool. Once again, we believe that better communication between architects (developers of EA material) and the business (the users of EA material) can facilitate the use of GEAR. The architecture handbook, which is one initiative from the EA team to simplify EA and GEAR, do not seem to be enough, since the issue of complexity remains. For that reason, one can see tendencies of how the EA material in some way is created by architects for architects. Despite the desire and effort made by the EA team, in order to reach the business, the material lack a language and format which can be understood by the business. According to (Hauder et al., 2013) a common challenge of EAM is the ivory tower syndrome were developed EA material and EA artefacts are created by the architects in isolation from the rest of the organization. This lead to EA material not being used and delivered EA products that do not match the requirements of the stakeholders (Hauder et al., 2013). With this knowledge, we suggest, if the EA material is intended to be understood and used by the business, it needs to be easier to understand or at least translated in such a language the business can understand. Additionally, another obstacle has been identified in relation to the EA material. The empirical material show evidence that the EA material explains a to-be-state rather than an as-is-state of the business. Which, according to the business respondents can result in decreased usability. However, the focus on a to-be-state of the enterprise can be supported by research which claims that EA should focus on the to-be state of the enterprise (Land et al., 2009).

The majority of respondents have express that there is a clear traceability between business and IT in the models, or at least there soon will be. This is an opportunity for a successful EAI (Ylimäki, 2008). A primary goal of EA at SKF (SKF Group, 2016) and of EA in general (Sessions, 2007) is business-IT alignment. It is therefore important to mention that alignment

is not an end state, instead it is a temporary state that needs to be maintained (Pessi et al., 2013). We therefore believe it is important of seeing business-IT alignment and EA as a continuous process, with elements that need to be maintained. Hence it is important that the EA and GEAR effort is not seen as a mission that soon is done. Instead, the maintenance process of EA and GEAR should be defined and put in focus to evade outdated EA material and decreased legitimacy of EA and GEAR at SKF.

It is mentioned by several of the architects, as well as business representatives, that there is a connection between the business strategy and the developed EA material within GEAR. According to Schmidt and Buxmann (2011) as well as Ylimäki (2008), the EA should be rooted in the business strategy. The rooting of EA in the business strategy is therefore viewed as an opportunity for SKF. In addition, the existing connection between EA and the business strategy are expressed by the CIO, as being a part of SKF's vision. According to the CIO, EA conduct an important building block in order to establish a structured and well-planned IT-landscape. This provides an opportunity for EAI at SKF.

7.1.2 EA Governance

Based on the results from the empirical material, we have identified a number of opportunities and obstacles. These will be presented in the two tables below and later on be followed by a discussion. The tables are independent of each other.

Opportunities
Established structure for EAM
Established EA rules and standards
EA is considered to be an aspect in projects within Unite
Projects receive good support from EA-expertise, when requested
EA board exists
Architectural plans exist
Obstacles
EA rules and standards not communicated
Weak formal power of EA
EA is not recognized as an aspect in projects outside Unite
EA function can be more strategically positioned between the IT and the business functions
Architectural board do not pay enough attention to EA rules and standards
No formal goals of EAI

No formal evaluation of EAI
No change management plan in association with the EA-effort exist

Figure 7: Table of identified opportunities and obstacles from CSFs.

This category of CSFs, EA Governance, constitutes of indicators within the CSFs of EA Management, EA Project Management, EA Rules standards, EA Planning and Assessment and Evaluation. To increase the chances of a successful EA implementation, there should be an established structure for EAM (Ylimäki, 2008). Based on the empirical material, the structure for EAM at SKF is currently being developed and is soon to be completed, this forms a opportunity for EAI at SKF. The next identified obstacle is weak formal power of EA in the organization. Based on our empirical material, business decisions can sometimes overrule EA decisions, rules and standards. To increase chances of successful EAI, EA governance should have a strong formal power within the organization (Aier & Schelp, 2010). Defined and documented EA rules, standards and quality indicates an opportunity for SKF, as argued by Kaisler et al., (2005) and Aier et al. (2010). However, while some business representatives had heard about EA rules, standards and quality gates, some had not. We suggest that these should be further communicated. We therefore identify the obstacle of EA rules and standards not communicated.

EA seems to be recognized as an aspect in projects within Unite, even if EA quality gates sometimes are neglected without consequences. However, according to the respondents, the EA aspect in projects outside Unite is absent to a high degree. This forms an obstacle for successful EAI, because of the importance of EA being recognized as a natural aspect within projects (Kaisler et al., 2005; Aier & Schelp, 2010). Projects receive good EA support from expertise (EA team) which is forms an opportunity for successful EAI (Kaisler et al., 2005; Aier & Schelp 2010). However, projects actively need to ask for this support. The EA presence within projects in the business is therefore dependent on project members reaching out for help, if not doing so, EA and GEAR will probably go unrecognized within the project. The possibility of project members asking for help is dependent on their knowledge about the existence of the EA and GEAR effort, which many times are missing. Therefore, we believe the EA team and the organization as whole, need to communicate the existence of EA and GEAR to the business, especially outside Unite.

Respondents, both business representatives and architects, believe that the organization need to be stricter in getting people adhering to the EA rules, guidelines and project quality gates. According to Ylimäki (2008), EA rules, processes, guidelines and standards should be clearly communicated to the employees in order to be followed (Ylimäki, 2008) We believe that there lies an obstacle in the business lacking knowledge about the existence of EA rules and the purpose of these rules. As a consequence, the business representatives can be questioning why these should be followed. Without seeing the purpose of EA and without having an answer of the question: “Why should we do this?”, we believe there is a risk of employees neglecting the EA rules and standards. In addition, the architectural board, ITAC, do not

seem to be very strict in making projects adhere EA rules and standards. This lack of attention can depend on other reasons, which is not visible through the empirical material. However, the existence of an architectural board indicates an opportunity for successful EAI (Aier & Schelp, 2010; Kaisler et al., 2005). We therefore believe that getting EA rules and standards adhered is dependent on two building blocks. One; providing the business knowledge about the existing EA rules and standards, how they work, why these should be followed and how they contribute to the better good of the organization. Two; stronger policing of EA rules, standards and quality gates. It is important to state that there, based on Schmidt & Buxmann (2011) seems to be a limit for how strong the policing of EA adherence can be, without the result of lowering the EA acceptance (Schmidt & Buxmann, 2011). However, based on our empirical material, we believe that the organization is far from this limit.

There exist no formal goals of the EA and GEAR implementation, which indicates an obstacle. The presence of such goals can increase the success of EAI (Ylimäki, 2008). Neither does a change management plan related to EA exist, something that also increases the success of EAI (Kaisler et al., 2005). However, architectural plans, which support the architects in their work, exist. We therefore believe that implementation goals of EA and GEAR should be established, together with a change management plan for EA. Formal assessment and evaluation of EA and EAI, as mentioned by Aladwani (2001) and Ylimäki (2008), do not seem to be conducted and therefore indicates another obstacle. We suggest that the possibilities of a structured and formal evaluation regarding the EA and GEAR implementation should be considered.

7.1.3 Communication

Based on the results from the empirical material, we have identified a number of opportunities and obstacles. These will be presented in the two tables below and later on be followed by a discussion. The tables are independent of each other.

Opportunities
Several communication channels are used
Obstacles
Communication is not proactive and frequent
Lack of communication
No communication plan or strategy of architectural communication
Information do not seem to reach many of those whom it concerns
Complex EA material

Figure 8: Table of identified opportunities and obstacles from CSFs.

The CSF of communication is of big importance for successful EAI, especially to achieve a common understanding and agreement of the EA scope, objective and content (Aier & Schelp, 2010; Schmidt & Buxmann, 2011; Ylimäki, 2008). The CSF of communication does most certain stand out in our empirical results. The result concludes that only one of four interviewed architects stated that the communication between the architects and the business is good. In general, the empirical material show that the communication is neither proactive or frequent. Based on the arguments of Ylimäki (2008), this lack of communication forms an obstacle for successful EAI. The empirical result indicates that several communication channels (e.g Yammer and internal mail) are used for EA communication. The use of various communication channels for EA communication indicates an opportunity for EAI (Ylimäki, 2008). A communication plan or strategy for architectural communication should be defined and documented (Ylimäki, 2008). Therefore, the absence of a communication plan or formal consideration of architectural communication forms an obstacle for EAI at SKF. What seems to be alarming is how information do not seem to reach many of those whom it concerns. A majority of the business representatives think the communication is poor, infrequent and does not feel addressed. They call out for easier and more understandable EA material. One of the business representatives believes that if GEAR is going to be used by the business, it requires a simplified presentation and better marketing. As stated by the SKFs CIO, the EA material needs be explained in a way that even your grandmother understands; *"If I can't explain this to my grandmother, then it's not clear enough"* (CIO).

We have found several other CSFs which are dependent on the CSF of communication. The first category of CSF, EA material, tools and methodology, states that the knowledge about EA, its importance and what is to be achieved by EA, should be well anchored in the organization. For that reason, we believe that sufficient EA and GEAR knowledge cannot be anchored without communication. EA material is for instance one area which could draw benefits of such communication. According to Schmidt and Buxmann (2011) and Ylimäki (2008), in order for EA to reflect the requirements of the business, it needs to be based on the business reality. We believe that, without sufficient communication between the EA team and the business, a reflection of the business reality is harder to achieve.

Just as the first category of CSFs, we believe that the second, namely EA management, is highly dependent on the CSF of communication. This statement is rooted in the lack of awareness of EA management, e.g. rules and standards. If EA governance should have a chance of being anchored in the organization, project teams and employees needs to know about the existence of EA rules, standards and quality gates, as well as understand these and their purpose. We suggest that this cannot be achieved without sufficient communication. If project teams are going to ask for help with EA aspects and if the architectural board (ITAC) are going to keep EA high on their agenda, we suggest EA existence and importance should be strongly communicated to the business. Even if there is a commitment to the EA and GEAR effort, this commitment can probably be leveraged if the existence and importance of EA and GEAR could be communicated to more stakeholders. Additionally, the fourth CSFs category, Stakeholder commitment and skills, have shown to be dependent on

communication. EA knowledge of non-architects is dependent on formal training, which today exists and can be conducted on request. However, many respondents seem to be unaware of the existence of such training. We therefore view communication as the missing element. The fifth category of CSFs, EA Pressure, states that business units should feel a need or a necessity of EA (Aier & Schelp, 2010). We suggest that a bigger sense of urgency need for EA can be communicated to the employees.

Even the last category of CSFs, Organizational culture, have obvious connections to communication. If EA are to be anchored in the culture of the organization and be a certainty in the way SKF conduct business, communication needs to make EA and GEAR visible in the organization. We believe that the view of the EA function is dependent on which value they create. A good Enterprise Architecture, that is mature as in the case of SKF, provides many values for the organization as a whole. However, this value needs to be communicated to the organization, in order to show the obvious value of the EA team and the work they are conducting. If this value could be communicated, both the EA team, EA at SKF and GEAR would increase its legitimacy and possibility to have a major impact on the business. We believe that all CSFs categories having a connection to communication is a major finding within our research.

7.1.4 Stakeholder commitment and skills

Based on the findings from the empirical material, we have identified a number of opportunities and obstacles. These will be presented in the two tables below and later on be followed by a discussion. The tables are independent of each other.

Opportunities
Involved stakeholders are generally committed to the success of EA
Management seems to have a commitment to EA
Training and education for non-architects are conducted
Training plan exist
Obstacles
Available training not communicated to stakeholders

Figure 9: Table of identified opportunities and obstacles from CSFs.

Our empirical material shows that stakeholders directly involved in the implementation of EA and GEAR, generally are committed to the success of EA. Top management and the CIO are also dedicated to the EA effort. This stakeholder involvement and management commitment forms two opportunities for the organization. As mentioned before, involvement is generally known to increase commitment (Schmidt & Buxmann, 2011; Ylimäki, 2008). We therefore

believe that more employees should be directly involved in the EA and GEAR implementation. There exists a training plan, training and e-learning in EA and GEAR. Both for architects and non-architects. The existence of structured training and a training plan indicates two opportunities for successful EAI (Aier & Schelp, 2010; Ylimäki, 2008). Architectural skills of non-architects are of high importance for the general impact of EA within the organization (Aier & Schelp, 2010; Kaisler et al., 2005). However, many business representatives and even architects, state that they have not heard about such training. It does neither seem to be a requirement of participating in any EA and GEAR training, instead it is available on request. Again, two essential building blocks for mitigating obstacles can be distinguished. One: Communicate information regarding the existence of EA and GEAR training. Two: Require that stakeholders participate in training in EA and GEAR. We believe that the answer lies somewhere between these two alternatives. However, it should start with the essential task of communicating the existence and the purpose of EA and GEAR training.

7.1.5 EA Pressure

Based on the results from the empirical material, we have identified a number of opportunities and obstacles. These will be presented in the two tables below and later on be followed by a discussion. The tables are independent of each other.

Opportunities
Business representatives recognize the need of EA
Dedicated EA-budget exist
Obstacles
No pressure of working with GEAR and EA
Recognition of EA need compromised by lack of understanding and communication

Figure 10: Table of identified opportunities and obstacles from CSFs.

All respondents recognize a need for EA and for the structure that EA results in. This forms an opportunity for successful EAI (Aier & Schelp, 2010). However, most of the business representatives do not feel any pressure of working with EA and GEAR, instead it is dependent on their own interest and available resources. The absence of pressure of working with EA forms an obstacle for EAI (Aier & Schelp, 2010). One business representative believes that GEAR needs to be marketed in a different and more extensive way, if employees are going to embrace it. We believe that this success factor is dependent on communication regarding the existence and the need for EA and GEAR. We believe that a sense of urgency can be helpful in order to convince people of recognizing GEAR and EA. This sense of urgency is also argued for by Aier and Schelp (2010). In addition, a dedicated EA budget exists. This is considered as an opportunity.

7.1.6 Organizational culture

Based on the results from the empirical material, we have identified a number of opportunities and obstacles. These will be presented in the two tables below and later on be followed by a discussion. The tables are independent of each other.

Opportunities
Willingness to adapt to EA.
Obstacles
Lacking visibility of EA
Willingness is compromised by time and cost pressure
EA team are passing forward the maintenance of GEAR to the business
IT and EA as organizational functions are viewed as both support functions and cost center, not as business enablers

Figure 11: Table of identified opportunities and obstacles from CSFs.

The Organizational culture represent the last category of CSFs. Initially, this single CSF highlights the importance of the right organizational culture for EA to flourish (Ylimäki, 2008). Attitude towards change in general are of importance in order to succeed with the EAI (Ylimäki, 2008). Among the business representatives, there are a willingness to adapt to EA and GEAR, since they recognize their values. For that reason, this forms an opportunity for successful EAI. According to Aier and Schelp (2010), the willingness to adapt to architecture depends on its visibility and perception outside the EA department (Aier & Schelp, 2010). Business representatives argue that many employees do not have the possibility of such a willingness, since they have not heard about EA and GEAR. This forms an obstacle for EAI. Again, we believe this depends on the lack of communication. We therefore argue that EA and GEAR, or at least its purpose, need to be made more visible in the organizational culture and be more of a certainty in the way SKF conduct business. The easiest way would be to start with extensive communication regarding the EA and GEAR effort. Business representatives believe that business units do not have enough time and budget to make enough commitments towards EA. This statement has been recognized as an obstacle. Aier and Schelp (2010) highlights the importance of that EA is grounded in the organizational culture and employees have a belief in architecture. According to another CSF it is important how the organization view the IS/IT function (Aier & Schelp, 2010). For that reason, SKF's situation regarding this matter have been identified as an obstacle. Due to the lack of visibility of EA in the business, among other reasons, it may not be surprising that the EA department and SKF IT are viewed as cost centers and support functions. Instead of as business enablers. Another interesting finding, which have been identified as an obstacle, is how the EA team seems to be passing forward the maintenance of GEAR to the business, based on statements from several of the architects. The future success of EAI may in this

reasoning be dependent on the businesses view of the importance of EA and GEAR. If the business is not aware of EA and do not understand its purpose, how are they then supposed to carry on the maintenance, especially when there are not any strict follow up of rules, standards or quality gates?

7.1.7 Summary

From above analysis, we have identified 20 opportunities and 23 obstacles related to SKF's EAI. Each EA project has its special characteristics, in which certain factors are of more importance than others (Nikpay et al., 2013). Based on this argument and for practical reasons, we have, together with enterprise architects in our studied organization selected the opportunities and obstacles we consider most emergent in the SKF EAI case. We thereby selected 11 opportunities and 17 obstacles that are of most relevance in our EAI case. These will be presented and further discussed in the next part of our analysis, in order to propose additional potential solutions for leveraging respectively mitigating these opportunities and obstacles.

7.2 Part 2: Diffusion of innovation

In this part will explore our empirical material from a DOI perspective in order to find additional potential solutions for leveraging respectively overcome identified opportunities and obstacles of EAI. We selected 11 opportunities and 17 obstacles that are of most relevance in our EAI case. *Figure 12* provides an overview these opportunities and obstacles that will be discussed. These are distributed in the five stages of the innovation-decision process, according to the stages we consider most relevant for each discussed opportunity and obstacle.

Opportunities

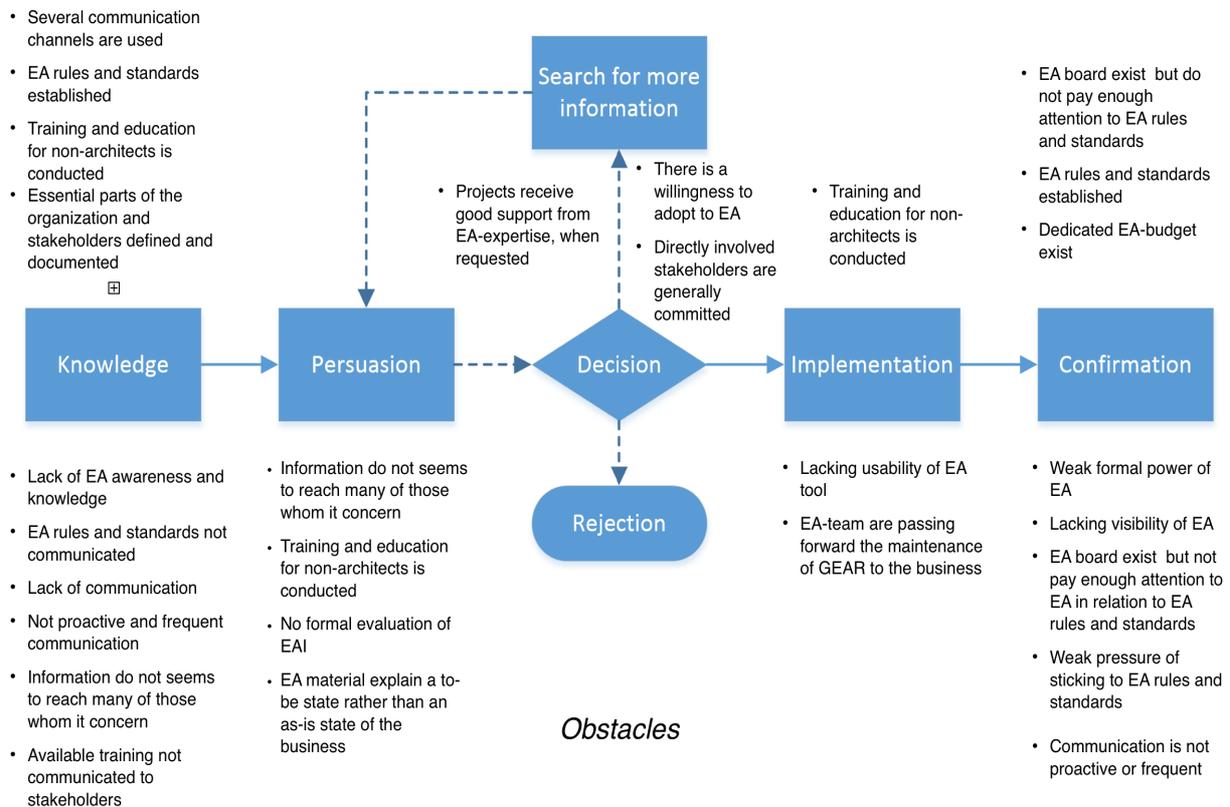


Figure 12: Model of opportunities and obstacles distributed in the five steps of Rogers (2003) innovation-decision process.

7.2.1 Knowledge stage

In order for the innovation-decision-process to start and eventually reach the *implementation* and *confirmation* stages (when the innovation is formally routinized by the organization) an individual need to have knowledge about the existence of the innovation, so called *awareness-knowledge*. According to Rogers (2003), individuals can actively choose to obtain knowledge regarding the innovation or passively be exposed to it. Based on our empirical material, the respondents are aware of the existence of EA and GEAR but mutually concludes that there are many people, especially in the business, not aware of EA and GEAR. While some respondents are aware of the existing EA rules and standards, the general understanding is that there is a lack of awareness concerning these. Only when *awareness-knowledge* (knowledge about the existence of the innovation) has been obtained, the *how-to knowledge* (knowledge about how to use the innovation) and the *principles-knowledge* (knowledge about the principles behind the innovation) can be obtained (Rogers, 2003). It is therefore important for the EA team to make sure *awareness-knowledge* is established before focusing on the establishment of *how-to knowledge* and *principles knowledge*. In the case of complex innovation, the amount of *how-to knowledge* needs to be increased in order to achieve successful adoption (Rogers, 2003). The EA team needs to deal with the *how-to knowledge* about the complex innovation of EA and GEAR. This is already acknowledged in the existing

providence of EA and GEAR training for adopters. However, *awareness-knowledge* about the existence of such training must be transferred to individuals. Transferring *awareness-knowledge* is therefore an utterly important factor for the EA and GEAR effort that should not be neglected. Based on the empirical material and Rogers (2003) arguments, we believe that *awareness-knowledge* are of uttermost importance to succeed with EAI. We suggest that the EA team prioritize the establishing of *awareness-knowledge* reaching the business with messages concerning EA and GEAR.

According to Rogers (2003), the general individual tends to have a quite passive role when being exposed of knowledge within this stage (Rogers, 2003). For that reason, the business units within SKF can be viewed as the general individual, having a passive role when being exposed by information regarding EA and GEAR. In order to reach them, we suggest the EA team to create an environment based on two aspects (1) make the individual feel a need for EA and GEAR and present it in a way that is consistent to the attitudes and beliefs of the individual (2) influence individuals through their peers in the communication network. According to Rogers (2003) adoption rate will increase if individuals recognize the need of the innovation, this need can be highlighted through change agents and opinion leaders. In addition, the innovation should be presented in a way that matches the attitudes and beliefs of the individuals (Rogers, 2003). This will be future explained below.

The empirical material show evidence that there is a distance between the EA team and the business. As communicated both by architects and business representatives, there is a lack of regular communication between architects and the business. If we take a further look at this situation and draw a rough generalization, we can distinguish two different groups with different beliefs and competence. We already know, from the theoretical framework, that the human communication (exchange of ideas) occurs more commonly between individuals who share the same attitudes and beliefs, something Rogers (2003) call homophilous individuals. When individuals are different to each other, the communication between them becomes more demanding and difficult, the individuals are heterophilous (Rogers, 2003). Based on this knowledge, we believe there exist a communication barrier between architects and the business, a barrier that is built on differences between the two groups. One reason for this barrier could be that architects communicate and exchange ideas regarding EA in terms of architectural and high-level IT terminology. The business has limited knowledge about these terms and can have issues understanding them. As a consequence, despite obvious benefits of EA and common business objectives, it is hard for the business to understand messages received from the architects. Rogers (2003) state that when individuals perceive messages which is contradictory with their existing beliefs, messages tend to be avoided or unheeded (Rogers, 2003). This might be an explanation why the business tends to avoid EA guidelines. As stated by one of the business representatives: “*Just to say the word Group Enterprise Architecture Repository (GEAR), already there you have lost half of the business (interest), what the heck are you talking about?*” (BR:4).

We believe this uncomfortable psychological state, mentioned by Rogers (2003), can be mitigated. To achieve this, links between heterogeneous networks, in our case the EA team

and the business can be established. Something that according to Rogers (2003), could accelerate the rate of diffusion (Rogers, 2003). In our case, we recognize that the two homophilous groups can slow down the adoption rate due to the lack of understanding between the two groups. We suggest that change agents can be used to support different sets of opinion leaders, preferably one from each group and to facilitate the need for EA and GEAR. Additionally, we suggest the EA team to review the possibility of identifying opinion leaders in other parts of the organization to support and encourage them in their important work of spreading EA and GEAR. Rogers (2003) state that this could accelerate the adoption rate. Individuals tend to follow opinion leaders, to seek information and advices regarding an innovation (Rogers, 2003).

7.2.2 Persuasion stage

After acquiring *awareness-knowledge* and basic *how-to knowledge* about the innovation, individuals seek more information to strengthen their opinions regarding the innovation. In the persuasion stage, the general perception of the innovation is developed. Within this stage it is of great importance that the right sort of information, regarding the innovation, is delivered in the right way to the right person (Rogers, 2003). Let us therefore discuss how the respondents receive information regarding EA and GEAR as well as how this information is delivered.

Rogers (2003) states that information spread through mass media have a greater impact of creating *awareness-knowledge* about an innovation. However, interpersonal relations are more effective within the persuasion stage since they create strong opinions among individuals and thereby could increase the adoption rate of the innovation. Interpersonal relations can therefore be considered as an effective method for changing attitudes towards a new idea (Rogers, 2003). A majority of our interviewed business representatives receive information regarding the EA and GEAR from informal meetings or conversations with the EA team. Business representatives who have had this kind of interpersonal relation with the EA team have decided to use the GEAR based on recommendations made by them. This speaks for the importance of interpersonal relations. According to Rogers (2003), interpersonal relations are of greater importance for individuals in later adoption groups (Rogers, 2003). For that reason, these relationships might be of even more importance for the EA team in the future.

Several business representatives express how they receive good support from the EA team when working with EA and GEAR, even if they currently feel that they need to ask for this support. For that reason, the EA team should continue working with the business in order to benefit the interpersonal impact by supporting the business in their work with EA and GEAR. When the use of EA and GEAR increase, it does however demand more internal resources in order to be able to maintain the interpersonal contact between the EA team and the business. However, it is important to mention that informal communication and word-of-mouth (WOM) probably is not enough if EA and GEAR should be adopted. We suggest that

informal communication should take place in addition to the formal routinization of EA rules, standards and quality gates.

As the empirical material shows, EA is an aspect in projects within Unite, however, not often in business projects. For the EA team, WOM could have a great effect due to how WOM spread messages of an innovation, potentially from individuals within Unite to individuals outside the Unite program. Individuals within Unite can recommend the use of EA and GEAR to their colleagues in the business. The effect of WOM have a great credibility due to how individuals put its own mark on their recommendations (Rogers, 2003)

Our empirical material reveals that some WOM already exist due to how the EA and GEAR have reached certain respondents, i.e. through personal recommendations. However, it has also been revealed that some business representatives express that they would like to see a more extensive content within GEAR, before they can use it effectively and before they would recommend it to colleagues. According to Hennig-Thurau et al., (2004), it is important to generate positive WOM effect concerning the innovation (Rogers, 2003). For that reason, we believe that it is of great importance that the EA team tries to visualize the value of EA and GEAR. This can for instance be visualized through business cases were the values and advantages of EA and GEAR are made visible. We believe that business cases, where EA methods together with GEAR are used in order to achieve successful outcomes, can be demonstrated for business representatives and adopters of GEAR, in order to achieve a higher adoption rate. By offering such presentations, we believe that a positive WOM effect can be generated. In addition, demonstration would also raise the innovations quality of *trialability*, since adopters get an insight in the use of EA and GEAR.

In order to reach individuals which have limited or none relation to each other, eWOM can be used. eWOM can facilitate a second dimension for the diffusion (Hennig-Thurau et al., 2004). We believe there is reasons for the EA team to increase their usage of eWOM. With this in consideration, we suggest that the current Yammer-site, which today is used to a small degree by practitioners of EA, can constitute a beneficial tool in order to initiate the eWOM. As argued in previous discussion, homogeneous network can result in barriers, where only similar minded individuals are collaborating. Yammer has the potential of being used as a heterogeneous network, where heterogeneous individuals, such as business representatives, can be included, take part of recommendations and be a part of discussions regarding the EA effort. As previously mentioned, information which is communicated through eWOM, for instance through Yammer, need to be addressed and communicated in the right way to reach the business.

Even if interviewed business representatives have an understanding of EA and GEAR, they - together with the architects, state that many people in the business does not understand and lack essential knowledge about EA and GEAR. It is mentioned by the respondents that GEAR lacks usability and many times is too complex to use, both for the architects and business representatives. This support us in our argument that the EA team should communicate EA and GEAR in an easier and more understandable way in order to increase

the adoption rate. According to Rogers (2003) there exists different adoption categories, which specifies different kinds of adopter behaviors. During the adoption process, different kind of adopter categories are present and as a result there exist a need for different types of communication and information. Early adopters often require a deeper and more detailed understanding of the innovation while later adopters prefer simpler and more accessible information (Rogers, 2003). Taking this in consideration for SKFs situation, we suggest that the EA team, other architects and directly involved stakeholders represents early adopters. For that reason, they need deeper and more detailed information. Continuously, the business representatives represent the later adopters. Later adopters prefer simpler and easier understandable information, which according to the empirical material do not seem to exist today. The architecture handbook has however been an attempt to provide such material, but can by business representatives be perceived as overwhelming. We therefore suggest that the EA team, in order to reach the business - the later adopters, need to present information which is simplified and more accessible than the existing information in form of GEAR and the handbook.

Finally, individuals want to know if the new innovation is functional, while at the same time seeking social reinforcement from others with the same view. Individuals therefore seek messages which might reduce uncertainty and consequences. This can be made through innovation evaluation information (Rogers, 2003). Taking Rogers (2003) theory in consideration, the EA team can use formal evaluations to identify existing uncertainties among the adopters and target these uncertainties with additional resources. In that sense, formal evaluation of the EA and GEAR implementation can provide insights to which uncertainties that should be dealt with.

7.2.3 Decision stage

The third stage in the innovation-decision-process describe individual's decision of adopting or rejecting the innovation. Individuals insecurity of adopting an innovation can be reduced through letting individuals try the innovation for a shorter period of time (Rogers, 2003). We believe that a connection can be made between the positive effects of stakeholders EA involvement (Schmidt & Buxmann, 2011; Ylimäki, 2008) and Rogers (2003) view of trialability as an enhancer of adoption. Our empirical material also shows stakeholders involved in the EA implementation, who have tried the innovation of EA and GEAR, have a more positive view of the innovation. Although our empirical data is too sparse to validate such conclusion. We therefore believe that further involvement in the EAI of business representatives outside the EA team can result in a faster adoption rate. Based on the arguments of Rogers (2003), this involvement can be widened by giving business representatives and other stakeholders the possibility of trying GEAR, preferably assisted by EA expertise.

The innovation-decision-process can also lead to the decision of rejecting the innovation (Rogers, 2003). Our empirical material states there are a willingness to adopt EA and GEAR among the respondents, which speaks for the decision of *adopt*. Based on our empirical

material, business representatives believe that many of the other people in the business have not heard about or acknowledged the existence of EA and GEAR. According to Rogers (2003), it is also important to highlight the risk of individuals rejecting the innovation, by forgetting about its existence (Rogers, 2003). This strengthens our argument—that *awareness-knowledge* regarding EA and GEAR should be established among employees.

7.2.4 Implementation stage

Within the implementation stage the issue of how the innovation are to be used, will appear. Implementation takes place when an individual puts an innovation to use (Rogers, 2003). When a new innovation is put into practice, it involves different behavioral changes. The empirical material shows a certain confusion among the business respondents when they use GEAR, due to how it reflects a to-be-state rather than an as-is-state. As a result, it may not reflect their expectation and lose some of its usefulness. According to Rogers (2003) an innovation can reach a higher rate of diffusion if it meets individual's expectations. We therefore suggest that the EA team should provide clear information on the to-be-state character of the EA material. As a result, the EA team can meet the user's expectation. This might decrease uncertainty among adopters.

According to Rogers (2003), active information seeking occurs within this stage and questions from individuals that still experience uncertainty. Individuals want answers of questions regarding where they obtain the innovation, how they should use the innovation and which operational problems can occur during the use of the innovation and how these problems can be solved (Rogers, 2003). We therefore argue for the continuance of providing sufficient EA and GEAR support to the business and projects. Based on this argument and our earlier argument of the importance of *awareness-knowledge* regarding the available training, we also suggest that the current situation of support available on request can be leveraged by better communication and advertising of the availability. If the *awareness-knowledge* of available support and training was general knowledge, we believe it would decrease the uncertainty surrounding EA and GEAR at SKF. The uncertainty would increase through answering adopter's questions regarding how to use EA and GEAR in their operational work, how EA material and GEAR can be accessed and how potential problems can be solved. This reduction of uncertainty may lead to a major victory in the innovation-decision-process of EA and GEAR, based on the arguments of Rogers (2003). In the event of the EA team passing forward the maintenance of GEAR to the business, the uncertainties of *what it is* and *how it is* used must be heavily reduced in order to not jeopardize the existing EA assets through ignorance or lack of maintenance, which could result in outdated EA material.

In the implementation stage, change agents and opinion leaders can be used for providing individuals with assistance regarding how to use the innovation (Rogers, 2003). Change agents would at this stage provide additional EA and GEAR support in addition to the existing, given by the EA team. The support of change agents and their role in generating *how-to knowledge* about EA and GEAR could also result in less uncertainty. According to

Rogers (2003), organizational structure has an impact of the implementation stage of an innovation. In this sense, SKF has an opportunity in the already existing architectural board, ITAC. The organizational position of the EA department also has an impact on the success of EAI (Ylimäki, 2008). It would therefore be kept in mind to position the EA department where the department both can reach business and IT and perhaps not within SKF IT.

A high degree of re-invention may lead to a fast rate of adoption of an innovation, due to its flexibility to suit a greater amount of opinions. A high degree of re-invention can also lead to a higher degree of sustainability of an innovation (Rogers, 2003). We therefore suggest that there lies a possibility in EA's broad area of use, being possible to use in many different ways to achieve a variety of values (Tamm et al., 2011; Land et al., 2009). Projects and business units can therefore use GEAR in a way that suits them and is aligned with their goals. Theoretically, one business unit can use GEAR for reducing costs while another business unit uses GEAR to achieve improved decision-making. We also believe that GEAR, as an IS, constitutes a high degree of re-invention due to the possibilities for information systems to be integrated with other systems and the almost endless possibilities of digital information. For instance, the information within GEAR can be presented in a different graphical user interface, something that might help to improve usability issues. This speaks for a high degree of re-invention. The high degree of re-invention of EA and GEAR therefore provides an opportunity for SKF and could, based on Rogers (2003) theories, be further explored.

7.2.5 Confirmation stage

The confirmation stage constitutes the fifth and final stage of the innovation-decision-process. Individuals seek information regarding the innovation even after the decision to implement has been taken. If messages of the innovation are in conflict with prior beliefs, the decision might be reversed. The risk of *discontinuance*, in other words the rejection of an innovation after the decision to adopt it, can be reduced by making sure to formally routinize the innovation in the organization (Rogers, 2003). There lies an obstacle in that EA and GEAR not yet have been routinized in SKF's operational work. We believe that the lacking understanding and complexity of EA and GEAR can lead to misuse that could result in unachieved values. This form of *disenchantment discontinuance* can result in decreasing adoption of EA and GEAR. We therefore strengthen our argument that sufficient establishment of *awareness-knowledge* and *how-to* knowledge through communication should be increased. If more *how-to* knowledge regarding EA and GEAR can be generated, the chances of misuse will be reduced and indirectly, the chances of *discontinuance*. Rogers (2003) state that in the confirmation stage, decision-makers want to strengthen the decision of adopting the innovation. This can be done to formally routinize the innovation in the organization (Rogers, 2003). The formally routinizing of EA and GEAR in SKF are on its way, with a dedicated EA budget, an architectural board, GEAR and other formal efforts. However, this routinization can be amplified by the formalization of projects and business units adhering to EA rules, standards and quality gates. The routinization would also be strengthened by the architectural board, more strictly, made sure EA rules and standards were adhered. Furthermore, EA and GEAR could have a more natural setting on the agenda of

meetings and in the communication space of SKF. Simplified, it probably would not pose a threat if the pressure of working with EA and GEAR was more pronounced, if this message is communicated in the right way. We believe this would result in a more formal power of EA that can provide a ground for the success of EA and GEAR at SKF.

7.2.6 Summary

Knowledge stage; Within this stage we have been looking at individuals existing knowledge about the innovation, in other words knowledge about EA and GEAR. We believe it is of uttermost importance that the EA team deals with the lack of *awareness-knowledge*, regarding EA and GEAR. Rogers (2003) argues that this *awareness-knowledge* is the first step of getting an individual to adopt an innovation. A complex innovation like EA and GEAR often needs a larger amount of *how-to* knowledge in order to be adopted. This is already acknowledged by the EA team by the offering of EA and GEAR training. However, *awareness-knowledge* regarding this training should be generated in order to make the business aware of it. The EA team and the business can be represented as two heterogeneous groups or networks, according to Rogers (2003) theory. We believe that change agents can support opinion leaders to influence individuals in the adoption process of EA and GEAR. Additionally, we suggest the EA team to review the possibility of identifying opinion leaders in other parts of the organization to support and encourage them in their important work of spreading EA and GEAR. Instead of solely argue for the use of EA and GEAR, change agents should also convey the need for EA and GEAR at SKF.

Persuasion stage; Within this stage we have been looking at how individuals seek more information to strengthen their opinions regarding the innovation. The general perception of the innovation is developed within this stage and it is therefore of great importance that the right sort of information, regarding the innovation, is delivered in the right way to the right person. According to Rogers (2003) and our empirical material, it is of importance that the EA team does not neglect the important role of interpersonal relations with the business. However, informal communication and WOM probably not is enough if EA and GEAR should be adopted. The adoption should be supported by the formal routinization of EA rules, standards and quality gates. It is important to generate a positive WOM effect concerning the innovation (Hennig-Thurau et al., 2004). For that reason, we believe that the EA team should visualize the value of EA and GEAR in order to please to generate a positive WOM effect that will be based on the values of EA and GEAR. This can for instance be done through business cases. In order to reach individuals who have a limited relation to each other, eWOM can be used. Based on Rogers (2003) adopter categories, we categorize business representatives as later adopters. Later adopters prefer simpler and understandable information regarding the innovation, something that do not seem to exist today. We therefore suggest that a simplified version of the architecture handbook should be developed. As suggested by Rogers (2003), the EA team can use formal evaluations to identify existing uncertainties among the adopters and target these uncertainties with additional resources.

Decision stage; This stage involves individual's decision of adopting, make full use of the innovation or rejecting, choosing to not adopt the innovation. Individuals insecurity of adopting an innovation can be reduced by letting them try the innovation for a shorter period of time, what Rogers (2003) would call *trialability*. Stakeholders involved in the EA implementation, who tried the innovation of EA and GEAR, have a more positive view of the innovation, even if our empirical material is too sparse to validate such conclusion. Further involvement in the EAI of people and business outside the EA team can result in a faster adoption rate. Finally, it is also important to highlight the risk of individuals rejecting the innovation by forgetting about its existence.

Implementation stage; Within this stage of the innovation-decision-process we discussed issues that occur when an innovation is put to use by individuals. Rogers (2003) state that an innovation can reach higher rate of diffusion if it meets individual's expectations. We therefore suggest that the EA team should provide clear information regarding the to-be-state character of GEAR. As a result, the EA team can meet the user's expectation and this might decrease uncertainty among adopters. Change agents can be used for providing individuals with assistance regarding how to use the innovation and provide with additional support for the EA team (Rogers, 2003). The support of change agents and their role in generating how-to knowledge about EA and GEAR could also result in less uncertainty with the same arguments as above. Finally, a high degree of re-invention may lead to a fast rate of adoption of an innovation due to its flexibility to suit a greater amount of opinions. A high degree of re-invention can also lead to a higher degree of sustainability of an innovation. The high degree of re-invention of EA and GEAR therefore provides an opportunity for SKF and could, based on Rogers (2003) theories, be further explored.

Confirmation stage; Within this final stage of the innovation-decision-process, we looked at how individuals seek information regarding the innovation, even after the decision to implement has been taken. The risk of rejection can be reduced by making sure to formally routinize the innovation in the organization (Rogers, 2003). There lies an obstacle in that EA and GEAR not yet have been routinized in SKF's operational work, which can result in an increasing rejection of EA and GEAR. Misuse due to complexity of EA and GEAR can result in unachieved values and increase rejection. If more how-to knowledge regarding EA and GEAR can be generated, the chances of misuse will be reduced and indirectly the chances of rejection. Furthermore, EA and GEAR should have a more natural setting on the agenda of meetings and in the communication space of SKF.

To summarize, we can distinguish three areas from which all of our discussed 11 opportunities and 17 obstacles can be derived from; *Knowledge, communication and formal power*. All of the three categories are dependent to each other. For instance, we have seen that lack of EA awareness and knowledge, in addition to awareness about EA rules, standards and available training, is dependent on the lack of communication. Knowledge cannot be transferred without communication. In turn, the impact of communication on people's actions, is dependent on formal power. Without formal power, established EA rules and standards can

be ignored without consequences. In addition, weak formal power of EA will make it less visible and decrease its natural role in how the organization conduct business.

8. Conclusions

This study aims to answer the questions of which opportunities and obstacles that can be identified within Critical Success Factors of EA implementation (EAI) and how these can be leveraged respectively overcome. To answer these questions, an interpretative in depth-case-study of EAI at a global company was conducted. The conclusion will be presented in two parts. The first part presents identified opportunities and obstacles for EAI. The second part propose possible solutions for leveraging respectively overcome these.

8.1 Identified opportunities and obstacles of EAI

Opportunities and obstacles have been identified through our model of CSFs of EAI (figure 5). In total, 20 opportunities and 23 obstacles of EAI has been identified. These have been presented in their respectively CSF category in the first part of our analysis. From that, we selected 11 opportunities and 17 obstacles that we found most emergent in our EAI case. We concluded that these opportunities and obstacles can be derived from three areas; *Knowledge*, *communication* and *formal power*.

8.2 Leveraging and mitigating opportunities and obstacles

Knowledge; A lack of EA awareness and knowledge can cause difficulties for EA to be anchored in the organization and decrease EAI success. Due to how individuals, in an early stage of a diffusion process not actively seek information about an innovation it is of great importance to establish *awareness-knowledge*⁶. Knowledge should be communicated in a way that state the need for EA and the architectural repository. EA can be viewed as a complex innovation that requires a certain amount of *how-to knowledge*⁷. This *how-to knowledge* can be established through the offering of formal EA training. The establishing of knowledge has shown to be dependent on sufficient communication.

Communication; Communication play an important role for successful EAI. A major finding within this study is that all CSF categories depend on the CSF of communication. A lack of communication decreases the chances of establishing EA awareness and knowledge. Additionally, a lack of communication leads to decreasing adherence to EA rules and standards, EA visibility and an EA that may not reflect business reality. Communication can be improved through the use of change agents and opinion leaders, due to how they can assist with convincing individuals of recognizing EA and provide required *how-to knowledge*. Change agents can establish a communication link between the two heterogeneous groups of architects and the business, through which the groups exchange knowledge. The values of EA

⁶ *Awareness-knowledge* is the knowledge about the existence of an innovation

⁷ *How-to knowledge* is the knowledge about how to properly use an innovation

and the architectural repository should be communicated to adopters, this can be done through business cases that demonstrates its values. Informal communication can be used in order to generate positive recommendations which can increase the adoption rate. Within EAI, the business can be categorized as later adopters. For that reason, they need simplified and more accessible versions of the architectural material and guidelines. Increasing usability of EA can also be achieved through the high degree of re-invention of an architectural repository. For instance, EA content within the repository can be presented in a different graphical user interface, within or in a different system. Increasing usability of EA can lead to a higher involvement of stakeholders. Stakeholders directly involved in the EAI generally demonstrates a higher commitment which can increase the adoption rate of. Therefore, high involvement of stakeholders should be strived after. Furthermore, by using *formal evaluation* of EAI, the organization can identify uncertainties that can be resolved in order to increase the adoption rate.

Formal power; The impact of communication has shown to be dependent on formal power. Without formal power, communication has less impact. We suggest that policing of stakeholder's adherence to existing EA rules, standards and quality gates should be sufficient and have a natural setting on the agenda of meetings and in communication. In addition, this policing of EA rules and standards would imply a pressure of using EA and the architectural repository while adhering to rules and standards. This form of formal power can generate visibility of EA which increases stakeholder's willingness to adapt to architecture.

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Appendix

Appendix A: Interview guide

Interview ID: 01

Role of respondent: Architects side

Question number:	Content	Speaker
1.	Do you think the organization have a clear definition of Enterprise Architecture and does it exist a clear mission and goals of what is to be achieved by Enterprise Architecture?	Researcher
		Respondent
2.	Does the developed Enterprise Architecture cover the most important parts and stakeholders of the organization and is it clearly defined and documented?	Researcher
		Respondent
3.	Is it decided how much of the organization that should be included and how deep and detailed the Enterprise Architecture should be?	Researcher
		Respondent
4.	Would you say that the Enterprise Architecture is rooted in SKF's business strategy and does the architectural process reflect the business reality? Please explain in what way it is rooted/not rooted?	Researcher
		Respondent
5.	Are all essential levels or views of the architecture modeled and is there a clear traceability between business and IT?	Researcher
		Respondent
6.	Are methods for developing and maintaining Enterprise Architecture structured and documented, do they specify processes, guidelines, best practices and drawing?	Researcher

		Respondent
7.	Does GEAR support easy, up-to-date, access to Enterprise Architecture artifacts and does it support modelling, decision processes and communication between stakeholders?	Researcher
		Respondent
8.	Is the Enterprise Architecture function of the organization strategically positioned in order to have enough impact?	Researcher
		Respondent
9.	Is there an established structure for EAM/Enterprise Architecture governance, for instance effective processes, change management and risk consideration?	Researcher
		Respondent
10.	Does Enterprise Architecture governance have a strong formal power in the organization and is there an Enterprise Architecture board with stakeholders representing different business units?	Researcher
		Respondent
11.	Are Enterprise Architecture considered and involved in all projects by default? Is program management, where different Enterprise Architecture project is managed, conducted?	Researcher
		Respondent
12.	Are quality gates established that projects, especially IS projects, need to surpass by fulfilling strict architecture requirements?	Researcher
		Respondent
13.	In what way are projects, during their lifecycle, supported by Enterprise Architecture expertise to ensure they are in line with the architecture?	Researcher

		Respondent
14.	Would you say that project teams are aware that the Enterprise Architecture exists and do they understand the concept? Do they collaborate with the architects?	Researcher
		Respondent
15.	Have the Enterprise Architecture function established rules and standards that are to be followed by employees? Do the employees follow them or do they get allowance to skip them?	Researcher
		Respondent
16.	Have it occurred issues when the existing IS landscape is changed as a result of the Enterprise Architecture initiative?	Researcher
		Respondent
17.	Are there specific goals of the implementation that are to be achieved? Are they used?	Researcher
		Respondent
18.	Are architectural plans established and used during the implementation? Does a change management or configuration management plan exist?	Researcher
		Respondent
19.	To what degree is the implementation process and architectural decisions measured and evaluated?	Researcher
		Respondent
20.	Is a communication plan or a strategy for architectural communication used?	Researcher

		Respondent
21.	Are various communication channels and possibilities of communication used?	Researcher
		Respondent
22.	Is the timing of the Enterprise Architecture communication considered and is the timing frequent and proactive?	Researcher
		Respondent
23.	Is the timing of the Enterprise Architecture communication considered and is the timing frequent and proactive?	Researcher
		Respondent
24.	Would you say there is a good communication between the architects and the business units?	Researcher
		Respondent
25.	Would you say top management and other stakeholders, representing different business units, are committed to the Enterprise Architecture effort?	Researcher
		Respondent
26.	Are these non-Enterprise Architecture employees involved in the implementation process?	Researcher
		Respondent
27.	Are non-Enterprise Architecture employees trained and educated in architectural work based on their individual needs? Does an Enterprise Architecture training plan for employees exist?	Researcher

		Respondent
28.	Are Enterprise Architecture team members continuously trained and educated?	Researcher
		Respondent
29.	Does a dedicated Enterprise Architecture budget exist and how is Enterprise Architecture financing conducted?	Researcher
		Respondent
30.	How high is the willingness among employees/managers to adapt to architecture? How do employees react to changes in the architecture?	Researcher
		Respondent
31.	Do you work for changing employees attitude towards architecture in order to spread the concept outside your business unit? If so, how?	Researcher
		Respondent
32.	Would you say that IS, Enterprise Architecture and other kinds of architecture are visible and well perceived outside the Enterprise Architecture-department?	Researcher

Appendix B: Interview guide

Interview ID: 01

Role of respondent: Business side

Question number:	Content	Speaker
1.	Do you know what Enterprise Architecture is? If yes, please explain your interpretation about the term, and the purpose of Enterprise Architecture.	Researcher
		Respondent
2.	To what degree do you feel that the Enterprise Architecture cover you part of the organization and the stakeholders related to your part of the organization?	Researcher
		Respondent
3.	Do you feel like Enterprise Architecture (GEAR) is rooted in SKF's business strategy and does it reflected your everyday business and practice?	Researcher
		Respondent
4.	To which degree are Enterprise Architecture models and artefacts of use to your part of the business? Do you feel like these strengthen the connection between business and IT?	Researcher
		Respondent
5.	Do you have access to Enterprise Architecture material, such as process models, artefacts, guidelines, best practices and other standards? Where do you find them?	Researcher
		Respondent
6.	Do you feel that the Enterprise Architecture tools (ARIS/GEAR) supports modelling, decision processes and communication between stakeholders? If yes, in what degree? If no: Why not?	Researcher
		Respondent

7.	Do you respond to requirements of the architects and do the architects have a formal power within your projects?	Researcher
		Respondent
8.	Have you heard about an Enterprise Architecture board or a way for making your voice heard concerning the Enterprise Architecture?	Researcher
		Respondent
9.	Do you consider Enterprise Architecture to be a part of your ongoing projects and if so, in what way is Enterprise Architecture recognized as a project aspect?	Researcher
		Respondent
10.	Do your projects need to surpass certain Enterprise Architecture requirements to get approved? If yes, please explain which.	Researcher
		Respondent
11.	Do you feel you are supported by expertise in how to handle architectural related issues in order to be sure that projects are in line with the Enterprise Architecture? If yes, to what degree? If no, explain why not.	Researcher
		Respondent
12.	Are you aware of any Enterprise Architecture rules and standards? If so, what are your thoughts on these?	Researcher
		Respondent
13.	Do you collaborate with the architects?	Researcher
		Respondent

14.	Have you experienced issues when existing IS landscape are changed due to Enterprise Architecture initiatives? Please explain your answer.	Researcher
		Respondent
15.	Have you been presented with goals and milestones of the Enterprise Architecture implementation? If yes, which?	Researcher
		Respondent
16.	Have you been presented with a change management plan, configuration management plan or an architectural plan? If yes, were they helpful in any way?	Researcher
		Respondent
17.	Have you been involved in any evaluation of the Enterprise Architecture implementation? Please explain how.	Researcher
		Respondent
18.	From which communication channels have you received information regarding Enterprise Architecture initiatives?	Researcher
		Respondent
19.	How often do you receive information regarding Enterprise Architecture initiatives? Would you consider the timing of the Enterprise Architecture communication and the communication with the architects to be frequent and proactive?	Researcher
		Respondent
20.	Do you consider yourself committed to the success of the Enterprise Architecture effort and have you been involved in the implementation process in any way? Please explain why and how.	Researcher
		Respondent

21.	Have you and your project members been trained and educated in architectural work based on your individual needs?	Researcher
		Respondent
22.	Do you feel there is a need for a new way of doing things and is the structured Enterprise Architecture approach the right approach for this? Please explain how.	Researcher
		Respondent
23.	Have you heard of a dedicated budget for projects concerning the Enterprise Architecture? If yes, explain.	Researcher
		Respondent
24.	Can you describe the attitude towards changes in your organization? Are you willing to adapt to changes related to Enterprise Architecture?	Researcher
		Respondent
25.	Do you work for changing project members attitude towards architecture? If so, how?	Researcher
		Respondent
26.	How do you and your colleagues view the Enterprise Architecture team and SKF IT? Are they viewed as cost centers, support functions or business enablers?	Researcher

Appendix C: Detailed presentation of results

1. EA material, tools and methodology

Scope and coverage: All architects express they have clear definition of EA, due to how it is present in their daily work. It is however perceived as uncommon that the business understands the concept as easy as the architects. Three out of four architects suggest that the definition should be better communicated for an easier understanding and spread. The lack of understanding is visible in several of the comments made by the business representatives: *“I think that many people, in a meeting yesterday, when we spoke about GEAR, many people don't know what it is and don't understand the term and purpose of EA” (BR:5)* and *“when looking outside, in the business, I do not think people know what EA is at all” (ARC:1)*. Of those business representatives interviewed for this study, two out of four expressed they have a clear definition of EA. The other two expressed that they have an idea but are not able to explain the term. There are however mentioned by all business representatives that EA offer great benefits for the organization. Benefits such as *“an important factor to make life easier” (BR:5)* and *“provide a description framework” (BR:2)* are mentioned. On the other side, despite the expressed benefits that EA might bring, the general perception of EA is that it has not yet reached out to the business completely.

According to both architects and the business representatives, there are parts still missing for EA to get a hold in the business. For instance, one of the architects express that the developed EA is highly mature. However, parts of the organization are not mature enough to take it in and understand it. Two of the business representatives express that it is visible that EA rather reflect a future state than how it is today: *“In all honesty I would suggest they reflect where SKF IT wants to go. Not necessarily as how It's done today” (BR:6 & BR:5)*. It is mentioned by three architects that the EA is still under development. Another architect explain that it is not totally clear how detailed the EA is because one still need to communicate with each project for what should be there and what should not: *“It is not quite clear how detailed it is to be discussed (with the projects) - should this be included or not included. There is a basic set of attributes and such, but here you are willing to change the items to suit them (ARC:2)*. The same respondent express that it exists a risk that one put in too much things into the EA and then not succeed with maintaining it.

One general issue expressed by all respondents is the deficiencies in the architecture in GEAR. Not all parts of the business are documented which make it less valuable and therefore result in less GEAR usage. The decreasing value can be found in one comment expressed by a business representative *“The small winnings we make through GEAR - are as much work as going out to stakeholders, actually (BR:4)*. There is however a general view that the EA is defined and documented. When it comes to the business, one of the respondents express that the EA at least cover their area of the organization. The general perception from the architects and the business representatives is that EA cover essential parts in the organization, from a high-level view. All architects express that EA cover additional levels of the organization. That would say it cover processes and models from strategic goals down to technical infrastructure and server level. One of the business

representatives express the following *“The processes are good. Not super detailed models, but it works well. Integrations, model with those artifacts work well. The information model was quite high-level and maybe it should be so, but we stay at the level of objects - how do people and organizations work together”* (BR:1).

It is communicated by the architects, that EA is rooted in the business strategy, at least when it comes to the work performed for the documentation in GEAR, which is said to be quite clear. It is however mentioned that it can be clearer. When it comes to the business-side, we have found that the respondents do feel a connection between EA and the business strategy. From the interview with SKF’s CIO, it has been interpreted that EA constitutes an important building block in the company's strategy. This is said by the CIO at SKF: *“We are (the management) in overall agree that, in order to get a well-functioning business, that also is efficient and cost-effective, we need to have an approach to Enterprise Architecture that enables this efficiency. I often compare what we call Enterprise Architecture with city planning. Because it is easier to see similarities when leaving their own little sphere, because IT is very abstract”* (...) *The lack of having an Enterprise Architecture makes those who are going to create solutions, that is, those who are going to build houses and roads, struggle and do their best without seeing the whole picture. And maybe they do not know how to match them (solutions). It's very obvious when you have it, like in Gothenburg, a river that goes straight through. If you do not have this plan, the whole plan, then there will not be any tram to Hisingen”* (CIO).

EA Models and Artifacts: Three of four (ARC:2, ARC:3 & ARC: 4) interviewed architects states that all necessary levels and views of the EA is defined and modelled, or almost modelled. One architect disagrees on the modeling and states that the views are defined but not modelled. However, this architect says that all the views are clearly defined all the way up, from business strategies, down, to technical architecture. One business representative (BR:2) is satisfied with the EA coverage of the business area, concerning information and data modelling, object owner, information owner and project owner. Architects believe there is a clear traceability between business and IT in the architecture, or soon will be, when the modelling is done. One architect adds that IT processes and business processes are aligned in the EA. BR:1 saw a clear traceability between IT and business, in the recent project and how these two areas was related to one another. Another business representative (BR:6) thinks that the traceability between business and IT is not currently that clear, but will be in the future. One architect believes there are too many advanced models to clearly see the traceability (ARC:4). Two business representatives (BR:5 & BR:3) think that the traceability between business and IT will be clear if more modelling and development is done. Another business representative believes business people will not ever understand the connection if they are not trained in EA.

Tools and Methodology: Three of the architects (ARC:1, ARC:2 & ARC:3) states that methods for developing and maintaining EA are structured and well documented even though some work on these methods are to be conducted. Two architects (ARC:1 & ARC:2) thinks that GEAR, is a good tool that supports functionality such as modelling, decision processes

and communication between stakeholders. One architect believes that GEAR lacks usability, for architects and especially for non-architects; *“They (non-architects) shouldn’t be using the tool”* (ARC:3). ARC:4 also have some issues with finding the way around in the tool due to its complex structure and high amount of details. ARC:4 also experienced errors when trying to create a GAP analysis in GEAR. When it comes to the GEAR usage of non-architects or business representatives, the usability is highlighted as far too complex. One architect (ARC:4) does not believe decision makers can use GEAR for decisions, since it is too complex for them to use. Another architect (ARC:3) do not believe business representatives should use GEAR because of lacking knowledge of EA and states that models and artefacts instead should be published at a website. BR:5 thinks it requires a certain amount of IT knowledge that many business users do not have and is afraid that the administration in combination with the complexity can be a bad combination: *“The danger I see if we are not careful it can just become an admin monster.”* (BR:5). BR:5 states that GEAR lacks to much content to be useful. One business representative (BR:2), thinks the tool provides good functionality but is not sure if it can be used for decision processes. BR:2 also lacks some knowledge in the tool but will try to learn more in the next project where GEAR will be used. Another business representative (BR:3) thinks the functionality is good but is afraid that the tool only will be used by architects due to that a large number of business-representatives not being aware of the tool or lacks essential knowledge in how to use it. Another business representative (BR:4) believes that the tool is too hard for business representatives to use and that a better usability and a clearer structure in combination with a better graphical interface is required if those people should use it. BR: 4 is worried that no one will maintain GEAR after the development is done: *“...Who will handle it after the projects are finished? Based on what I know, no IT system owner has been assigned the instruction to maintain GEAR. How will we make it survive so it is not becoming a one-time off?”* (BR: 4). BR:4 also thinks the tool is lacking to much content to be of use but uses the material in GEAR that is presented on SharePoint. The last business representative (BR:1) thinks the tool is way too complex for ordinary business users, *“its models can be compared to blueprints of nuclear weapons”* and *“if you let them loose in ARIS it can go down the drain”* (BR:1). BR:1 also says that the business is not that eager to get access to GEAR. SKF’s CIO expresses, according to our interpretation, a similar view and argues for an easier material: *“We need to do a lot more when it comes to that (understanding). This developed GEAR, that's good, but it needs an additional dimension. I usually say as follows: "If I cannot explain this to my grandmother, then it's not clear enough" (CIO).*

2. EA Governance

EA Governance and management: Regarding the established structure for EAM, the architects state that the governance process is currently being developed, and soon is completed. However, there are some parts missing. Two architects state that the architecture change process still is unclear. Regarding the formal power of EA in the organization, one architect states that the architecture team is not always able to overrun the decisions of the business and exemplifies the following: *“In this project I am doing, building a confederation database and there we decided to use terminology, as it was used in GEAR. The issue then, as*

soon as we went out to users to communicate it, it turned out that the user community had used 20 years to accomplish specific kind of terminology, and it (GEAR) was ignored” (ARC:4). However, ARC:4 also states that “GEAR itself, is one of the strongest governances I ever seen in any IT context” (ARC:4). One architect (ARC:3) says that EA have certain power within the organization but it is a question whether it is strong or not. In addition, there has been situations where the business has done as they pleased without collaborating with the EA team. Business representative (BR:2) argues that the organization needs to be stricter in getting the business to stick to the EA rules and guidelines, which also have a relation to the formal power of EA in the organization.

Two architects (ARC:2 & ARC:4) state that the organizational position of the EA function is strategically positioned in order to have enough impact. “We work closely to Group IT and should therefore have the possibility to have a high-level impact on the organization” (ARC:2). One architect (ARC:1) does not think the EA function is strategically positioned because the respondent does not feel that the EA team always reaches the business. ARC:1 says this might have got to do with the position of the EA team. Another architect (ARC:3) believes that EA should be positioned between the IT and the business functions and argues that in the new organization, a governance structure where EA is involved in the decisional organs should be established. Currently, the EA aspect comes in late in the project lifecycle when the business or business consultants, have taken decisions without EA in mind, this can be problematic.

An architectural board exist in the organization, in the form of ITAC. Decisions regarding the SKF EA framework, GAF, has been discussed in the board. However, two business representatives do not think its board meetings are frequent and no one have asked them, personally, what they think of the EA initiative in the organization (BR:6 & BR:4). One architect (ARC:2) and one business representative (BR:1) mentions that certain architectural decisions should go through the board of ITAC and also do so. One business representative (BR:5) have not heard of any “EA board” and another business representative (BR:3) states that the board have left the decisions, regarding the respondent’s part of SKF in the hands of the respondent and the respondent’s colleagues. BR:3 also states “I don’t see any hard line between architects at SKF”.

EA Project Management: Two out of four architects (ARC:2 & ARC:4) consider EA to be involved in projects within Unite. Both architect (ARC:1) and (ARC:3) do not believe the projects are considering EA aspects. Four out of seven business representatives express that EA, to some degree, is involved in projects. According to two of the business representatives, EA are default aspect because of how it has a natural part in their daily work. For one of them, the EA artefacts are used in the ongoing mission to capture the Enterprise Architecture (BR:6). For the other one, which is working with design of databases, the EA are important in order to create the design, the process data and the reports. It is, according to the respondent (BR:2), a responsibility for them to work with EA in order to create the architecture as well as keep themselves updated to the architecture. It is also mentioned by one of the business representatives (BR:5) that EA is a part of the projects because the lack of EA is considered

as a problem. EA is therefore an investment which will help in the future. In addition, the need of EA is said to be an own initiative. It is mentioned by all business representative that EA is not mandatory, which according to one of the business representatives (BR:5) might be a problem. *“If a need is not recognized for EA in the projects, it will not be used. (BR:5)”*

One view, which is common in the empirical material, is how GEAR lacks content to fit the projects entirely and enough. This view, that the EA material is not considered to be completely finished, is shared by all respondents. For instance, one of the architects (ARC:4) express there are a lot of project not yet documented in GEAR. This is mentioned by another architect which adds that the documentation in GEAR in addition become less prioritized when the business is in a rush or heavily loaded in their projects (ARC:2). As a consequence, documentation is created in several ways, based on goodwill. This is said by one of the representatives: *“Right now, without a standardized method, everyone does what they want to do with Excel, PowerPoint and Visio, and everyone documents for themselves, in their own way. And the processes are repeatedly documented for different purposes”* (BR:3). Because of the unsatisfied documentation, quality and completeness, all business representatives express the issue of people doing things in their own way.

Three out of four architects express that it exists EA quality gates for projects (ARC:2, ARC:3 & ARC:4). It is mentioned by them all that in order for project to be accepted there are gates projects need to pass in ITAC, PMO and reviews. There are, expressed by one of the architects (ARC:3), quality gates in the beginning and in the end of the project. However, in between that, there are none. The general view for all architects is that the quality gates not works that great with the current effort. It is said by one of the architects (ARC:4) that the quality gates have become less strict and situational in order to support the business. It is visible that the business representative many times do not need to follow any quality gates. Three out of five business representatives express that they do not have to follow any EA quality gates. It is a general perception that project receive good support from EA expertise in the EA team. All business representatives express that they are aware the available support from the EA team. One business representative express that they received support and feedback of what they have done (BR:1). Another representative express that they have not yet started with EA but will ask for help in the future (BR:3).

Two of the architects (ARC:2 & ARC:4) believe that projects teams are aware and understand the concept of EA. This is said by one of the architects: *“EA have been around for quite a while in SKF. It has never been that consequently driven like now, what has been done with the EA team the last three years, it has been driven that strong, the awareness is quite high”* (ARC:4). One of the architects clearly express the lack of understanding of EA in the projects and is therefore skeptical: *“No, not enough, we are just in the beginning of rollout now, there is not enough understanding in the projects. It is quite natural”* (ARC:3). Three of the business representatives see a huge challenge with EA within project because of its complexity. This is said by one of them: *“It is completely complicated to use this, and because of that one might pull out. And that's probably not unusual. For example, on a project we started, one person made an effort and worked with the new methods, together*

with the architects. But, according to him, it was too complex and he found it difficult to know what was required of him. So, he gave up” (BR:3). Another business representative (BR:1) state that it is common that project leaders normally do not know about EA and therefore it is hard to get input.

Rules and EA process: All architects state that there are established EA rules and standards but some of them are not sure if these are clearly formulated to the rest of the organization. The architects believe that project teams, to some degree, are aware of the EA rules and standards. However, one architect (ARC:3) states that the organization is in the beginning of the new EAF and methodology, so it is natural that the awareness in project teams is quite low. Two of seven (BR:2 & BR:6) business representatives are aware of EA rules and standards within their functions of the organization. Three business representatives (BR:1, BR:3 & 4) are not aware of any EA rules and standards. One business representative (BR:1) speculates in if the IT architects, or the solution architects who are assigned to business projects, could be aware of these. BR:6 states that they cannot skip any EA rules and standards: *“No we can’t skip them, we need to follow them. In the higher-level approach to the process, we follow them, okay”* (BR:6). Two business representatives (BR:1 & BR:2) states that, in their recent projects, they have been trying to stick to the EA rules and standards, however they both waived those to some degree due to complexity reasons and time pressure. One business representative (BR:3) have not heard about any EA rules and standards but believes that they may be on their way. BR:3 does not feel any pressure of, for example, modelling in a certain way and does not feel any pressure of having an EA awareness or of using GEAR as a tool. *“If we not have had any interest in it (EA), I believe we could have skipped it totally (BR:3)”*. BR:3 does not believe that many employees are sticking to the EA rules and standards. *“People who presents their projects and solutions in ITAC are all doing it in their own way. “There are no rules regarding modelling, connections or dependencies to other artefacts. People are very much doing it in the way they please. That makes it very hard for me to take decisions or even to understand”* (BR:3). Three other business representatives (BR:1, BR:2 & BR: 6) believes that the EA rules and standards are not followed strict enough and two of them argues for more control of EA rules and standards. Two architects (ARC:1 & ARC:2) also believe that the EA team have not been strict enough in getting people to comply with the EA rules and standards and a third architect (ARC:3) says that the EA rules and standards are not always being followed. One architect (ARC:4) believes that the standards may be too complex for people to understand. Two respondents (BR:3 & BR:7) believe there lies a challenge in keeping up with EA rules and standards for new technology that are already being used in the organization, such as *Internet of things*.

EA Planning: One architect (ARC:1) and one business representative (BR:2) state that there have been goals and project milestones for developing GEAR and its documentation. However, there do not seem to be any formulated goals of increasing EA awareness or getting GEAR implemented and used throughout the organization. No one of the architects had heard about such goals. No respondent had heard about a change management plan in association with the EA effort, however two architects (ARC:2 and ARC:4) state that there

are different kinds of architectural plans. For instance, one of them expresses: “*There are something you call current mode of operations, CMO and intermediate mode of operation, IMO, which represents an in between position, then there are FMO, Future mode of operation*” (ARC:2).

Assessments and Evaluation: Two out of four architects express that assessments and evaluation have been measured quite well when it comes to Unite. Two architects explain that they have not heard about any measurements, at least not that clearly formulated. One of the architects (ARC:4) explain that the measurement in some areas have the “yes-or-no-character”. Four of the business representatives have in different forms been exposed to assessments and evaluation. Above all, in relation to feedback to GEAR and its guidelines. Three of the business representatives explain that have not experienced any formal assessments and evaluations.

3. Communication

Communication: The success factor of communication stands out from the result due to the large amount of negative observations. Regarding the communication between the architects and the business, this skeptical view is evident. Only one of four interviewed architects stated that the communication between the architects and the business is good. In general, the result also shows that the communication is not proactive and frequent. One architect (ARC:1) thinks it hard to reach the business and to have a major impact in their way of working. ARC:1 says that GEAR, for a long time, has been in a project phase but now is entering a maintenance phase. ARC:1 is not sure about if this have been communicated enough. Another architect (ARC:2) is afraid that the business is not reached by the EA communication and the communication about GEAR, even if the architect says that this is acknowledged. ARC: 2 also believes that the communication regarding EA and GEAR is proactive. None of the four architects are in regular contact with the business, instead the contact is managed through SKF IT which then meets the business in projects. The architect's state that their managers, within architecture, might have a better picture and a more positive view on the communications with the business. In contrast, one of the architects (ARC:3) has hard to see that there are very much communication between their managers and the business. ARC:3 also believes the communication is very internal within the EA team. Another architect (ARC:4) have a slightly more positive view of the communication and states that an architect often is involved in business projects which highlighting the aspect of architecture within the projects, however it depends on the project and sometimes architectural decisions can be overruled if there is a cost or time pressure. It also depends on the project members knowledge and interest in architecture. “*I think there is a really good cooperation where people are mature enough to understand there is really having a positive impact.*” However, ARC:4 also have seen worse examples: “*I heard feedback like, “after five minutes I was out basically”. Therefore, I believe there is an issue, that people must have an easier understanding on what is in there... (ARC:4)*” ARC:4 also believes architectural communication is there but is not given enough attention due to other things that going on the

same time. Another architect (ARC:3) also states that: *“There is a good communication between different projects and different persons at certain times, so to say...”* (ARC:3).

When it comes to the business representatives, the view of the communication is mixed. One business representative (BR:2) thinks they have had good communication with the architects and enough support from them. Another (BR:3) believes that it is just a coincidence in combination with geographical location and personal interest that BR:3 and BR:3's colleagues have heard about EA and GEAR at SKF and states: *“There are probably a lot of people that are not that well informed, we have 140 factories and suppliers”* (BR:3). The information BR:3 has received regarding EA and GEAR have been limited to the Architecture Handbook and infrequent informal meetings. Another business representative (BR:4) thinks the communication is poor, infrequent and does not feel addressed. BR:4 believes that there are a lot of work to do if the organization is going to embrace EA and GEAR: *“Just to say the word Group Enterprise Architecture Repository (GEAR), already there you have lost half of the business (interest), what the heck are you talking about?”* (BR:4). The business representative (BR:4) believes that if GEAR would reach the business, it would require a simplified presentation, better marketing, better communication and the action of getting the business to understand the values and purpose of GEAR and EA. The next business representative (BR:1) share the view of bad communication: *“We have a pretty long way to establish this (EA & GEAR) in the business. I think it can be done in a couple of different ways, in some way I think it should be integrated in the existing processes.”*. BR:1 also states: *“If I had not been interested in EA and not a part of the Yammer channel, I wonder if I had got any information about this (GEAR) at all”* (BR:1) and *“I cannot remember that I, as a SKF project leader, have received any mail or meeting invitation”* (BR:1). The last business representative (BR:6) believes that *“communication is one of the biggest downfalls with SKF IT. Both internally and also with the business”*. BR:6 have colleagues that BR:6 believes should have gotten information about EA and GEAR but the respondent does not think they have. BR:6 also thinks that a lot of the communication is not followed up: *“Even if somebody announce something, that's it, it is just an announcement. It has no real follow-up, there is no real further enhancement of the message”* (BR:6). BR:5 have gotten very little information, as a project manager, about GEAR and BR:5 would not call this information frequent and proactive.

No communication plan for architectural communication exist, according to the respondents. One architect states that there is information on the intranet, training and conferences. Various communication channels are used such as Intranet, SharePoint, newsletters, physical meetings, presentations and training. There is also a channel on Microsoft Yammer (Yammer), where different stakeholders can communicate and view information. However, Yammer seems to only be used by people having an interest in Enterprise architecture, whether it is personal or a part of their job. No one, neither architects nor business representatives, could say that the timing of the architectural communication is planned or formally considered.

4. Stakeholder commitment and skills

Commitment and stakeholder participation: Three out of four architects express they have experienced high commitment from other stakeholders (ARC:1, ARC:2 & ARC:4). One of the architects (ARC:2) explain that EA have made a step in the right direction of becoming accepted. All business representatives express that they have faith in EA and are supporters of it. One of the respondents expressed that when the “line organization” first had to adapt to EA and GEAR, they were confused because they did not understand the artefacts, the models and the guidelines. Now, most of them are positive and have found out there lies value within it. Another business representative (BR:3) express that BR:3 see the value but the time is not enough, especially when the manager does not prioritize the use.

Despite the fact that a majority of the architect express commitment from other stakeholders they have all experienced challenges. According to one of the architects (ARC:1), not all teams in Unite have yet understood EA and in the business, it is believed to be even less understanding. Two other architects (ARC:2 & ARC:3) express that one major challenge is to keep the EA and GEAR updated and maintained. This is also recognized by the business representatives. One representative from the business-side express that there has been a struggle in getting people in the business to apply for access to GEAR, *“They prefer we do it for them”* (BR:1). BR:1 compare the use of GEAR with nuclear drawings: *“They cannot use the tool, they cannot model, it feels strange, compare it sometimes with nuclear drawings, it's a little too advanced, but they can take ownership of the models...”* (BR:4).

All architects state that they feel commitments from managers. One architect expresses that: *“There has been a lot of money invested in this, within Unite and parts of the management are sure of this”* (ARC:3). One of the business representatives argues that the commitment is a double-directed-responsibility, meaning that there should be strict goals which also people consuming the EA have to follow. One of the architects wonders if managers really know what a commitment like that would imply: *“I'm not sure about that. To join architects and architects in all our 150 projects and just document everything and we will work in a special way, it will take power from the organization - if you want to do it in a good way”* (ARC:3).

Two out of four architects (ARC:1 & ARC:4) express that they think that stakeholders are involved in the EA implementation. There are only one of the business representatives (BR:1) that state to be involved. Two architects (ARC:1 & ARC:3) state that stakeholders are not involved in the implementation. One of the business representatives state that because of the poor content in GEAR, it is not worth to use and therefore the commitment is low.

Training and Education: According to two out of four architects (ARC:2 & ARC:4) it exists curriculum for training and education for those who will perform modelling. Two of the architects (ARC:1 & ARC:3) express that they have not heard about any training for non-EA employees. One of the architects express that there are different packages depending on who that will work with the modeling. Another architect express that the existing training has an ad-hoc character: *“You can sign up for an education but we do not know when it's going or if it's going. If enough education means that we should take all architects and train them in these steps, it will be very many hours of education. There is no push, it will be just pull in*

that case, for those who want to” (ARC:3). Three out of the business representatives express that they have been exposed to training in EA and GEAR. The training has, according to them all, not been specific to their roles but they believe that the training they received was enough. The training was given in the beginning of Unite program and for GEAR. Two of the business representatives express that they cannot remember any training (BR:3 & BR:6)

One of the architect express that it exists a training plan, in form of E-learning and teacher-based training (ARC:2). Another architect does not believe it exist any training plan at all (ARC:3). The rest of the architects have not mentioned any training plan and the existence of this do not seem to be general knowledge. There are various answers on the question if EA team members are continuously trained and educated in EA. This might depend on the fact that several of interviewed architects are consultants and therefore receive their personal training from their own employee: *“It is different for different people, it looks different for training at the various consultancy companies. It is Individual for Consultants”* (ARC:2).

5. EA Pressure

Economic pressure: All business representatives recognize the need for EA, some are more positive than others reaching from *there is a need to EA is absolutely the right way*: *“yes, if it (EA) is used as a tool for strategic decisions.”* (BR3). One business representative (BR:4) clearly recognize the need but states that EA must be marketed in another way than GEAR currently is marketed, if the business are going to recognize this need. BR:1 believes more people are going to recognize the need of EA in the future when current SAP, master data, information and process initiatives have come a longer way. One business representative (BR:6) recognize the need for *“tightening up the way in which we do things”*. It is at the same time mentioned that the issue of communication and *“bringing people”* together needs to be dealt with first. Most of the business representatives are lifting the issue that increased control of *getting* employees to adhere to the EA rules and standards is needed, if the EA effort is going to succeed. As it is today, most of the respondents do not feel any pressure of working with GEAR and EA. Quotes such as: *“What might be improved is the sense of emergency of the topic, recognize the area”* (ARC:4), *“No one is pushing, we are free to do however we please”* (BR:3) and *“I’ve heard of it (GEAR) but I haven’t looked it up and no one has really told me that I have to understand what it is”* (BR:6) clearly represents this. According to the respondents, there are a dedicated EA budget but they are afraid this budget is being cut. The respondents do not think that projects should pay for the EA work, that might stop them from recognizing EA and make them neglect it. In any way, this is even more risky in the current situation of many projects not understanding the value of EA. Some respondents say it might be financed by the projects in the future, when the architecture and its content is more mature and people have a better understanding of its purposes and values.

6. Organizational culture

Organizational culture: Two respondents believe that the general attitude towards change within organization is not very good. However, the architects and the business representatives believe that many people want to adapt to EA. One business representative believes that

business units does not have enough time and budget to make enough commitments towards EA. The adoption is often supported by early adopters and supporters of EA and GEAR. However, people need to be aware of GEAR and EA if they are going to be positive, one business representative says. One business representative (BR:1) believes that the willingness of change is higher within SKF IT, because of tradition. Again, the business does not feel any pressure to adhere to EA rules and standards and seems many times not to be aware of requirements and gates within projects. One business representative thinks there are a worry that EA and GEAR would require too much administration and costs. Again, business representatives believe there are many people who does not know about GEAR and EA.

One architect (ARC:2) and one business representative (BR:1) highlights that the organization and the EA team are close to a critical point where the enterprise architects are passing forward GEAR to be maintained and used by the business. *“When we are passing this on, I was leading it – I think it is good that we use the developed models - but then the question was: Why should we do that? That seems like a lot of work. Will the rest of SKF do that? They asked me that question.”* (BR:1). The architect states the importance of the pass through of GEAR to the business and the importance of that GEAR will be well received and maintained.

Five respondents believe that EA is not very visible outside the EA department. Although one architect thinks it much more visible than three years ago. One business representative (BR:2) thinks the visibility has been varied, more in certain periods and less in some. One of the architects (ARC:4) highlights the importance of change management and that change management must be conducted right in combination with the EA effort. The respondent believes more aspects need to be considered: *“I’m not talking about IT change, I am talking about cultural change - change management in the projects. If we are doing it right, a number of people will be working differently then we have been doing so far”* (ARC:4). Two business representatives (BR:4 & BR:6) believe that IT and EA aspects within business projects often are down prioritized. For instance, one of them argues: *“Quite often, they build a business case within in the business. There would be various elements to that and one of those elements would be it, they would just put a number on IT without soaking it up!”* (BR:6).

Three out of four architects (ARC:2, ARC:3 & ARC:4) have tried and are trying to spread the concept of EA to the rest of the business, at least within the project they are working in. One of the architects explains: *“As part of projects and in this project, I try to introduce the architecture through my own work. How I document and what tools I work with in the projects but also in the first meeting with a sponsor if I am involved early, trying to explain how the work should be conducted”* (ARC:4). The architect explains that that they have not spread the message enough and that one should have communicated it to other stakeholders more than they do today. When it comes to the business representatives, three out of five that state they are actively spreading the concept to other colleges. However, it is mentioned by one of them that the response is not always positive: *“Yes, I have said that we should use this (laughter) and not everyone has seen the value”* (BR:1). Another business representative

(BR:6) explains that the respondent works with spreading awareness of the respondent processes and that makes it a part of EA. The respondent (BR:3) states that the concept is hard to spread at all because other employees do not understand the meaning of EA.

One of the architects (BR:4) explains that the view on IT and the EA department is changing in the right direction and people have started to recognize it will help them. However, the general view is that one would like to see it as an enabler but it has more a support or cost-center appearance. According to two of the business representatives, the IT and the EA department are viewed as support-functions. According to one of the representatives (BR:4) the IT and EA department is not viewed as an enabler because of the slow processes. *“How does this work? How do the data streams look? Who uses this data? Where is it born? Etcetera. If we have it in GEAR where we can say "give me 10 minutes" then you have the whole picture and you will do it in a sitting session. Instead of "give me six months and I will give you a complete mapping out of this". Ah, then they would have seen it as an enabler”* (BR:4).