From guess to success

-How to govern service-oriented architectures

ELIN LUNDBJIST
GUSTAV PERSSON

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Department of Business Administration

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Mentor: Jukka Hohenthal
Authors remark

The project was initiated in January 2015 and finished in June the same year, in close collaboration with Scania. Without the commitment from Scania, it would have been impossible to execute the thesis. We would like to show a special gratitude to our mentors at Scania, Staffan Vildelin and Nils Zetterlund. Without your hospitality, guidance and dedication, this thesis would have been an impossible mission. We would also like to thank the entire SOA centre at Scania, as well as all the respondents that participated in the study, for welcoming us into your environment, and making us feel as a part of the organisation. We would like to thank our mentor at Uppsala University, Jukka Hohenthal, as well as our co-mentor Cecilia Gullberg, for your guidance during seminars. Finally, we would like to thank our fellow students in our seminar group at Uppsala University, who provided us with invaluable input and feedback that allowed us to write a thesis we are proud to have performed.
Abstract

Service-oriented architecture (SOA) governance has been identified as the most important factor affecting the outcome of SOA within organisations. However, authors have failed to explain how organisations should govern specific aspects of its SOA, leaving a gap in the literature. Therefore, the purpose of this study was to investigate established SOA governance mechanisms in order to explain implications of governance in a SOA context. The research question of the study was to identify which SOA governance mechanisms do or do not provide support for different constituents of SOA. The study also contained three sub-questions; (i) Is there a difference between how SOA governance mechanisms support technical vs. non technical constituents of SOA? (ii) Is there any SOA governance mechanism that is more important than others? (iii) Is there a relation between the SOA governance mechanisms?

The study was conducted using theories related to SOA and SOA governance. We identified the most academically accepted SOA governance mechanisms to test their support for different constituents of SOA. To get an holistic view of SOA, we used a SOA maturity framework to identify what the constituents of SOA really are. The support of the SOA governance mechanisms were then studied in relation to the different constituents of SOA, through interviews and observations, during a ten week internship at Scania.

The results showed that as good as every SOA governance mechanism supports the constituents of SOA, although the level of support varied. In general, we found patterns separating the support for technological and non-technological constituents of SOA. The technological constituents of SOA were to a great extent provided the same support from SOA governance mechanisms, which also was true for the non-technological constituents of SOA. Interestingly, except for one SOA governance mechanism, the technological constituents of SOA and the non-technological obtained different levels of support from governance. The most important SOA governance mechanisms are the creation of standards and policies, having processes to create and enforce policies, processes for education, and establishing SOA skills and training. We can also conclude that there is a relationship between many of the SOA governance mechanisms, and that academics and practitioners therefore have to view SOA governance holistically, rather than independent governance mechanisms.

Key words: Service-oriented architecture, SOA, SOA governance, SOA governance mechanisms.
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1. Introduction

This chapter provides an introduction to the thesis by presenting the background to the project, the studied company and the purpose. The chapter ends with an outline about what the thesis will include.

1.1 Background

According to Nolan (2000), information has drastically changed from the 1960 inauguration of the computer. At first, the processing of information was centralised and could thus be controlled by an IT department. The development of IT systems has led to more decentralised information management, and in turn information technology has become an increasingly valuable vehicle for organisations to enhance performance and generate competitive advantages. (Nolan, 2000) Zuboff (1988) argues that in an increasingly dynamic and global business environment, IT forms a critical component of improving business agility. Therefore, organisations are trying to become more flexible and responsive to changing business conditions. In line with Zuboff (1988), Szyperski (2002) argues that the traditional centralised IT-control inhibits adaption to environmental changes, hence also the agility of the business, and today IT has to support that users want to be able to access information instantaneously. Choi et al. (2010) argues that it is quite difficult, expensive, and time consuming to make changes in response to changing business conditions with traditional architecture of IT. Consequently, traditional solutions are no longer feasible in the long run as they cannot address the customers needs adequately (Szyperski, 2002).

Businesses are finding themselves in a situation where they are facing pressure to reduce their IT-related costs while still increasing operational efficiency, customer responsiveness and adaptability (De Leusse et al., 2009). As a result, many organizations are adapting to the environment and are moving towards a service-oriented architecture (SOA). In 2010, SOA represented a total global market value of $5.518 billion, up from $3.987 billion, which is a 38% growth (Nadhan, 2012). Further, service-oriented architecture framework and software revenues grew 24% over original projections in the year 2011 (McKendrick, 2012). Consequently, more and more companies have started to implement SOA. A SOA is architectural technique that involves the interaction between loosely coupled services that function independently, whereas a service is a function or a collection of functions that an application performs. The basic idea of
SOA is about cleaning the existing IT architectures by addressing most of the major systems as services, and abstracting those services into a single domain where they are formed into solutions. (Erl, 2004; Szyperski, 2002) A SOA strives to reuse the functionality of existing systems rather than building them from scratch, release services and make them available throughout the organisation (Channabasavaiah et al., 2003). A common benefit of a SOA is that it creates value from existing systems, making legacy systems an asset rather than an obstacle. With SOA, organisations can achieve increased reuse of IT assets, enhanced flexibility, reduced integration expenses, and gain greater business agility. Consequently, SOA can facilitate the adaptation to the dynamic environment, and it can be seen as a tool to align business strategy and the IT strategy and architecture (Bieberstein et al., 2005).

Creating and implementing a SOA is nothing that can be done in an instant, as it requires meticulous planning and execution. SOA has to grow incrementally, and the process has to be governed (Vegeter, 2009). Joachim et al. (2013), Biske (2008) and Marks (2008) name the lack of SOA governance as the main reason to why SOA projects fail. SOA governance is about managing organisational dependencies, and focuses on that everyone throughout the organisation is working together and that separate efforts are not working against each other (Vegeter, 2009). SOA governance is also about guiding who makes decisions and ensuring decisions are consistent across the organisation as a whole (Joukhadar & Rabhi, 2014; Ott et al., 2010). This implicates that governance is a very important aspect to consider when working with SOA. SOA differs from previous technologies, and when organisations treat the implementation of SOA like any other technological implementation, benefits from flexibility, reuse and reduced costs are not achieved (Biske, 2008; Marks, 2008; Vegter, 2009).

1.2 Problematisation

In theory, SOA carries tremendous potential for organisations who are willing to adapt to service-orientation. Of course, when something has the potential to increase efficiency while reducing costs, it is most likely complicated to achieve. Governance is often mentioned as a critical factor in the success of SOA in any enterprise (Vegeter, 2009). However, the literature on the topic is scarce and standardised governance models have yet to be adopted. Authors have failed to explain how organisations should govern specific aspects of its SOA, leaving a gap in the literature. This gap has left academics and practitioners with a blank paged treasure map;
they know that SOA has to be governed, but they do not really know how it should be done or where it is necessary.

Today, organisations know what constituents are important for successful SOA. Successful SOA needs to be enterprise wide, and therefore constituents of the business, organisation, method, application, information, architecture, and infrastructure are essential (The Open Group, 2009). Supposing organisations knew if and importantly how different constituents of its SOA can be governed, they would be aided significantly in reducing the complexity that SOA brings. For example, policies are often mentioned as crucial when it comes to SOA. But with the enterprise-wide scope of SOA, there are differences in opinions on where policies are important. Policies might support the business, SOA architects, project leaders, developers or the enterprise architects in different ways. They may be crucial in many aspects of SOA, but probably not all, because some processes require more flexibility in order not to be inhibited by rules and structure. (Joachim et al., 2010)

With the knowledge that more and more organisations are transforming into a SOA, and there is a gap on what SOA governance is and how it can actually be used to support organisations, it is interesting to investigate established SOA governance mechanisms in a large organisation. For example, knowing where or where not to impose and enforce strict policies, or other governance mechanisms, can save organisations both headaches and money. Therefore this study will examine all constituents of a SOA from a SOA governance perspective, in order to address these issues and in the end find out if or how SOA governance mechanisms can support the different constituents of SOA. Before concretising the purpose and research question of the study, a short explanation of the research objective Scania will be provided.

1.3 Scania
Scania is a global company that operates in approximately 100 countries and employs more than 35,000 employees. They are a leading manufacturer of heavy trucks, buses and industrial and marine engines. Furthermore, the company provides and sells a wide range of service-related products and financial services. Scania has its headquarter, production and several sales and service points in Sweden. The business is mainly located in Södertälje.
The company’s operations rely on smart IT solutions. Therefore, the IT organisation, Scania IT, is an integral part of the company's core business. Scania IT is a part of the organisation and provides IT solutions for Scania as a whole. Their main task is to develop systems for both products and the business, and also to manage administrative systems and ensure their operation. The goal is to remain at the forefront and offer a high level of service to streamline Scania's operations globally. Most of Scania's IT functions are clustered in Södertälje, where the global responsibility for the development, operation and support lies. Scania IT employs approximately 1200 people.

The IT operations at Scania is currently in the midst of a period of transition. Scania develops their methodologies continuously using SOA, and have new strategic platforms for the future. At a general level, Scania's offer to the customers tends to go from products to complete solutions. This means Scania does not deliver a truck, a bus or a motor without a solution where a smart service structure, financing and other services are important components. For example, this may involve providing vehicle data about the drivers' driving style and vehicle fuel consumption, to give a picture of the vehicle's overall economy. To meet these demands, Scania IT is continuously developing. They have established a SOA function that has worked with implementing SOA, in order to improve reusability, the customer service-level, enhance flexibility and reduce IT-related costs.

1.3.1 The implementation of SOA and the thesis contribution to Scania

In order to improve the above mentioned factors, Scania IT has worked with implementing SOA since 2005. Without SOA, Scania had a value stream mapping that gave them a lead-time to get data from one application to another application of over eight months (from business need to implemented). The hours spent were approximately around 400 hours, where most of the time was spent on cross-functional planning and coordination. With SOA, the needed information is available to use in a service, cross-functional planning and coordination is reduced and the lead-time is reduced to two months, with less than 100 hours spent. Therefore, the business drivers and general requirements on SOA is quicker time to market, enhanced flexibility, and reduced lowered through reuse and higher efficiency. The long-term goal is a desired state where the organisation naturally applies SOA principles and services in the daily delivery of IT.
Today, ten years after the start of the implementation, Scania has approximately 40 services in operation, and the SOA is incrementally being established within the company. The most widely used service is used by 18 consumers, and is creating great value for the company. However, to reach the goals set at the start of the project, the implementation needs to be assessed. The assessment is made to provide guidance related to steering of the SOA-function. The width of SOA and the complexity that comes with an implementation has resulted in limited SOA governance within the organisation.

1.4 Purpose and research question

The purpose of the study is to investigate established SOA governance mechanisms in a large organisation in order to explain implications of governance in a SOA context. By using Scania as a research object, we will get insight in a SOA-function that has been operating for over ten years. Hence, SOA has been present in the organisation for several years and therefore the consequences of governance/lack of governance will be graspable. We aim to identify what kind of steering is needed for the constituents of the SOA, and in which contexts governance have the greatest impact. An increased awareness will enable organisations to focus governance efforts on specific parts of the SOA and in the end help them to reach the benefits of SOA in an more efficient manner.

We believe we will be able to answer which SOA governance mechanisms do or do not provide support for different constituents of SOA? In this study, SOA governance relates to organisational structures, processes, and employees and relations within an organisation. The constituents of SOA in this case are business, organisation, method, application, architecture, information, and infrastructure. Both the SOA governance mechanisms and the constituents of SOA will be further elaborated in the theoretical part of the study. The main question is further broken down in three sub-questions, which will contribute in fulfilling the purpose in a greater extent. The first two sub-questions are focusing on whether the support from the governance differs or are equally important, while the third have the intention of highlighting potential relations between the governance mechanisms. (i) Is there a difference between how SOA governance mechanisms support technical vs. non-technical constituents of SOA? (ii) Is there any SOA governance mechanism that is more important than others? (iii) Is there a relation between the SOA governance mechanisms?
1.5 Outline

Theoretical background - The theoretical background presents the findings from the literature study. The chapter starts by introducing SOA, the importance of it, and its constituents. Following this concept, SOA governance mechanisms are presented. The chapter ends with a theoretical framework for presenting and analysing the empirical findings.

Methodology - The methodology presents the research approach and the research process. The research process explains how the thesis was carried out, choice of method, data collection, management of data, and method of analysis. The chapter ends with a discussion of the study's validity and reliability.

Empirical findings - This chapter presents the empirical findings from the case study of Scania. The empirical findings are structured according to the three governance mechanisms presented in the theoretical framework.

Analysis - This chapter presents an analysis of the empirical findings in relation to the theoretical framework. The analysis is based on different themes that arose when analysing the empirical data. The themes stem from the theoretical framework but have been adjusted accordingly the empirical data.

Conclusions - This chapter presents a concluding remark about the thesis, taking the research question and the purpose into account. The chapter will end with answering the research question as well as the sub questions.

Discussion - This chapter presents a discussion about the implications of the results, the limitations of the study, and proposal for future work.
2. Theoretical background

In this chapter we will present and explore previous research and theories regarding SOA and SOA governance, relevant to the purpose. The chapter ends by presenting the theoretical framework, which will be used to gather and analyse the empirical data.

2.1 Introduction to service-oriented architecture (SOA)

As mentioned in the previous chapter, SOA is architectural technique that involves the interaction between loosely coupled services that function independently, whereas a service can be combined to provide the functionality of a large software application (Erl, 2004; Szyperski, 2002). This goes in line with Maurizio et al. (2008) who defines SOA as an architectural style, whose goal is to achieve loose coupling among interacting software agents. The basic idea of SOA is about cleaning the existing architectures by addressing most of the major systems as services, and abstracting those services into a single domain where they are formed into solutions. SOA is a way to define and create an IT infrastructure that allow different applications to exchange data and contribute in business processes, irrespective of their operating systems or the programming languages of those applications. (Newcomer & Lomow, 2004) A SOA is mainly composed of a collection of services that communicates with each other. The term service is therefore a key concept, and can be described as a unit of work done by a service provider to achieve desired end results for a service consumer. Hence, a service is a function or a collection of functions that an application performs (Maurizio et al., 2008).

Figure 1. The figure illustrates the basics how SOA works. The consumer is an application that consumes the service, which invokes data sources based upon the task.
The figure illustrates how services can be used to clean the existing architecture, whereas the *service* contains a certain information and functionality. The service gathers information from other sources, such as customer relationship management systems, financial systems or supply chain management systems, illustrated as data in figure 1. The service uses the information and provides functionality to the service consumers, to perform a specific task. The service consumer, illustrated as *consumer*, is an application that uses the information and functionality provided by the service, which makes it possible to have multiple users using a service.

In traditional IT systems, the functions performed by a service are built into the system, statically. The problem with the traditional perspective is that it is difficult to reuse the functionality of existing systems, which often leads to different organisational units building new systems from scratch or purchase new ones. For example, every time you need new functionality or information into the system that you are using, you need to build a point-to-point integration retrieving the information or functionality. This in turn makes the architecture more fragmented, as new integrations are being built for each case. This problem can be overcome with SOA, as the same service can be used in multiple locations within an application, as described in figure 1. This means that the function can be coded once and then be reused where it is needed. (Maurizio et al., 2008) Instead of installing different software in different departments of a company, the same service can be reused by the departments that require that specific functionality, and be called upon as needed. Further, the functionality of services within a SOA is usually tailored to be aligned with the business processes of the firm.

Service-oriented architectures (SOA) brings huge potential benefits for organisations, as they by implementing a SOA can directly address challenges faced by ever changing business and IT environments (Erl, 2006). SOA can be regarded as a strategic weapon, as it increases the flexibility of an organisation due to shortening of development and deployment, reduces IT-related costs in the long run, and creates an agile enterprise where IT and the business can be aligned even in changing market conditions and business processes (Choi et al., 2010). In order to reap the potential benefits of a service-oriented architecture, enterprises need to make SOA as much of a priority for the business stakeholders as the IT department. This means that in order for a business to be agile and adaptive, the organisation must represent its core business
processes through flexible business models. SOA is a way for organisations to structure their organisation and operations in order to leverage capabilities, coordinate efforts to leverage IT profitability, and reduce complexity. Done properly, SOA creates a greater ability for the enterprise to monitor, react and adapt to opportunities and challenges. (Brown et al. 2008; Maurizio et al, 2008)

2.1.1 Constituents of SOA

With the purpose of investigating established SOA governance mechanisms in a large organisation, we felt the need to use a model that incorporates SOA as a whole, including all important aspects of it. There are tonnes of literature regarding how to guide an implementation (Choi et al., 2010) or critical success factors of SOA (Vegeter, 2009). However, the vast majority of the literature fails to explain what SOA in fact constitutes of. The only models that actually describe important aspects of SOA as a whole are maturity models that are used to assess SOA within an organisation. The majority of the academic maturity studies fail to clarify in detail different constituents of SOA, and focuses on different maturity levels. In our opinion, this limits their practical use. With that in mind, we have compared the academic literature with industry papers, to find a balance between academic ground and practical use. In table 1, we have compiled a mix of academic and industry papers in order to identify what constituents of SOA are suitable for this study.

<table>
<thead>
<tr>
<th>Authors (academic vs industry paper)</th>
<th>Constituents of SOA</th>
</tr>
</thead>
<tbody>
<tr>
<td>Arsanjani &amp; Holley, (2006) (academic &amp; industry paper)</td>
<td>Business, organisational, methods, process, application, information, infrastructure and management</td>
</tr>
<tr>
<td>Hirschheim et al., (2010) (academic paper)</td>
<td>View of SOA, benefits and metrics, business involvement, methodology, sourcing of services, governance</td>
</tr>
<tr>
<td>Lee et al., (2010) (academic paper)</td>
<td>Strategy, technological infrastructure, organisation/management, project management, and governance</td>
</tr>
</tbody>
</table>
As table 1 illustrates, the academic authors fail to provide a comprehensive view of SOA as spanning over the business and IT. As SOA is business driven but realised through IT, we believe a view of SOA constituting of both business and IT-aspects is needed in order to answer our research question. The models provided by the industry authors IBM, Open Group and Oracle, incorporates all aspects from the academic literature, but integrated into one single model. Therefore, we believe the industry models are to be useful for our academic purpose as they have obvious similarities to previous academic research. We have found The Open Group Service Integration Maturity Model (OSIMM) to be most suitable for this purpose as it provides a comprehensive yet detailed overview of the constituents of SOA. The model will act as a base for the constituents of SOA, and we will complement the information regarding its constituents with academic definitions and explanations.

The original purpose of OSIMM is to assess the current maturity state of SOA within an organisation, and does therefore include all the important aspects of SOA. The model is based upon seven dimensions; business view, organisation and governance, method, application, architecture, information, and infrastructure and management. In the model, governance is treated as any other factor of SOA. However, governance is the key to the success of SOA and is
concerning all aspects of it (Rosen et al., 2012; Biske, 2008; Marks, 2008; Vegter, 2009). Therefore, governance underlies all of the other dimensions. For example, there need to be governance of both method and architecture. Consequently, governance cannot be treated as a constituent among many since it has the potential to affect the entire outcome of a SOA implementation. With this in mind we will use the OSIMM constituents as a foundation of the study, but separating governance from the model in order to identify how governance do or do not support the other constituents of SOA. We will also name the business view constituent to *business* and the infrastructure and management constituent *infrastructure*, in order to simplify the flow of reading. In the following section, we will present the constituents of SOA, followed by SOA governance, which will be presented in 2.2.

**2.1.1.1 Business**

According to The Open Group (2009), one of the constituents of SOA is the business, which means the organisation's current business practices and stakeholders. This includes how business processes are designed, structured, implemented, documented and executed. This perspective also addresses the IT strategy, for example how the cost of IT capabilities are allocated across the organisation, and how well the IT capabilities support the flexibility of the business. In order to be flexible, Arsanjani and Holley (2006) argue that the business units must establish collaborative relationships with each other and IT stakeholders.

Abdi (2010) argues that the alignment of IT with a business strategy requires that the senior business management take a different approach towards IT, and devote certain amount of time trying to understand how IT is used in their business. Business and IT executives must have a mutual understanding, a shared vision, and incorporate their understanding to align IT and business missions, priorities, strategies and processes (Arsanjani & Holley, 2006; Hirschheim et al., 2010). This goes in line with Rosen et al. (2012) who argue that there must be a vision and a roadmap that is combined within processes that can support the organisation to implement SOA. It often takes a couple years before the benefits of SOA are visible and the services can be reused to enhance IT flexibility. Therefore, it is often a big challenge for IT to convince the business to think long term and focus on services rather than buying a solution of the shelf. This problem is often rooted in the enterprise wide change of mindset required to realise SOA. (Biske, 2008; Rosen et al., 2012)
2.1.1.2 Organisation

The Open Group (2009) argues that organisation is an important aspect of SOA, and this constituent is focused on the structure and designs of the organisation itself and the necessary measures of organisational effectiveness in the context of a SOA. Unlike the business constituent of SOA, organisation addresses the organisational structure, roles, relations, and the empowerment necessary to adopt a service oriented strategy. Also included is the availability of different skillsets, training and education within the organisation. Hence, the organisation constituent of SOA brings more focus to how to maintain an efficient organisation and the actions that can lead to that. Using SOA to align IT and business is a critical step to realise the benefits of SOA, and to be truly effective the SOA needs to be extended to transform organisational structures and behavioural practices throughout the organisation (Oracle 2013; Rathfelder & Groenda, 2008).

The organisational structure becomes vital when it comes to SOA, as organisations often find themselves assigning multiple roles to one employee, which results in confusion (Rosen et al., 2012). Instead, roles needs to be defined and agents need to be identified in order for SOA to perform optimally. Further, there must be an explicitly defined collaborative relationship between IT and the business units, to ensure realisation of the benefits associated with SOA. (Bieberstein et al., 2005) Therefore, the organisational structure, roles and responsibilities are important aspects to consider when implementing a service-oriented architecture. SOA requires cooperation among many functions within an organisation, and success would not be possible to attain without well-defined roles and responsibilities among the participants. (Rosen et al., 2012)

2.1.1.3 Method

In order to realise the benefits of SOA, organisations have to ensure that everyone involved in the process use service-oriented principles (Abdi, 2010; Rathfelder & Groenda, 2008). According to The Open Group (2009), one constituent of SOA is the use of consistent SOA specific methods. This constituent of SOA is focused on the methodologies and processes employed by the organisation and its employees when developing SOA. Method addresses the development lifecycle, such as the use of requirements and project management, design methodologies and design techniques and tools. The methodologies have to support the creation, development and use of services, and need to be shaped to the overall enterprise context,
business vision, and strategy. Establishing consistent methodologies to address arising challenges from SOA is highly important in order to continuously develop and implement services that can create organisational value. This means different stakeholders and groups have to cooperate and use the same well-defined methodologies, describing the important steps of different processes. (Lee et al., 2010; Rosen et al., 2012) For example, there are methods to develop architecture, applications etcetera. Hence, it spans over the other constituents as well. Due to its importance and since methods are essential to implement SOA, method is an independent constituent and is treated as a constituent of its own.

2.1.1.4 Application

Application in this context refers to the technological aspects of building services, and is therefore a major constituent of SOA. According to The Open Group (2009), application focuses on the application style, the structure of the application and its functionality. It also addresses the reusability, flexibility, and extensibility of the applications, which benefit from standardisation. This is regardless of whether several applications have been created to serve different lines of business with essentially the same functionality. Bieberstein et al. (2005) argues that it is critical to create consistency in the application development and in the technological aspects of SOA to ensure interoperability. In order to achieve efficient SOA deployments, the organisation has to enforce the consistency in both design, structure and functionality of applications. This can be done by having internal standards relating to applications, to provide a template for projects to create standardised, readily accessible and easily consumable services. (Lee et al., 2010; Bieberstein et al., 2005)

2.1.1.5 Architecture

According to The Open Group (2009), one of the constituents of SOA is architecture, which addresses the structure of the architecture. This includes topology, integration techniques, enterprise architecture decisions, experience in SOA implementations as well as related standards and policies. Hence, the architecture constituent of SOA is of technological character. Companies that implement SOA successfully have an understanding of not only how to use technology itself, but also how to use it as an asset in a business context. These companies have an architectural vision that describes the structure of applications in terms of a logical distribution of responsibility across organisational levels. The architecture describes how
services fit into that mix, what services are, how to build them, and how to use them. (Rosen et al., 2012)

Today, many organisations find themselves in a situation where different units have their own funding practices, which makes it hard to keep consistency regarding its architecture. In order to be successful with SOA, different business units have to coordinate their efforts to ensure architectural investments are consistent and promote reuse. This difficulty can often be augmented by projects having a strong position within the organisation. Therefore, organisations should focus on cross-functional promoting and sustaining of a coherent organisation wide architecture. (Bieberstein et al., 2005; Lee et al., 2010) This is often complex, and organisations often use a reference architecture; an architectural blueprint of a SOA, in order to maintain structural coherency throughout the company. The reference architecture specifies what technologies are being used and the relationship between them. (Vegeter, 2009; Rosen et al., 2012)

2.1.1.6 Information

According to The Open Group (2009), one of the constituents of SOA is information. This aspect is focused on how information is structured, and how information is modelled. Hence, it is of a technological nature. The information constituent of SOA addresses how to access information, which is often fragmented, stored in different organisational functions, systems and geographical locations. For SOA purposes, accessing information and making it useful throughout the organisation is highly important (Biberstein et al., 2005). This is often a challenging task, as the format, terminology and overall data characteristics differ between systems. Therefore, organisations often create business information models where they model important concepts within the organisation and try to establish the relationship among the concepts (Lee et al., 2010). Hence, consistency in the semantics and their definition are important aspects to consider. This can be problematic as the ownership of information often lies within the organisational function that has originally purchased the information system. This results in cross-organisational coordination efforts being required in order to sort out issues relating to information. (Lee et al., 2010; Rosen et al., 2012)
2.1.1.7 Infrastructure

Abdi (2010) considers SOA as a management tool, enabling alignment between business strategy and the enterprise architecture. According to The Open Group (2009), the last constituent of SOA is infrastructure, which focuses on the organisation’s infrastructure capabilities, service management, IT management and IT administration. It also addresses how services requirements are met and what types of integration platforms are provided. Hence, the infrastructure constituent of SOA is of technological character. However, the organisation's infrastructure may not be prepared for SOA, which can result in high costs. To support emerging technologies and new requirements, internal standards need to be constantly updated and governed. (Lee et al., 2010) In order to respond to changing business needs, the infrastructure needs to be flexible and manageable. Nevertheless, organisations often ignore the need to having an infrastructure that supports management of services until they have started implementing a SOA. (Bieberstein et al., 2005)

2.2 Introduction to SOA governance

SOA Governance is essential to the success of any service-oriented architecture (SOA) (Rosen et al., 2012; Biske, 2008; Marks, 2008; Vegter, 2009). It is important as organisations that implement a SOA will neither get the possible benefits from technology alone, nor will it align IT and business processes (Varadan et al., 2008, Marks, 2008; Vegter, 2009). Further, it is important to make a distinction between SOA governance and the closely related, yet different concept of IT governance. IT governance refers to specifying the decision rights and accountability within an organisation in order to encourage certain behaviour in the use of IT. An approach to IT governance has to answer what decisions have to be made in order to ensure effective use and management of IT, who will make these decisions and how the decisions be made and monitored within the organisation. (Weill & Ross, 2004; Ott et al., 2010).

The literature regarding IT and SOA governance is however inconsistent and entails conflicting claims regarding the role of SOA governance. Practitioners, such as IBM, view SOA governance as an extension of IT governance (Brown et al., 2008). In line with them, Joukhadar and Rabhi (2014) choses to treat SOA governance as an extension of IT, merging with the business operations. Their view of SOA governance as spanning over both IT and business is consistent with the view of SOA being a strategic tool to align IT with business objectives. Therefore, SOA
governance addresses how an organisation's decision rights, processes, policies and measures has to be changed and augmented for a successful adoption of SOA, that may span over organisational boundaries (Brown et al., 2006). In this thesis, SOA governance is considered as an evolution of IT governance bringing a tighter business involvement in supporting IT services and development.

2.2.1 SOA governance - definition and importance

SOA governance is gaining more and more attention in research (Joukhadar & Rabhi, 2014, Ott et al., 2010; Dodani, 2006) and many organisations and academics are trying to develop adequate governance mechanisms for service-oriented architectures (Joukhadar & Rabhi, 2014; Ott et al., 2010). In many aspects, SOA differs from previous technologies, and when organisations treat the implementation of a SOA like any other technological implementation, benefits of flexibility, reuse and reduced costs are not achieved. (Joukhadar & Rabhi, 2014) However, the implications of available SOA governance frameworks are yet to be empirically supported (Joukhadar & Rabhi, 2014), resulting in a knowledge gap for both academics as well as practitioners. Today, there is no generally accepted definition of SOA governance, but Ott et al. (2010) propose the following definition after building on the works of Dodani (2006) and Malinverno (2006).

“SOA governance focuses on the decisions across the entire service lifecycle to enable organisations to realise the benefits of SOA. It is an approach to exercising control and mitigating risk by establishing organisational structures, processes, policies and metrics suitable to ensure that the adoption, implementation, operation and evolution of a SOA is in line with the organisation’s strategies and objectives and complies with laws, regulations and best practices.”

(Ott et al., 2010 p.45)

The definition highlights the close relationship between SOA and IT governance. Further, it has many similarities to the generic IT governance model by De Haes and Van Grembergen (2009), which is also built upon three categories; structures, process and relational mechanisms. The definition provided above covers the same aspects as Marks (2008) and Biske (2008), who highlight the importance of processes, policies and people in order to manage SOA successfully. Although a lot of the literature regarding SOA governance lacks general acceptance, authors seem to agree that creating structures, assigning responsibilities, as well as creating and
enforcing policies, are at the centre of SOA governance (Ott et al., 2010, Marks, 2008; Biske; 2008; Joachim et al., 2013). It can be concluded that SOA governance is the means to an efficient SOA by establishing behavioural rules and guidelines of the organisation and employees, from architects and developers to service consumers, providers and even applications themselves (Marks, 2008; Varadan, 2008).

2.2.2 SOA governance mechanisms

All of the SOA governance mechanisms proposed below consist of different governance mechanisms important in governing SOA. In table 2, we have compiled a mix of works from both academic authors and industry papers, in order to identify what SOA governance mechanisms are suitable for this study.

<table>
<thead>
<tr>
<th>Authors (academic vs industry paper)</th>
<th>SOA governance mechanisms</th>
</tr>
</thead>
<tbody>
<tr>
<td>(academic paper)</td>
<td></td>
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<tr>
<td>(industry paper)</td>
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<tr>
<td>(industry paper)</td>
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<tr>
<td>Joachim et al., (2013)</td>
<td>Structures, processes, employees and relations</td>
</tr>
<tr>
<td>(academic paper)</td>
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<td>(academic paper)</td>
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</table>

Table 2. The table illustrates different SOA governance mechanisms.

As table 2 illustrates, the SOA governance mechanisms identified by different authors are very similar regardless if the publication is academic or industry. Joachim et al. (2013) made a literature study of the most frequently used SOA governance mechanisms stemming from three categories; structures, processes, and employees and relations. The comprehensive literature
review sheds light on what mechanisms are commonly used in SOA governance studies, and provides us with guidance on what governance mechanisms to study in this thesis. After reviewing existing literature we found that academic authors such as Biske (2008) and Marks (2008), as well as industry authors such as Brown et al. (2006) and Holley et al. (2006) all used SOA governance mechanisms similar to Joachim et al. (2013). However, the big scope of Joachim et al. (2013) literature review and the detailed descriptions of the SOA governance mechanisms is why we chose Joachim et al. (2013) model as a starting point. We will use the most frequent governance mechanisms provided by Joachim et al. (2013) to further investigate which SOA governance mechanisms do or do not support different constituents of SOA. This because it provides a useful ground to start from when exploring governance mechanisms support of an organisation.

We build upon the three categories of SOA governance mechanisms; structures, processes and employees and relations, and complete them with further literature within the domain to incorporate as much relevance as possible into our theoretical model. These governance mechanisms are useful because of their relation to IT flexibility and service reuse (Joachim et al., 2013), which is also the aim of our research company. In the following section, we will use the three categories of SOA governance mechanisms as a starting point to develop and to provide a full explanation of them.

2.2.2.1 Structures
Structures in this context refer to establishing decision making bodies, creating standards and policies, and assigning new roles and responsibilities. The new decision making body, if created, is often called a SOA centre of excellence (CoE). (Joachim et al., 2013) The CoE relative power often varies between identifying problems and making recommendations, to having authority to take actual decisions. The CoE is usually formed as a board or steering committee comprised of owners of different business domains, IT people and SOA experts. (Joachim et al., 2013) The CoE is often used to define best practices and to communicate and educate employees about SOA (Schepers et al., 2008). The formal power of the CoE will often be different depending on the organisation in question. While some prefer to centralise control into one unit, others decentralise control to individual business units. The latter can often improve flexibility, but also demands more coordination between units. (Schepers et al., 2008) Boards or committees such as
a CoE are commonly being mistaken to equal effective governance, when in fact it is one of many governance mechanisms. They should only be implemented for the right reasons, and when they are, it is beneficial if they are comprised of people with high organisational status, to communicate the importance of the SOA initiative. (Marks, 2008)

Setting standards and policies to guide development and management of SOA is also considered an important structural governance mechanism (Joachim et al., 2013). One example is to create policies regarding a reference architecture, which can serve as a blueprint of SOA. Having this kind of high level abstraction of SOA can unify the way people works through guidance, create less confusion regarding what standards to follow and in the end increase efficiency. (Vegeter, 2009) Policies, however, does not only relate to having a reference architecture. It can be standards in the form of functionality standards, design standards or development methodologies standards. The single most important output of imposing standards is a definition of the internal SOA-related technological standards to which all projects must comply (Vegeter, 2009; Marks, 2008). These policies should not only cover the technological standards but also the business and organisational aspects of a SOA, and should include the organisation and processes needed to guide the business success of a SOA. (Marks, 2008) SOA developments usually gets carried out through different projects, hence, poor project execution will lead to poor SOA in the end. Governance of projects is therefore an essential part of SOA governance, and how the organisation run its projects must be governed by policies to ensure desirable behaviours in the process. (Biske, 2008)

Another important aspect is the establishment and management of new roles and responsibilities within the organisation. These roles have to support cross-organisational collaboration and coordination of SOA related activities, for example when services have to be developed, modified or reused in another domain. It is also about defining roles and accountabilities, such as who owns the services, who makes improvements, who supports issues or, very importantly, who identifies new services. (Joachim et al., 2013; Vegeter, 2009; Marks, 2008) The new roles and responsibilities are important aspects of governance because the parties and individuals involved have to work together, and governance should make sure that separate organisational efforts are not working against each other. A clarification of purpose, definition of roles and responsibilities and clear accountability for decisions and actions are among the most important
aspects of SOA governance. (Vegeter, 2009; Marks, 2008) Brown et al. (2006) suggests that authority and decision rights should be assigned to roles in the organisation rather than people. Hence, SOA governance is also about managing different dependencies within an organisation, guiding who makes decisions and making sure cross-functional coherency of decisions. (Vegeter, 2009) Further, roles and responsibilities have to be defined regarding funding and budgeting of SOA initiatives, which can be quite difficult. The difficulties stem from the fact that many organisations have different functions that have their own budget and make their own decisions regarding IT investments. When implementing SOA, the benefits lies in reuse of enterprise assets and IT flexibility through cross-organisational collaboration. Therefore, the structure and funding practices within an organisation can be an issue, as funding practices and the mindset of the entire enterprise has to change in order for SOA to be successful. (Marks, 2008)

2.2.2 Processes

According to Biske (2008), it is imperative that a successful SOA have processes for the creation of policies as well as processes to facilitate communication, education, measurement, and policy enforcement. The policies described in the previous chapter will be useless unless there are processes for their enforcement. Further, processes should ensure communication between business and IT. (Biske, 2008; Holley et al., 2006) It is important, as communication is a means to align IT with business in the SOA context. When communication between IT and business employees is facilitated and good, SOA is more likely to succeed in fulfilling business demands due to reduced problems and misunderstandings. (Joachim et al., 2013)

The educational aspect is important, as none will exercise desired behaviour unless they know what SOA is and how they fit into the puzzle. Hence, the educational aspect relates to general knowledge about SOA rather than specific skills or training. If everything related to SOA is understood and embraced by stakeholders within the organisation, enforcing policies will be easy because the staff will be willingly and not forcibly compliant. The SOA effort has to be measured on important aspects, as people then can be held accountable and the change can be managed to get the desired behaviours from employees. (Biske, 2008) Governance processes in this context should map to the overall strategy and goals of the organisation, and support the definition, management, and policy enforcement of the organisation. There should also be
processes for tactical execution of SOA initiatives. The processes can also include planning processes, management processes, or project processes. (Marks, 2008)

2.2.2.3 Employees and relations

The last category of SOA governance mechanisms is comprised of governance actions relating to the employees and the relations among the SOA stakeholders. People carry out activities within an organisation and are therefore an essential part of the SOA effort. Often the same people remain within an organisation when it shifts to a SOA. However, governance efforts often have to change in terms of policies governing the people in order for SOA to be successful. People are the leaders of the change associated with SOA, and they are responsible for getting things done, which in this context are about creating desirable behaviour through policies and ensure that the policies are enforced. (Biske, 2008) SOA stakeholders need clarity of the purpose and intent of their actions. Hence, it is vital that all employees know their part in the SOA puzzle, and their relationship to other stakeholders (Marks, 2008). Even if they do understand their role it is possible they lack sufficient experience and they will probably need to develop their skills through SOA training. With that in mind, training processes have to be established in order to create a common understanding of the mindset of SOA within the organisation. The training can be on how to build services, to understand technologies, architecture or design techniques or more broadly to create an understanding of the mindset change required for SOA. If employees do not understand the mindset required for SOA, chances are that design and application of services will not fulfil the long-term strategic vision and not meet the demands of the business. (Joachim et al., 2013) SOA training and skills differs from the educational aspect previously described, and is more focused on specific SOA skills, such as development or architecture techniques, rather than general knowledge of SOA.

The common understanding of SOA will also aid in the collaboration between IT and business stakeholders. With SOA being driven by business requirements and executed by IT, stakeholders have to collaborate with each other to maximise the value. The shift of IT operating model is likely to change the relationship between business and IT and governance efforts has to support, promote and facilitate the new relationship. (Biske, 2008) If both sides understand SOA and each other’s operations and objectives, collaboration will be easier and with less misunderstandings. We have earlier described the importance of communication between IT and business
employees, and to ensure good collaboration communication is the key. Hence, establishing knowledge exchange between units can create or enhance mutual understanding of the two parties. Further, it increases the flexibility when it comes to IT projects, which is one of the main objectives with SOA. (Joachim et al., 2013)

2.3 Theoretical framework

The theoretical framework consists of a combination of the literature previously described in this chapter, and will provide a structured way of presenting and analysing the empirical data. The framework is based upon the constituents of SOA and the SOA governance mechanisms. Table 3 provides a summary of the seven constituents of SOA, and table 4 summarises the three SOA governance mechanisms.

<table>
<thead>
<tr>
<th>Constituent of SOA</th>
<th>Summary</th>
</tr>
</thead>
<tbody>
<tr>
<td>Business (non-technical)</td>
<td>The strategy, vision and goals of the organisation, as well as the business practices and stakeholders. This also includes how business processes are designed, structured, implemented, documented and executed.</td>
</tr>
<tr>
<td>Organisation (non-technical)</td>
<td>The design of the organisation, roles, relations and transformation of structure and behaviour favourable to SOA. This constituent also deals with the availability of SOA skills, training and education.</td>
</tr>
<tr>
<td>Method (non-technical)</td>
<td>The methods, such as design methods, techniques and tools used to transform to SOA. This constituent deals with the cross-functional consistency of methods employed and shaped after strategy and vision.</td>
</tr>
<tr>
<td>Application (technical)</td>
<td>The applications style, structure and functionality and how they can be reused, flexible and extendible within the organisation. This constituent also deals with technological standardisations to ensure compatibility and consistency.</td>
</tr>
<tr>
<td>Architecture (technical)</td>
<td>The architecture is about the structure and decisions related to the organisation’s technologies and the relationship between technologies. This constituent deals with consistency and standards of topologies, integration</td>
</tr>
</tbody>
</table>
techniques, and design decisions.

<table>
<thead>
<tr>
<th>Information (technical)</th>
<th>Information is about the definition, structure, relationship and accessibility of information. This constituent deals with making information accessible throughout the organisation with a consistent terminology and single defined concepts.</th>
</tr>
</thead>
<tbody>
<tr>
<td>Infrastructure (technical)</td>
<td>Infrastructure is about having a flexible and manageable infrastructure with continuously updated standards and needs. This constituent deals with infrastructure capabilities, service management, how service requirements are met and how integration is facilitated.</td>
</tr>
</tbody>
</table>

Table 3. Summary of the constituents of SOA.

<table>
<thead>
<tr>
<th>SOA governance mechanism</th>
<th>Summary</th>
</tr>
</thead>
<tbody>
<tr>
<td>Structure</td>
<td>The establishment of a decision making body, the creation of standards and policies, and the creation of new roles and responsibilities.</td>
</tr>
<tr>
<td>Process</td>
<td>Establishing processes for policy creation and enforcement, IT and business communication, and education.</td>
</tr>
<tr>
<td>Employees and relations</td>
<td>SOA training and skills, and IT/business collaboration.</td>
</tr>
</tbody>
</table>

Table 4. Summary of SOA governance mechanisms.

The two tables mentioned above have been consolidated into this thesis theoretical framework, see figure 2. The theoretical framework will allow us to investigate established SOA governance mechanisms, and identify implications of SOA governance. Finally, by using this specific theoretical framework we are able to identify in which constituents of SOA, different governance mechanisms provides support for organisations, and where they do not.
We believe that the theoretical model can generate a substantial theoretical contribution, as no previous model has been able to match different SOA governance mechanisms with different constituents of SOA. The aim with using this model is to provide answers more specific than that SOA governance is simply very important. We believe the use of the model can and will help academics and practitioners to identify a suitable governance structure for their specific organisation. Even if the model is applied on a single case study in this thesis, it sheds light on which SOA governance mechanisms supports different constituents of SOA.

Figure 2. The figure illustrates the thesis theoretical framework.
3. Methodology

This chapter presents the methodology that was used to conduct this thesis. The first section presents the research approach, which acted as a guide for how the empirical data was matched to the theoretical framework. Furthermore, it presents how the research process was carried out. The chapter ends with a discussion about the validity and reliability of the study.

3.1 Research approach

The purpose of the study was to investigate established SOA governance mechanisms in a large organisation in order to explain implications of governance in a SOA context. To be able to do this, a case study has been carried out in conjunction with observations of the research object and interviews during a 10-week internship. A case study contains a detailed and thorough description of the reality during a period of time, which usually aims to highlight the unique features of a specific case. With that in mind we decided to use a qualitative research method, as it aims to gather an in-depth understanding of a specific domain. Based on the studied case, the goal was to make a theoretical analysis by investigating whether the theoretical ideas presented are supported by the empirical data. (Bryman & Bell, 2011) According to Dubois and Gadde (2002), there are difficulties and opportunities characterising the case study approach. The main difficulty is handling the interrelatedness of the various elements in the research work, while the main opportunity is the possibility to get in-depth knowledge of a phenomenon or situation. To overcome these challenges and seize the opportunities, Dubois and Gadde (2002) have presented an abductive approach, see figure 3. This process is called “systematic combining”, and it emphasises a dynamic workflow throughout the research processes. The researcher can continuously re-evaluate and develop the theoretical framework and empirical data as the study progresses (Dubois & Gadde, 2002), which is the reason why this approach was determined as a suitable research method for the thesis.
The framework acted as a base for the analysis and helped us gather information and data at the right places. The systematic combining lets the researchers evaluate how theory and empirical findings are relevant to each other, and it also challenges the theoretical framework to constantly be aligned to the case, which are done continuously throughout the research (Dubois & Gadde, 2002). Our research had a broad scope, as neither the research question nor the scientific angle was predefined. These areas were developed and defined as the study progressed, hence the abductive approach was a good fit for this study. The practical implication of using this method was that as we gathered more data and found new insights about the case, we could redirect the theoretical framework in order to develop new useful insights. It allowed us to reflect over what we had learned, how the empirical data was relevant in relation to the current theoretical framework, and in the end enhance the overall quality of the study.

3.2 Research process

To fulfil the purpose and present the work in a clear and logical way, we created a roadmap for the methodological approach. The roadmap outlines the main steps of our qualitative research, see figure 4. The research process was non-linear and we moved back and forth between the steps, to adapt the model and data collection as the project progressed. Bryman and Bell (2011) argues that working iteratively with theory and empirical data will reap the best results when
combined. This is because the focus of the study is re-evaluated towards finding what is most interesting about that specific research object or phenomenon. In our study, it allowed us to enter the study with an open mind, gather data suggesting SOA governance was of value to study, re-evaluate the focus of the study, iterate on theory and in the end investigate the phenomenon in-depth qualitatively.

**Figure 4. The figure illustrates our research process.**

### 3.2.1 Choice of theory

Our intention with this thesis was always to get a deeper understanding of the SOA implementation at Scania. However, we had a broad scope in the beginning and the research question was not yet defined. Therefore, we felt the need to use a model that incorporates SOA holistically, including all important aspects of it. As explained in the theoretical section, the academic authors provide technological and business aspects of SOA in their models, but none incorporated both aspects. With SOA being business driven but realised through IT, we believed a view of SOA constituting of both business and IT-aspects was needed. With that in mind we deemed the academic models to be inadequate and turned our focus to models provided by industry authors and consulting firms. We chose The Open Group Service Integration Maturity Model (OSIMM), since it was most suitable for our purpose as it provides a comprehensive yet detailed overview of the constituents of SOA. With our broad scope in mind, we believed this model to be useful for our academic purpose as it has obvious similarities to previous academic research. To strengthen the theory, the model has been complemented with academic definitions and explanations throughout the process.
As time progressed, we began to see patterns in our data suggesting SOA governance might have a bigger importance on the outcome of a SOA implementation than other constituents. This made us narrow the scope of the study and change the research orientation to focus on SOA governance. When reading literature regarding the subject, the lack of case studies was obvious and convinced us that there is a need to further investigate SOA governance on a practical level. We found that the academic literature is consistent in that governance is the key to the success of SOA, and governance underlies all of the other constituents of SOA. Because of this, the OSIMM model acted as a base for our theoretical framework, and we decided to separate governance from the other constituents.

Further into the process, the empirical data indicated that SOA governance might support different constituents of SOA in different ways, sometimes very much, sometimes not. We found this interesting as the academic literature names SOA governance as the key to successful SOA implementation. This made us re-evaluate the previous theory and empirical data and narrow down the research question yet again. We decided to investigate which SOA governance mechanisms do or do not support the different constituents of SOA. In order answer the question we needed to know what SOA governance mechanisms were common in the literature. As explained in the theoretical section, we chose Joachim et al. (2013) model as a starting point because they provide a literature review of the most frequently mentioned SOA governance mechanisms, with detailed descriptions. This was important, as we needed to define each of the governance mechanisms in order to be able to study them and explore how they support different constituents of SOA. We completed the literature from Joachim et al. (2013) with other literature related to their SOA governance mechanisms, to get a holistic and broad academic foundation for our study.

3.2.2 Data collection

During our internship at Scania, we collected data through qualitative interviews and on-site observations. Performing qualitative interviews gives the respondents a lot of freedom to make their views known (Bryman and Bell, 2011). For us this was an advantage as it allowed us to ask questions such as how and why and hence get in-depth explanations, which led to deeper understanding. Observations gave us a deeper understanding of the target audience, which, according to Bryman and Bell (2011), is an appropriate approach when you do not really know
what information will be interesting for your purpose. The two collection methods have complimented each other, as interviews provided us with subjective perspectives, while observations gave us the opportunity to make our own opinion. In this way, we have compiled internal and external information about what we have studied, which in the end helped us form an objective picture of the reality.

3.2.2.1 Semi-structured interviews

In this research, we performed semi-structured interviews with standardised templates, and the questions were adapted based on the role of the respondent. See appendix 1 for the interview templates. In this standardised template, the questions were related to a specific constituent of SOA, and were matched to the respondents’ role at Scania. We chose to perform semi-structured interviews since it gives the interviewer the opportunity during the interview to dig deeper as interesting discussions or subjects emerge. The advantages with a more open approach such as semi-structured interviews are primarily related to if the researchers have limited previous knowledge about the area. However, the downside is that the answers provided will be less specific and there is a risk that some answers will be left out or ignored while interviewing. (Bryman & Bell, 2011)

We have conducted 18 interviews with people that are working with SOA, IT, and business at Scania. In the beginning, the head of the IT solution and strategy department suggested possible candidates to interview. As the research progressed, we complemented with respondents that we considered relevant for our purpose. At this point, a second interview template was created to further explore SOA governance at Scania. The basis of the second template was the SOA governance theories used in the thesis, see appendix 1. The complementary respondents were found from research on Scania’s intranet as well as recommendations from other respondents. All respondents were selected to be interviewed because they possess relevant knowledge related to SOA. This also ensured that we collected data that covers both the constituents of SOA and the SOA governance mechanisms, see appendix 2 for an overview of the titles of the respondents. The interviews were planned in advance and lasted between 40-80 minutes, with an average duration of about 45 minutes. When presenting the empirical findings, we will present a comprehensive view that is a combination of a number of interviews and observations. In general, we will only reference to a specific respondent in citations. As multiple interviews were
performed, we chose this method because we do not want to base something on what only one respondent said. Even though it would be beneficial to link names to the title of the employee and also link the constituent to the employee, we cannot do that, as it would uncover the identities of the respondents. Therefore, when presenting the empirical findings, the respondents have been assigned fictive names, in order to maintain their anonymity. We are aware that this is not ideal, as the reader does not know which constituent the respondent belongs to. To mitigate, we created appendix 2 in order to give the reader a better understanding that we have interviewed suitable people for our thesis.

Even though we exclusively performed interviews in a semi-structured format, the amount of follow-up questions varied in different stages of the research process. For example, we used more follow-up questions in the beginning of the study in order to create an understanding of SOA as a concept but also of SOA in the context of Scania. We did this because our purpose was not yet defined in the beginning and we wanted to get familiar with Scania as an organisation. Once a basic understanding of SOA and Scania was reached, the interviews tended to become more of the traditional semi-structured and as our knowledge of SOA and Scania increased we were able to pose more targeted questions. The interview process allowed us to first gain a basic understanding and then move further into certain areas that appeared more important.

3.2.2.2 Observations

Even though semi-structured interviews are useful, the answers might be affected by subjective experiences. We therefore complemented the interviews with on-site observations in order for us to create our own opinion of how SOA governance supports constituents of SOA. Observations were mainly used as a guiding tool for further data collection but also to gather hands-on information about SOA at Scania and SOA governance. One source of information was the meetings that we participated in throughout the research process. The meetings were of different strategical and tactical character, and focused mainly on SOA and IT within the organisation. During the internship we were a part of the organisational culture, and shared office with the SOA-centre in an open environment. This allowed us to have informal conversations with important SOA-people within Scania on a regular basis. Further, being a part of the organisation meant we also had lunch and shared breaks with our colleagues and hence learned a lot through informal communication and through the grapevine. We also stood by as observers during more
formal meetings, where we aimed to blend in with other organisational members and take notes regarding interesting information that surfaced.

Two kinds of observations were performed throughout the thesis: participant-as-observer and observer-as-participant. Bryman and Bell (2011) argue that both are methods that include a long-term commitment to an organisation's everyday routines and activities, and it lets the observer get an inside perspective and a deeper understanding of individuals reality in their natural context. Since both methods have an open approach, which means the members of the social setting are aware of the researcher's status, there is some risk that they change their behaviour because of nervousness or do not want to share information. However, we were introduced as employees hired to perform a specific task, and in the context of SOA employees were aware of the importance of our mission and hence considered us as a part of the group. Rather than unwillingness to share information, people were truly open and wanted to engage in discussions and convey their opinion of the issues at hand. This made observing easy as colleagues engaged us in discussions, clarified specific corporate concepts and shared information in order for us to get a rich empirical background.

**3.2.3 Management of data**

After each interview we sat down together and discussed and summarised the interview to make sure that the key findings were preserved. All interviews were recorded after asking for permission, and were then transcribed. The interview transcriptions were structured after the standardised template, which allowed us to retrieve and compile relevant data efficiently. To further simplify the collection of data, we created a standardised preface for each interview, which contained the name and title of the respondent, the date and length of the interview, followed by a summary, reflection and related key words. To facilitate that both of us had access to our material, we have created a common folder on Google Drive where we have been collecting all our data. In this folder, we have everything regarding the research, such as planning, the audio files, metadata regarding the interviews, the academic sources and so on.

Bryman and Bell (2011) argues that observations are easily forgotten if not recorded. With that in mind, we wrote a diary each day regarding what we had experienced accompanied by our own reflections. When writing the diaries, the contexts, events and reactions were taken into account.
and we tried to write as vividly as possible. Further, we also wrote down the employees’ reflections and thoughts. Since we have taken notes regularly and sorted them after date, the relevant data could easily be found.

As mentioned earlier, the interviews were transcribed and compiled in one document. To become well versed in the topic and the respondents’ answers, we read and discussed all the transcripts. As we used the semi-structured approach, it allowed us to gather and compile data and compare answers to each other. To get an overview of the empirical data, we used colour coding of the responses in order to separate the answers from one another. Bryman and Bell (2011) argues that this type of analysis involves the relationships and differences and a deeper understanding of the responses can be distinguished. We constructed a thematic coding, which facilitated comparison and alignment to the current theoretical material. As we used a systematic combining process, we could use the empirical data consisting of transcripts, summaries, key words in different colours to get an overview of what was really interesting. When new insights emerged, it allowed us to iterate and create alignment between empirical data and theory.

### 3.2.4 Method of analysis

The theoretical framework was used to break down and structure the empirical data in order to ease the analysis itself as well as the communication of it. The empirical data is presented after the three governance mechanisms, embedded with the seven constituents of SOA. Distinguishing and identifying the relevant data was facilitated by the use of thematic coding, which helped us to identify keywords and key phrases. We used the thematic coding, keywords and key phrases to categorise the empirical material in relation to the theoretical framework. For example, all the material relating to one constituent of SOA was compiled in one document in one colour, whereas the keywords and key phrases were structured under each category of SOA governance. We have also used our theoretical framework to present an overview of our empirical findings, see table 5 in chapter 4 for a summary of the SOA governance support. The assessment is based upon our view and judgement of the empirical data, and is presented in different scales. At first, we used the scales of support, strong support and no support. However, we found it too hard to illustrate the support simply in terms of strong support or support, as there were more nuances to it. Therefore, we decided to illustrate the support as strong support, support, limited support, no evident support and does not support. Further, the empirical data presented is considered to be
relevant to explain which SOA governance mechanisms do or do not support the different constituents of SOA. Consequently, this means that some empirical evidence has been removed since it does not help to meet the purpose of the thesis.

The highly structured approach allowed us to identify patterns and relationships in the empirical data. It resulted in us being able to extract one voice from various interviews by generalising what was really said and combining it with our own observations. This resulted in high utilisation of our material, both from interviews and observations, which in the end allowed us to convey an objective perspective on what was being studied. The empirical data is analysed with respect to the constituents of SOA and how well they are supported by SOA governance mechanisms. Hence, the theoretical framework have been used to create a structured approach while analysing, since we analysed each governance mechanism to distinguish similarities and anomalies between the provided support for different constituents of SOA. The analysis is based on different themes deriving from the theoretical framework, which have been identified on the basis of empirical data. The analysis will look into each part of the governance mechanisms as well as take a more holistic view to summarise the mechanisms support.

3.3 Validity and reliability

Using the abductive approach called “systematic combining”, made it possible to go back and forth between the theory and the empirical data. By doing this, it was possible to start in a broad sense and continuously narrow down the theoretical framework according to the empirical findings. The use of an abductive approach let us continuously re-evaluate and develop the theoretical framework and empirical data as the project progressed. As a result, the data collection depends on the development of the study. This has led to relatively high validity, since the questions asked to the respondents and the remarks were relevant to the study's scope.

Due to the development of the case and as new insights about the empirical world were made, new data was collected. This is the reason why the study might be regarded as evolutionary and is the reason why the data was not collected at the same time. In a worst case scenario, the approach could have some impact on the analysis as the SOA function is constantly working and governance practices can change over time. However, since Scania has been implementing SOA for ten years this scenario is highly unlikely. To mitigate the possible effects, the collected data
has been discussed with leaders at Scania regarding its validity and no changes have been made to decrease the data accuracy.

To ensure that the interview questions were designed in a proper manner and that the respondents would interpret the questions in a desired manner, we conducted two pilot interviews (Christensen et al., 2011). Performing pilot interviews is considered leading to greater validity as they ensure that the interview template includes issues relevant to the topic (Deacon et al., 2007). With the help of the pilot interviews, we shaped and reshaped the questions to become more understandable and evaluated whether the questions were interpreted correctly, and if they produced relevant answers. Thus, we increased the study's validity as we could measure what we aimed to measure more confidently.

Deacon et al. (2007) argues that reliability includes how reliable measurements are and describes the quality of the data. Consequently, high reliability means that independent measurements provide approximately identical results. As mentioned earlier, the study has high validity, however, the reliability is not seen as being equally high because the interviews conducted were semi-structured. If the interview template would be used again, it is not certain that the answers would be the same. This is due to the use of semi-structured interviews, and as mentioned before we have had both more and less semi-structured interviews. This made it possible for us to adapt the interviews to the person and context, and to ask different follow-up questions. The more open approach allows the respondents to make their own judgement of the question and answer in accordance to their opinion. Trying to strengthen the research reliability, we have administered and processed the quality of the questions, through the pilot interview. Further, prior to each interview we presented the study and its purpose in short to ensure that the respondents had the same mindset.
4. Empirical findings

The purpose of this study was to investigate established SOA governance mechanisms in a large organisation in order to explain the implications of governance in a SOA context. We find that presenting the empirical data structured after the three SOA governance mechanisms will make it easier to distinguish similarities and anomalies between the provided support for different constituents of SOA. The chapter ends with an overview of the empirical findings.

4.1 Structure

Under this constituent of SOA governance we will present the empirical findings relating to the establishment of a decision making body, the creation of standards and policies, and new roles and responsibilities.

4.1.1 Decision making body

Recently, reuse became one of three priorities in the organisation’s IT strategy. The SOA centre also got a big amount of centrally financed money to develop standardised interfaces in order to develop a portfolio of services. To guide this effort, Scania has created a steering committee, which purpose is to guide the organisation towards creating more services. The steering committee is comprised by experts from SOA and IT, and review proposed service candidates and decide what projects to fund or not to. The committee is considered important in terms of selecting service candidates, which means where a service can be useful within the organisation. The committee also uses its central funding to develop SOA on an own initiative in order to create a portfolio of services. The general idea is that the more services they create, the quicker the development of future services will be, and then SOA will be a better solution than point-to-point integrations or buying other applications. However, employees perceive difficulties related to the steering committee, as its formal power is limited. (Marshall; Barney; Victoria; Observations)

“It happens that IT tells the business that they cannot do this, but they often do it anyway. The business has the final word, and they are stronger than us [IT] as they are paying for it. It says in different places that we have the mandate to say no, but in reality we cannot do it, we do not have the strength to do it” – Marshall
As described in the citation, the formal authority of the steering committee is limited when it comes to decisions, as they can be overruled by the business. When IT is developed at Scania, projects are formed to make sure proper functionality is created. The steering committee can make recommendations and urge the projects to do one thing, but they do not make the final decision. Hence, the projects have a strong position within the company. Many employees find that the steering committee’s lack of authority can create misalignment between IT and the business as projects disregard policies in order to stay within time and budget. This means that they often buy a solution or make a point-to-point integration instead of reusing an existing one, if reusing means the process will be more time consuming. Scania has an organisational structure where employees have authority to take decisions from the bottom of the hierarchy, where they can decide what is best for them. Many respondents consider this to be a strength for the organisation, but it also creates SOA governance-related issues as the IT departments lack control and authority. (Marshall; Barney; Observations)

“For the job that we want to drive, this governance model is not the best.” - Marshall

Regardless of what constituent of SOA, the respondents find the steering committee useful in its purpose as it drives SOA forward within Scania. The main argument used is that they form a control mechanism and their approval creates mandate for lower level employees to proceed with projects. The group is comprised by senior managers, and it occurs that they are busy with other tasks and do not have the time to meet and discuss SOA. As the steering committee gives projects a go or no go, they are perceived to form a bottleneck if they do not meet and take decisions on a regular basis. Further, it is unclear to employees outside the committee what criteria apply to what projects gets approved or not approved. The steering committee is considered to be on a high management level, and employees doubt whether they have a comprehensive understanding of the details of what they are funding. (Lily; Ranjit; Ted; Observations)

“The steering committee often discuss strategies and forget the tactical execution. You have to look at SOA as a whole, but they tend to miss that.” - Ranjit
Respondents related to all constituents of SOA do not experience any direct support from the steering committee on a daily basis. It is described as a result of the hierarchical and physical distance between the parties. The steering committee is regarded as good to have from an organisational, structural and governance perspective, as its clear purpose and assignment simplifies the work of others. However, the steering committee is taking decisions on a more abstract level and decides on what project others can work on. (Observations)

4.1.2 Creating standards and policies

“If we want to have everyone moving in the same direction and strive for reuse, we have to limit the decision rights of every individual.” – Marshall

Scania has realised the potential value of SOA governance, although they do not consider themselves to have the accurate governance structure today. For example, they have not standardised how to build services or how to use them, but they believe they are on their way. The general opinion is that governance does not work within the organisation as people find ways to avoid the organisational structures or processes to benefit themselves. The SOA centre is, while expanding, setting standards and policies as they go. Today, the number of employees varies between seven and nine. (Barney; Ranjit; Robin) The majority of the employees have raised concerns regarding that the lack of standards and policies creates difficulties in keeping consistency and efficiency, while some feel this method creates flexibility in their daily operations. As a shift to SOA requires a shift in behaviour, the empirical data indicates that governance of standards and policies would support the organisation constituent of SOA greatly. (Lily; Observations)

“Sometimes I think you should loosen up when it comes to standards. It is important that they add value, and if you do not think they do, you should not be afraid to disregard them.” - Ted

Employees have different views of whether imposing standards and policies provides support or if they would inhibit flexibility. For example, the infrastructure constituent of SOA wants to have control and have everything as orderly and tidy as possible. Therefore, they want strict standards and policies that limit what others can do and the implications of the actions of others might have on the infrastructure. (Marvin; Observations) The same goes for the application,
architecture and information constituents of SOA, who wants clearly defined standards and policies to create consistency. Even though these constituents have for example a formalised enterprise architecture, design and development standards, a common information model or infrastructure guidelines, the respondents perceive that standards and policies often are not anchored and understood within the organisation. (Lily; Ranjit; Zoey; Ted) All respondents states that the technological standards related to SOA are the most developed in comparison with for example methodologies.

“Autonomy is in our DNA and it is up to each project and employee to do what they believe is best for Scania.” - Robin

In comparison to the constituents of SOA that value order and tidiness, the business, organisation and method constituents of SOA are driven by other factors, and want to work in a fast pace with agile methodologies. They are more concerned with delivering solutions in a fast pace to satisfy the projects. This may create difficulties for other constituents of SOA as they might have to create workarounds as a result of the contradicting methods used. (Lily; Barney) Even though the aforementioned constituents of SOA are driven by other aspects than the technological constituents of SOA, employees believe that how they work could be in accordance to standards in a greater extent than today, to ensure consistency in the delivery of projects.

"We would benefit from having more governance, because we have a good technological standards to ensure compatibility, but everything else is done based on individual preferences.” - Patrice

4.1.3 New roles and responsibilities

“Roles and responsibilities are defined and available on the intranet, but it is a challenge getting everyone to act accordingly. I do not know how anchored they are within the organisation” - Ted

Scania lacks comprehensive role descriptions formalised in policies or rules. Ever since the SOA centre was assigned central funding, it has gotten more responsibilities but the responsibilities have not been formalised and delegated within the group. There used to be formal descriptions
but they are not relevant today, due to a change to an agile process methodology. (Barney; Lily; Observations) As for the method constituent of SOA, it is vital to know your role and your relationship to others, especially when working with agile methods. Employees often have multiple roles but they do not have time to complete their work assignments, as there is a shortage of resources. There are mixed opinions regarding the roles within the constituents of SOA, as some respondents think they are quite clear even though employees have multiple roles, and some do not. Further, employees experience certain ambiguities in their interaction with employees from other constituents of SOA. One example is if someone wants help from the SOA centre, then the people who are currently at the SOA centre physically will help even if it is not in their job description or their area of expertise. This does not affect the business constituent of SOA, as they usually are the ones ordering a solution, and only cares about functionality. As Scania IT or the SOA centre deliver that functionality, they do not need deeper knowledge regarding the roles and responsibilities of the other constituents of SOA. (Barney; Lily; Ranjit; Observations)

“You envision your idea and when enough people have said ‘yes, this makes sense’, you have reached a decision.” - Lily

The lack of clarity of roles and relationships is perceived to affect decision making which highly affects the organisation constituent of SOA. Often, as described by the quote above, people within the organisation do not understand how decision making is performed, which goes for all of the constituents of SOA. Employees believe it is the cause of a vague structure and lack of knowledge regarding other stakeholders and their needs. At the same time, the descriptions of roles and responsibilities are available on the organisation’s intranet. (Lily; Ted; Observations) Stakeholders stemming from the more technologically oriented constituents of SOA; application, information, architecture and infrastructure, expressed that they would benefit if everyone knew their role and relationship to others in a greater extent. However, their role often involves less interaction with others as they usually get assigned tasks based on decisions in projects. As they have less interaction with others they do not acquire the same support from knowing everyone's roles and responsibilities. (Observations)
"We have a lot of freedom, which engages us in our work. But on the other hand, it can be slow at times when you do not really know what to be achieved." - Zoey

Employees from the technological constituents of SOA expressed that they do not really know what demands management have on them and what they should do. They have very few clear directives and the goals that they are working towards are set on a high level. (Lily; Carl; Ted; Marvin) An issue raised by respondents from all constituents of SOA is that no one has the responsibility to promote reuse of services within the organisation. A majority of the respondents believed that SOA would get better traction within the organisation if people get assigned responsibility to spread the word about SOA within the organisation.

4.2 Process

Under this constituent of SOA governance we will present the empirical findings relating to the establishment of processes for policy creation and enforcement, IT and business communication, and education.

4.2.1 Policy creation and enforcement

"Once they have done that [created policies], I do not know how the process to ensure that they are used looks. Or if you leave it there, which I think we do... You want everyone to use them but there is no real follow up on it, which means that you are attracted to bypass policies when things do not really work out as you want." - Lily

As of today, Scania lacks established and communicated processes for how to create policies, which are usually created on an ad-hoc basis when someone wants to formalise something. Regardless of constitutional belonging, employees lack the knowledge regarding how they would go about if they wanted to create a policy. The information is to be found on the intranet but none of the respondents know where.

"People always question standards and policies, or go around them. Either the standard is too complicated or it is not anchored enough." - Ted

As described in 4.1, a few policies exist but are considered good to have rather than rules to follow. Hence, enforcement of policies is rare within the organisation as people easily can avoid
following them without any further reprimands. As good as every respondent have expressed that policies simply does not work as they should within the organisation. Working from a bottom-up perspective gives individuals a lot of freedom to make their own choices but with the lack of control that comes with the methods people can do what they want. Usually when policies are created there is no follow up on whether they worked or if they are being used. (Ted; Lily; Robin; Marshall; Patricia; Ranjit)

Policies related to the business, organisation and method are less enforced than more technological policies related to the remaining constituents. These policies concern for example how project management, development, documentation and implementations are performed. The general thought behind the lack of following and enforcing policies in these constituents of SOA is that there are many ways to reach the goal in this context. In spite of how they work today, respondents have expressed that it would be easier if everyone performed the same task in the same manner to ensure quality and consistency of the work. In contrast, when it comes to more technological constituents of SOA; information, architecture, application and infrastructure, the need to follow policies is bigger as solutions have to be able to work together. In these cases the lack of compliance to standards can cause technical issues leading to reuse being a more expensive solution than others. Therefore the obedience to and enforcement of policies is more anchored in these more technological constituents of SOA as opposed to business, organisation and method. (Ted; Lily; Zoey; Ranjit; Patricia; Observations)

4.2.2 IT and business communication

“We [the SOA centre] are quite far from the business operations, and it is very seldom that we come in contact with anyone else than Scania IT.” - Lily

The communication between IT and business within Scania is limited, at best. IT does not come in contact with business stakeholders on a regular basis. (Robin; Victoria; Marshall) However, the majority of the respondents have expressed that more communication among the stakeholders would be beneficial as expectations could be clarified and both sides could get a better understanding of each others operations. The SOA centre and IT today believes that the business is more interested in what functionality they get, and does not care about whether the solution is realised through SOA or something else. As of today, there are no formal
communication channels or formalised meetings between business and IT. The communication that occurs is usually related to when a new project is initiated and the project leaders realise the need to involve stakeholders from IT in the process. (Observations)

Several respondents have uttered that they believe projects are the most successful when stakeholders from both IT and business communicate, collaborate and share the responsibility. Even though a few respondents from the application and information constituent mentioned that they communicate with business stakeholders from time to time, it is nothing that is done extensively. Similar to what was described in the previous section about policies, employees from the technological constituents, besides architecture, communicate less with the business as they get tasks based upon requirements from others. (Carl; Patricia; Ted) Communication between IT and business, even though it is not formalised, usually takes place in earlier stages of projects and is more related to the constituents of business, organisation, methods and architecture. The reason the architecture constituent of SOA differ from the technological constituents is that solution architects are an important part in initiating new projects and deciding how to realise the requirements from the business. (Barney; Patricia) Finally, there was not enough evidence to conclude whether governance of IT and business communication support the infrastructure constituents of SOA.

4.2.3 Education

It is important for Scania to get people in the mindset of SOA, from information needs to realisation. Scania is trying to educate employees to think reusability, to think in a bigger perspective, what information can be shared and what can be reused. (Marshall; Barney) This very important for the business and organisation constituents of SOA, as the business must understand SOA in order to increase reuse and lower costs through shared services. The SOA centre is trying to educate other stakeholders through workshops and presentations, but nothing is formalised and the general opinion is that the business stakeholders does not know enough about SOA to realise the benefits. Solution architects are key employees in each IT project, and they are the ones that try to find the best solution for the requirements at hand. They do not have any loyalty to the SOA centre and often provide the fastest solution, often not SOA, to satisfy the projects. Respondents have expressed that a majority of all the solution architects does not know enough about SOA to steer the projects in the direction of SOA. Hence, creating educational
processes for the architecture constituent would help key employees to understand SOA in a greater extent. (Patricia; Ted; Marshall; Observations)

“We are trying to teach others to see information as a common asset, but many people find it difficult to think in abstract terms. Fortunately, some of us are a bit perverted and can see the beauty of a generalised information model.“ - Carl

As the quote illustrates, information is a common asset for Scania. The respondents from the information constituent of SOA have expressed that having the right mindset of SOA is important, since they are one of the key people to educate about SOA. It would help people to see common information needs that could lead to shared services between organisational units, which can be reused and in the end lower IT-related costs. (Carl; Ted; Ranjit)

“We have to get better at having at least a few things that apply, and then continue to have a lot of autonomy.” - Barney

There are no educational processes when it comes to the method constituent, since there are no standardised methodologies and different methods are used to develop a service, such as user-stories, workshops, use cases and other tools (Barney; Lily). Scania hires a lot of consultants, and since there are no clear work methodologies, the consultants often bring their own tools and working methods. This in turn contributes to a more inconsistent work environment for Scania. As the citation above describes, it would be beneficial to narrow down the number of methods that can be used, rather than deciding on a single one. Therefore, having educational processes receives limited support, as it is good but not essential for the method constituent of SOA. In line with the method constituent, there is no process to educate the application constituent of SOA. When application developers are hired, they are assumed to possess the SOA mindset. However, it does not mean that there is no need to educate employees within the application constituent of SOA, but it is not essential to do so. (Ted; Marvin; Observations) We did not find any evidence suggesting the infrastructure constituent of SOA would benefit from governance of educational processes.
4.3 Employees and relations

Under this constituent of SOA governance we will present the empirical findings relating to the establishment SOA training and skills and IT and business collaboration.

4.3.1 SOA training and skills

To be employed by Scania IT, or more specifically SOA centre, candidates need to have the right resume. Asides from that, there are no quality assurance processes securing that people possess the right skills to understand and practice SOA. For example, it happens that an application developer who has never created a service before is assigned to develop one. (Ted)

“When I started here, I read SOA standards, but it is not mandatory to do so. I do not know if there is any way to secure that people have the right education. There is no formal on-boarding process.” - Ted

According to the respondents, employees working with different constituents of SOA need different levels of education. For example, it is important for the architects to understand the mindset of SOA, that they are doing solutions that are loosely coupled. People working within the other technological constituents of SOA have to know how to perform certain tasks to ensure interoperability and compatibility of services and systems. In these cases there is usually only one way to do something right, hence SOA training is the key to create technological consistency. This was the result for information, architecture and application. (Carl; Ted; Patricia; Marvin) We did not find any evidence suggesting that governance of SOA training and skills support the infrastructure constituent of SOA. Constituents of SOA concerning more soft factors such as business practices, organisational design or methods may have more ways to reach a desired outcome. This does not mean that these constituents of SOA would not benefit from more SOA training, as knowledge about for example SOA specific methods could make work more efficient through consistency. Further, the same is valid for the business and organisation constituents of SOA, as more skills and training would likely benefit SOA at Scania, even though it works without training as well. (Observations)
“It would be good if more people knew how we see SOA at Scania. There are people who know what SOA in general is, but maybe do not understand how we actually express or work here at Scania.” - Barney

Scania used to have courses in SOA, but they were not marketed throughout the organisation, which resulted in low interest. Today, Scania conducts ad-hoc training, but nothing is formalised. Training is not mandatory, which means that employees have to take own initiatives if they want to learn more, and if they do not see the value of learning about SOA, they will not. Several respondents argued that there is a general need for more people at Scania get knowledge about SOA. (Marshall; Ted; Barney)

4.3.2 IT and business collaboration

The biggest business driver for implementing SOA is to enhance the reusability, which in turn leads to decreasing costs for Scania as a whole. The business itself always strives to reach cost efficiency and IT uses the same argument for new IT initiatives. Therefore IT and business have a mutual understanding that SOA is beneficial for both the business and IT. However, Scania IT operates in their own bubble, and may not have the same goals as Scania as a whole. At Scania, there is a department that is working as a bridge between IT and Business. And according to policies and standards, projects should go through this department to create coherence in the work. But, this is something that is bypassed, which creates difficulties in the collaboration between IT and the business. (Victoria; Robin; Ranjit; Observations)

“The business are trying to see Scania IT as IT for Scania. At the same time, they are in their own little organisation and are working towards their own goal. Hence, a gap is created.” - Robin

Sometimes, the business want something which IT delivers, sometimes without seeing how it relates to corporate goals in its entirety. Decisions to launch new IT initiatives are usually taken on a higher organisational level, and do not directly concern all constituents of SOA until requirements land on their table. The collaboration between the business and IT commonly includes the business, organisation, architect and method constituents of SOA. The reason for that is that these constituents of SOA are more involved in earlier phases of the development
process, which demands more collaboration in order to decide how to realise business requirements through SOA. As a result, these constituents of SOA acquire more support from governing the collaboration with the business. When the scope of the project is decided, the more technological constituents of SOA facilitate the execution of the initiatives. Besides the solution architect that is usually involved earlier in the project, the application, infrastructure and information constituents of SOA does not require as much collaboration with the business. Sometimes they are involved earlier in the process but not as extensively as the non-technological constituents of SOA. Therefore, the support of IT and business collaboration is limited for the aforementioned constituents of SOA. (Observations)

“It would be beneficial for us to get some ambassadors on our side [the business], because we want that, but IT has to take the initiative” - Victoria

The business and IT does not really understand each other’s objectives, as they differ. The parties do not communicate much and they perceive that it creates a gap between IT and business. They are working towards different goals, like two different organisations, instead of working together. (Victoria; Robin; Observations) According to the employees there is a need to start working together against a common goal, and focus on one thing. The executive board is involved in the IT within the organisation, but the business as a whole is not. Scania has launched an initiative where they arrange field trips where IT meets with the business to talk and create a better understanding of their respective operations. The thought was that a better understanding of each other’s operations would be beneficial for the collaboration between units. The aim was for each unit to make four visits a year but during the first year no unit came close to that, hence expectations were lowered to one or two visits a year. (Victoria; Robin; Barney; Marshall)

4.4 Overview of the empirical findings

The table below summarises how SOA governance mechanisms support or do not support the different constituents of SOA. The support is illustrated as Strong support, Support, Limited support, Does not support, and No evident support. Strong support means that the empirical data indicates strongly that the SOA governance mechanism support the constituent in that context. Support indicates that we have found empirical evidence that the SOA governance mechanism
support the constituent. *Limited support* indicates that the SOA governance mechanism support the constituent, however it is limited. The levels of support is also colour coded with different shades of green, showing what degree of support it provides. *Does not support* is colour coded in red and is referring to that the SOA governance mechanisms do not support the constituent at all. Finally, *No evident support* is colour coded with blue and indicates that we have not found any empirical findings that can be used in this context.

<table>
<thead>
<tr>
<th>Structure</th>
<th>Business</th>
<th>Organisation</th>
<th>Method</th>
<th>Application</th>
<th>Architecture</th>
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<td>Strong support</td>
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<td>- New roles and responsibilities</td>
<td>Does not support</td>
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<td>Strong support</td>
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<td>Processes</td>
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<td>Strong support</td>
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Table 5. Summary of SOA governance mechanisms support of different constituents of SOA.
5. Analysis

This chapter presents the analysis, which is based on different themes that stem from the theoretical framework but have been adjusted accordingly the empirical data. The themes are relevant in explaining which SOA governance mechanisms do or do not provide support for different constituents of SOA. The analysis will look into each part of the governance mechanisms as well as take a more holistic view to summarise the mechanisms effect on different constituents of SOA.

5.1 The strategic significance and limited support of the steering committee

The governance mechanism of structure at Scania illustrates both similarities and differences regarding how governance mechanisms support different constituents of SOA. The establishment of a centre of excellence, at Scania called the steering committee, provides limited support for all different constituents of SOA. We argue this is because the steering committee is on such a high organisational level separated from the daily tasks of the vast majority of employees. The committee operates on a more strategic level, making the support of the committees actions visible long-term rather than tactically. In contrast to Joachim et al. (2013) who suggested that the centre of excellence should be comprised by owners of different business domains, IT and SOA experts, the steering committee at Scania is only comprised by IT and SOA experts. This might hamper the business and IT collaboration that is necessary in order to realise business requirements through SOA. This indicates that the involvement of business owners in the committee would be beneficial to get more support from having a centre of excellence. If that was the case, it can be argued that the steering committee could have a greater impact and support the constituents of SOA in a greater extent.

Schepers et al. (2008) argues that the role of the steering committee is to define best practices and educate employees about SOA. This is not done today as Scania lacks best practices, education and overall rules guiding SOA. The theoretical aspects of the steering committee as described in the theoretical section would all provide support for Scania if they were present and implemented correctly. Instead, employees perceive the steering committee to be of best use functioning like it does today, as they would hinder employees in their daily work if they were more involved. This might have to do with the strong autonomy at Scania, where employees feel that strategic guidance is more important than tactical.
5.2 Standards + policies = success?

Inconsistency is a major topic that we have discovered during our observations and interviews. Scania is a company with traditions of high employee autonomy, but in order to be successful with SOA they have recognised the need to limit the decision rights of every individual. In spite of this insight, Scania has failed to create comprehensive standards and policies related to SOA. The empirical data reveals differences regarding how the constituents of SOA are supported by the presence of standards and policies. The strongest empirical support of governing standards and policies is found in the technological constituents of SOA; application, information, infrastructure, and architecture. In line with the theories from Lee et al. (2010), Bieberstein (2005) and Vegeter, (2009) who argues for the need for consistency regarding technology, all these constituents of SOA need to ensure compatibility, consistency and have control over their part in SOA at Scania. Therefore, imposing standards and policies is absolutely vital for their operations to be successful. This finding is in line with Marks (2008), who argues that imposing SOA-related technological standards is the single most important output of imposing standards. According to Marks (2008), these standards and policies should not only cover the technological standards but also the business and organisational aspects of a SOA, and should include the organisation and processes needed to guide the business success of a SOA. The important outputs of standards and policies are that they can unify how people work, create less confusion and increase efficiency of SOA. Hence, the empirical data indicates that the technological constituents of SOA; application, architecture, information and infrastructure, are largely supported by governance of standards and policies.

In contrast, the business, method and organisation constituents of SOA are all guided by less standards and policies than the more technological constituents of SOA. The empirical data indicates that the business, method and organisation constituents of SOA would acquire support from increased governance of standards and policies, as the empirical data suggests that people working in different ways is creating confusion which is leading to inefficiency. This is the opposite of arguments provided by Abdi (2010) and Rathfelder and Groenda (2008), who claim that everyone has to use the same SOA-principles and methods. As this is highly important for the method constituent of SOA, it is likely that the method constituent of SOA would benefit from more governance of standards and policies. Further, as the organisational constituent of SOA deals with transforming employees’ behaviour favourable to SOA (Rathfelder & Groenda,
2008), their behaviour has to be governed. In doing so, the support of standards and policies can have great positive implications.

Scania has a culture of independence and autonomy, and has to balance the implementation of standards and policies with employees’ independence. If Scania completely minimises the autonomy, the risk that employees become inefficient, as their motivation suffer. Hence, even though it is evident that all constituents of SOA are supported by standards and policies, there is a difference between how strict they should be, whereas the technological and organisation constituents of SOA demands higher governance than the business and method constituents of SOA. The differences can be due to the high degree of autonomy at Scania, which suggests that organisations that have a history of strict governance might have better prerequisites to implement SOA, as the accompanied limiting of freedom is not as extensive.

5.3 The establishment of new roles and responsibilities

The theory on SOA governance identifies the steering of new roles and responsibilities as an important factor. Marks (2008) and Vegeter (2009) argues that clarifying purpose, defining roles and responsibilities and establishing clear accountabilities for decisions and actions are among the most important aspects of SOA governance. The empirical data shows that all the constituents of SOA, except business, would be supported by having clearer and better defined roles and responsibilities. The business is not supported as they care about getting things done, and when a need arises, they contact IT to help them execute what they want. Hence, they do not need to know about the new roles and responsibilities created by the shift to SOA. After implementing a new organisational structure where units were shattered and with the expansion of the SOA centre, employees does not fully understand their role and responsibilities, how they go about to make decisions or their relation to other stakeholders. While managers suggest descriptions are present at the intranet, they are not anchored within the organisation. Hence, the support provided by governance mechanisms, such as standards, policies and roles and responsibilities, is dependent on how anchored and enforced they are within the organisation.

The lack of clearly defined roles makes employees perform multiple roles which they do not have time to perform, and work becomes inefficient as they do not know who decides what. In line with this empirical finding, Rosen et al. (2012) argues that organisations often find
themselves assigning multiple roles to one employee, which indicates that the organisational and role structure is in fact vital for successful SOA. Hence, the organisation constituent of SOA is strongly supported by governance of new roles and responsibilities. This, again, might have to do with the high levels of autonomy within the organisation, which might have worked in the past but is creating issues in the context of SOA. The method constituent of SOA is often more involved in projects where they decide what has to be done and how, whereas the technological constituents execute the work.

In the projects the roles are decided on a project basis for the involved parties, and hence does not require the same support and governance of roles and responsibilities. Stakeholders from the technological constituents of SOA find themselves being outside the projects core, which might require roles and responsibilities to be clearly defined as bottlenecks can be formed if they cannot perform their work due to lack of knowledge of what to do or who to talk to. This does not happen often, but the empirical data suggests that governance of roles and responsibilities would support these constituents, although the support is limited. To summarise, the organisation and method constituents of SOA are supported by governance in a higher extent than the other constituents, even though they also acquire support. The technological constituents of SOA get limited support by this governance mechanism.

5.4 Increase the likelihood of goal achievement by establishing processes for creating and enforcing policies

The governance mechanism of process at Scania illustrates both similarities and differences regarding how governance supports different constituents of SOA. Regardless of constitutional belonging, employees lack established and communicated processes for how to create and enforce policies, and when someone wants to formalise something it is done on an ad-hoc basis. One reason for policies not being enforced is that there is a general view that they are good to have rather than rules to follow. As a result, people always question them, which can be argued to derive from the strong individual autonomy within Scania. If the employees want to go in a direction that is contradicting the policies, they will find a way to go around them, without any reprimands. Policies related to business, organisation and method are less enforced than the ones related to the information, architecture, application and infrastructure constituents of SOA. This
might stem from the fact that there is less inherent freedom related to the technological constituents of SOA, as the output has to be compatible with the overall SOA.

According to Lee et al. (2010), stakeholders and groups have to use the same well-defined methodologies, to make sure everyone involved in the process use service-oriented principles. The empirical data suggests that lack of enforcement of policies creates a fuzzy working environment as the employees are working in different ways and in different directions. This indicates that the method constituent of SOA would benefit from establishing processes for creating and enforcing policies. By doing so, Scania would take action towards creating an environment where people’s work becomes more predictable, consistent and transparent. A major part of standards and policies in relation to the organisation constituent of SOA is to transform behaviour favourable to SOA (Rathfelder & Groenda, 2008). Therefore, if there is no process to make sure policies are being obeyed, the behaviour will not change. Hence, governing the creation and enforcement of policies would provide support for the organisation constituent of SOA.

The empirical evidence implies that creating and enforcing policies is more important in the more technical constituents of SOA, as inconsistency can create a fragmented technological environment and counteract interoperability. This is in line with Lee et al. (2010), Rosen et al. (2012) and Biberstein et al. (2005) who all advocates for consistency in the technology related to SOA. Hence, it is of great importance to have processes to make sure the right policies are created, as well as enforced. We argued earlier that the technological constituents of SOA would be strongly supported by the creation and standards and policies. Having processes for their creation and enforcement is therefore also of the essence. The empirical findings indicates that there is a need for stronger policy enforcement through all constituents of SOA, even though the policies are enforced somewhat more frequently in the information, architecture, application and infrastructure constituents.

The way policies work within Scania is the direct opposite to the theories of Biske (2008), who argues that its imperative that successful SOA has processes for the creation and enforcement of policies. Policies will be useless unless there are processes for their enforcement. In other words, the theory and the empirical data implies that Scania would be more successful in their SOA
implementation if they establish and communicate processes for the creation and enforcement of policies. In spite of the evidence, Scania has come quite far in their SOA journey, increasing its reuse on a regular basis. This suggests that even though an organisation is unsuccessful according to Biske’s (2008) theories, they can still produce SOA and collect the benefits. The question then becomes what Biske (2008) deems as successful, and how far organisations can really develop and implement SOA without processes for creation and enforcement of policies. In interpreting the empirical evidence in contrast to the theory, one can argue that organisations can implement SOA without the presence of policies and standards, and processes for the creation and enforcement of the likes. However, without them, organisations will likely not be as successful, it will likely not be as efficient and it will not be as cost-effective. Therefore, having processes for the creation and enforcement of standards and policies can have positive effects on both reuse and cost-efficiency, which are two of the biggest benefits with SOA.

5.5 The importance of IT and business communication

There is a psychological and physical distance between business and IT, which arguably stems from the business caring about what functions they get and not about how it is done or by whom. As a result, the communication between IT and business is limited, at best. During our interviews with the business respondents we have discovered that SOA centre operates in their own bubble leaving the business stakeholders unaware of what they are doing, and how far they have come in the implementation process. Joachim et al. (2013) argues that when communication between IT and business employees is facilitated and good, SOA is more likely to succeed in fulfilling business demands due to reduced problems and misunderstandings. In line with this, Biske (2008) suggest that processes should ensure communication among SOA stakeholders, both within and between business and IT. With no communication formalised between IT and business at Scania today, it leads to misunderstandings and in the long run the end result will likely suffer, as there is no communication process to bring the parties closer together. It does not matter that some employees within IT involve the business, it has to be formalised, enforced and become a part of how employees work. Communication within IT and the SOA centre is adequate even though it is not formalised extensively. As employees from multiple constituents of SOA work together within an office they communicate on a regular basis and does not need processes to ensure they do.
Biberstein et al. (2005) argues that there must be an explicitly defined relationship between IT and the business units, to ensure realisation of the benefits associated with SOA. To conclude, there is evidence that employees want more communication, regardless of constituent of SOA, and processes to ensure communication between IT and the business could definitely be a valuable support in the implementation of SOA for all constituents of SOA. The empirical data suggests that this is more important for the business, organisation, method and architecture constituents of SOA, than for the application and information constituents. This goes in line with the theories of Arsanjani and Holley (2006), who argues that the business must establish good communication with each other and IT stakeholders. We argue that the support of communication processes is strongest for the business, organisation, method and architecture constituents, because they are involved in an earlier stage in projects, where communication with business stakeholders is more frequent. No evidence was found as regarding how governance of IT and business communication would support the infrastructure constituent of SOA. Therefore, the application and information constituents of SOA receive limited support from this governance mechanism, as they usually communicate with IT stakeholders based upon what has been decided earlier in the project process. Communication for the application and information constituents is therefore more with IT stakeholders than business. In spite of this, it does not mean that they do not benefit from communicating with the business, as they sometimes need to ask business stakeholders if what they are doing is in line with the requirements they had. This somewhat contradicts the theories of Arsanjani and Holley (2006), Biberstein et al. (2005) and Biske (2008), as it shows that communication between IT and business does have to not include all IT stakeholders.

5.6 Education - a key aspect tying SOA governance together

Biske (2008) and Rosen et al. (2012) argues that it is often a big challenge for IT to convince the business to think long term and focus on services rather than buying a solution of the shelf. This problem is often rooted in the enterprise wide change of mindset required to realise SOA. In line with the theory, one of the biggest obstacles facing SOA at Scania is getting stakeholders around the organisation to understand the mindset of SOA, to think and strive for reuse. The problem is augmented by communication being limited between IT and the business, the individuals’ autonomy and the lack of obedience to policies. As different units make their own purchases, asides from the centrally funded services built on the SOA centres own initiatives, they will not
build SOA unless they have to or understand the benefits. This is a major issue as the business stakeholders are only interested in functionality, and are usually the ones that initiate projects. If they knew and understood SOA, it is more likely that they build SOA. The business constituent of SOA is critical in relation to the educational processes, as the business are the ones that have to understand SOA in order for it to spread within the organisation, making it top of mind as the solution of new projects. To conclude this reasoning, the empirical data is in line with the Biske (2008) and Rosen et al. (2012), indicating that the business constituent of SOA would largely be supported by education about the mindset of SOA.

Having processes for education is important, as none will exercise desired behaviour unless they understand the mindset or get forced to. According to Biske (2008) educating this mindset is vital and will carry multiple benefits, not only will more services be created resulting in higher reuse and resource efficiency, but policies will be easier to enforce because the staff will be willingly and not forcibly compliant. Educating employees about SOA will also make them see how different units can create joint services from common information needs and in the end reduce IT-related costs. However, since education about SOA is low or non-existent within Scania, they fail to reap the benefits and instead keep struggling with getting better traction within the organisation. The empirical data suggests that the benefits of education would carry tremendous weight for Scania and would aid significantly towards the goals of higher reuse and lower costs of IT. Today, Scania has the technological knowledge to successfully build SOA and people are hired because of their knowledge within the area, which is enough for them to perform their job. Nevertheless, the educational aspect is vital regarding the architecture and information constituent of SOA since they are key in terms of SOA. This is mainly because solution architects are a part of every project and are usually the ones that decide whether to build SOA or not. Further, the information constituent of SOA would also be supported, as employees have to understand the relationship between information and create services with consistent definitions and terminology.

Concerning the organisation constituent of SOA, education regarding the roles and relationships previously described can be highly beneficial to avoid confusion and make work more efficient as less time is spilled on irrelevant tasks or trying to locate others that might be able to help. The empirical data is in line with Bieberstein et al. (2005), who argue that the roles and
responsibilities have to be clearly defined in order for SOA to be successful. This indicates that educational processes as well as the governing new roles and responsibilities support the organisational constituent of SOA. This notion is further augmented by the understanding of SOA, which would arguably aid in transforming the behaviour of the employees, described by Rathfelder and Groenda (2008). Hence, creating educational processes would provide great support for the organisation constituent of SOA.

5.7 Getting the right people to acquire the right skills and the right training
Cutting costs is one of the main arguments with SOA, but the lack of knowledge of roles and relations, and clarity of purpose and intent can make the development process lengthy and costly. This is highly related to the educational aspects previously described in this chapter. As the shift to SOA is not only a change in technology, but also structures, processes, tasks and overall mindset; preparing for, communicating and reinforcing the change is vital. People are at the centre of it, and we have already declared that it is the people rather than the technology that is the most complex issue. Therefore, organisations have to make their employees understand everything related to SOA, and make sure they possess the right skills to be successful. The empirical evidence suggests that SOA education and training are central, and is highly related to the success and support from other SOA governance mechanisms. For example, understanding the mindset, standards, policies, roles, and relations will not be achieved without educating stakeholders about what applies within the organisation, followed by why and how. This underlines how SOA governance mechanisms are intertwined and organisations have to make sure to identify the best governance structure for their organisation and their constituents of SOA.

The empirical evidence further suggests that training is important through all constituents of SOA, except infrastructure, as we did not find any empirical evidence regarding that constituent. The skills of the technological constituents of SOA are considered being a prerequisite to get hired within the organisation. However, as mentioned before it is vital that these employees know and understand SOA. For example, the solution architects will not build SOA unless they do not possess the skills to do so. Today, many lack these skills, and as a result many architects do not feel comfortable with SOA. Furthermore, unless the application developers know how to build services, the end result will likely suffer and time and money will be spent in vain. SOA is
driven by the business, which means that if the business constituent of SOA acquires more training and knowledge about how SOA works at Scania, they will also understand the benefits. Consequently, governance of training and skills support the business, as the increase of training will empower the employees to take the initiative to build SOA more often. Furthermore, the method constituent of SOA receives the same support as the business. Abdi (2010) and Rathfelder and Groenda (2008) argued that organisations have to ensure everyone uses SOA-principles. Acquiring the skills to use these principles and methods is therefore important. The empirical data suggests that if people at Scania possessed skills and used SOA-principles, they would avoid confusion and work would be more consistent.

5.8 Collaboration is essential but not required for everyone

Abdi (2010) argues that the collaboration requires that the senior business management take a different approach towards IT, and devote certain amount of time trying to understand how IT is used in their business. In line with Abdi (2010), Scania has realised the need for IT and business to collaborate, which can be seen by the efforts where IT and the business make field trips to each other, in order to gain an understanding of each other. However, these efforts are not working, as Scania nowhere near reached the number of visits they set out to reach. As employees feel that IT and the business are working against separate goals with limited collaboration today, it shows that governance of the IT and business collaboration would support Scania in its implementation of SOA. Biske (2008) means that IT and the business have to collaborate to maximise the value of SOA, and that the new character of the relationship between IT and business brought about by SOA needs support by governance, to facilitate the relationship.

Governing the process of how IT and the business collaborate could possibly reduce the gap that is perceived between the parties today, by creating a common understanding of each other’s operations. The facilitation of collaboration between the parties is rare today, and is made on a project and ad-hoc basis. As of today where IT views their collaboration with the business as “going there and fighting the battles”, there are great possibilities to improve the relationship. With projects paying for solutions IT often find themselves obeying to the business demands. If collaboration would be established it would arguably be easier to make good SOA solutions, especially if the business stakeholders understand SOA. As discussed in the previous section,
education is a major part of other SOA governance mechanisms as well. For example, facilitating IT and business collaboration would be much easier if people were educated about SOA, possessed the mindset, and saw the bigger picture. This does not relate as much to the application, information and infrastructure constituents of SOA as the business, organisation, method and architecture constituents. As the empirical data shows, the latter constituents of SOA are involved in earlier phases of the development process, which demands more collaboration in order to decide how to realise business requirements through SOA. The output of the collaboration is usually specifications of what the more technological constituents of SOA should do. This is in line with our reasoning regarding the governance mechanism of IT and business communication, as it is closely related to IT and business collaboration.

Bieberstein et al. (2005) argues that there must be an explicitly defined relationship between IT and the business in order to realise the benefits associated with SOA. Further, Lee et al. (2010) and Rosen et al. (2012) argues that the method constituent of SOA would benefit from different stakeholders and organisational units collaborating to ensure the use of consistent methods. Hence, the empirical findings are supported by theories from Bieberstein et al. (2005), Lee et al. (2010) and Rosen et al. (2012), showing that governance of the collaboration between IT and the business supports the business, organisation and method constituents of SOA. This is, in a higher extent than application, information and infrastructure of SOA. Furthermore, that does not mean that more IT and business collaboration in terms of the technological constituents of SOA would not be beneficial. The most evident support in this case is for the constituents of business, organisation, methods and architecture, which can also be due to the operational model at Scania, and it is possible that the support of the IT and business collaboration governance mechanism would be different in another organisation.
6. Conclusion

This chapter will present a concluding remark about the thesis, taking the aim and the purpose into account. The purpose of the study was to investigate established SOA governance mechanisms in a large organisation in order to explain implications of governance in a SOA context.

6.1 Which SOA governance mechanisms do or do not provide support for different constituents of SOA?

We have found that the decision making body provides the same limited support for all constituents of SOA. When it comes to the governance mechanism of creating standards and policies we can conclude that the technological constituents of SOA are strongly supported, and the more soft constituents, business, organisation and method, are also supported but not in the same extent as the others. The business constituent of SOA is not supported by the governance mechanism of new roles and responsibilities, which is opposing the organisation and method constituent, as they are strongly supported by having a structure for new roles and responsibilities. We have found that this governance mechanism provides the same limited support for all the technological constituents of SOA.

Having processes to create and enforce policies provides support for all constituents of SOA. Application, architecture, information and infrastructure are supported in a higher extent than the other constituents of SOA. The governance mechanism of establishing processes for IT and business communication provides support for the business, organisation, method and architecture constituents of SOA, while it provides limited support for the application and information constituents. The governance mechanism of educational processes provides strong support for the business, organisation, architecture and information constituents of SOA. Educational processes provide limited support for the application and method constituents.

We have found that the SOA training and skills provides strong support for the application, architecture and information constituents of SOA, while it provides support for business, organisation and method. The business, organisation, method and architecture constituents of SOA are supported by the governance mechanism IT and business collaboration, while application, information and infrastructure are limitedly supported.
6.2 Is there a difference between how SOA governance mechanisms support technical vs. non-technical constituents of SOA?

The support from SOA governance mechanisms differs between technical and non-technical constituents of SOA, besides the support of the decision making body. The differences are most evident for creating standards and policies, having processes for policy creation and enforcement, having processes for education and SOA skills and training. These governance mechanisms all support the non-technical constituents of SOA, but they strongly support the technical constituents of SOA. When it comes to softer SOA governance mechanisms, such as IT and business communication and collaboration, and governing new roles and responsibilities, the non-technical constituents of SOA are supported in a higher extent than the technical constituents. The only anomaly is the architecture constituent of SOA, which tends to be important in all SOA governance mechanisms.

6.3 Is there any SOA governance mechanism that is more important than others?

The most important SOA governance mechanisms are the creation of standards and policies, the enforcement of standards and policies and facilitating SOA training and skills. These SOA governance mechanisms all show strong support for at least three constituents of SOA, and support for at least three. Further, SOA education shows strong support for four constituents of SOA, and limited support for two constituents of SOA, and is therefore also highly important.

6.4 Is there a relation between the SOA governance mechanisms?

There are clear relationships between the SOA governance mechanisms, and very few will work adequately without the presence of others. For example, creating standards and policies will not create any value if there are not processes to enforce them. Further, there will be no collaboration between IT and business unless there are processes to govern the communication between the parties, and vice versa. Another example is that without education to make sure employees understand the SOA mindset, it will be useless to train them and spend time and money to ensure they acquire the right SOA skills. This illustrates how SOA governance must be approached holistically and that it should be approached as a package, rather than independent mechanisms.
7. Discussion

This chapter presents a discussion about the implications of the results, the limitations of the study, and proposal for future work.

7.1 Empirical contribution: implications for academics and practitioners

The result of this study, in spite of the difficulties regarding generalisation of the result, carries potential weight for both academics and practitioners. As far as we know, there has never been a study identifying not only which SOA governance mechanisms are important, but also where in the context of SOA these mechanisms are most beneficial. The general view among both practitioners and academics is that SOA governance should be implemented everywhere when shifting towards a SOA, as it is the single most important factor affecting the outcome of SOA initiatives. By illustrating which SOA governance mechanism supports which constituent of SOA, we have filled in the blanks of the treasure map discussed in the introduction to this thesis. Our results will possibly aid organisations in determining the suitable SOA governance structure for their organisation. We show organisations not only that SOA governance is important, but also what governance mechanisms are, and where in the context of SOA they should be applied. These results should not be regarded as a truth; rather, they should be viewed as an indicator of where organisations should put emphasis in their efforts to set an adequate governance structure. Organisations are heterogeneous beings, and none look like the other. We have created the map, now it is up to whoever finds it to interpret and translate it to adapt it to their context.

7.2 Theoretical contribution: implications for academics and practitioners

SOA governance is considered crucial and it will remain so. The starting point of this thesis was the lack of concrete frameworks of where to apply SOA governance in the context of SOA. To us, this was a great frustration. We wanted to be able to break down SOA into its constituents, which was when we turned our heads to SOA maturity models. SOA maturity models, as described earlier in the thesis, incorporate all the important aspects of SOA. Therefore, we saw the possibility to apply SOA governance mechanisms to the constituents of SOA incorporated in the SOA maturity models. As it turns out, it works. By using our theoretical framework, academics and practitioners can get a holistic yet detailed view of SOA, and use the framework to identify suitable governance structures for organisations, in accordance to their context and culture. Further, with the business climate of today where IT functions are outsourced, the model
can be customised to incorporate the constituents of SOA that the organisation in fact has to govern. Users can also incorporate more SOA governance mechanisms if they feel it is beneficial for their purpose. To sum up, the theoretical contribution of this thesis is immense, as we have created a model that is novel and useful, and can be customised to fit different organisations in different contexts.

The result of the study is clear; SOA governance is important, and we have discovered that SOA governance mechanisms should be applied differently in different parts of SOA. We also illustrated how these governance mechanisms are intertwined and that efforts to implement one mechanism can be useless without the presence of others. However, an interesting question that arose during our case study was whether the presence of SOA governance mechanisms could counteract the effects of other mechanisms. For example; establishing a powerful decision making body that is involved in the daily operations could make employees feel that they do not need to know about the roles and responsibilities of others or collaborate with IT/business, as the decision makers will delegate tasks. Hence, the decision making body could possibly affect other governance mechanisms negatively depending on its mandate and involvement in the daily operations. Further, too much training and education could make employees feel that they are the best at what they do, and therefore choose not to consult others about important matters. Hence, this could inhibit the SOA governance mechanisms of IT and business communication as well as IT and business collaboration. It could also have negative effects on the obedience to policies or standards, as employees might feel confident in that their way is the best and that the policies and standards are wrong. As a result, consistency throughout the SOA governance initiative is needed to make sure that all the efforts are aligned and sends the same message.

7.3 Limitations

Our empirical data suggested that there is a strong autonomy at Scania, and the employees are used to have the power to make decisions on a regular basis. We believe this stems from the company’s culture, as everyone we have interviewed have expressed their own view of decision making within Scania. Since there is a lot of autonomy, it might have contributed to us seeing more of the lack of governance instead of its presence. In comparison to a company with a more strict culture and a lot of governance, we maybe would not have seen governance as a strong influence on the success of SOA.
Our empirical findings include observations and 18 interviews. These are conducted only on people working with, or with a relation to SOA. Since there are more people involved in the SOA process that are affected by, or related to SOA, there can be other important people that could have had an impact on our results. During our interviews and observations, we got a holistic view of who the key people that could contribute the study were. Therefore, we consider our collected data to be sufficient in order to draw conclusions about how the different governance mechanisms support SOA at Scania. Further, we have conducted a single case study; hence we have only been studying one company. It is therefore difficult to generalise our results to other companies, as there are factors such as culture, amount of employees, access to employees, etcetera that might have affected the outcome of our study.

The theoretical model was used at Scania, which might have implications on the result. One possible problem could have been if not all the constituents of SOA were present within the organisation, which could have limited the use of the model. For example, if IT functions were outsourced it would not have allowed us to gather data related to all constituents. This was not a problem as all Scania’s IT functions are in-house. All constituents of SOA were present within the organisation, and we had access to employees representing them. The abductive research approach of this study allowed us to be certain that the model was going to work in this specific context. One factor that might affect the use of the model is Scania’s corporate culture, informal procedures, relationships, power structures and the likes, that will differ between organisations hence making the use of the model different between organisations. We do not see this as an issue, as the same factors will affect the use of any model in any organisation.

### 7.4 Future work

Given that this study was performed on a single organisation it would be interesting to see the results in a study on multiple organisations. The result of this thesis suggests that both SOA as a function within organisations, and well as SOA governance can be broken down into components. By doing so, we can leave the discussion of the importance of SOA governance, and instead focus on where in organisations it is important and what factors affect how it should be applied. For example, it was clear to us that we made the study in an organisation with a bottom-up structure and with an extremely independent culture. It would therefore be interesting
to see how factors such as culture and previous structure affects the support of which SOA governance mechanisms.

The reasoning above in 7.2 are theories of speculative character, however, these speculations occur since there is not scientific evidence proving that SOA governance mechanisms do not have a negative effect on other SOA governance mechanisms. Hence this illustrates a possible area to study. As our study shows that SOA governance mechanisms should be applied differently relation to the constituents of SOA, it is important to know whether the implementation of specific SOA governance mechanisms can have a negative effect on the presence of other mechanisms. This is an important area to study, and we believe what has been discussed in this chapter are the steps needed towards identifying the implications of SOA governance in a SOA context.
References


Appendix 1 - Interview template

Questions related to the constituents of SOA

Business

1. What are the major business drivers for this initiative?
2. What is the business vision and goals, and how are these related to what IT is currently doing?
3. Is your current Business Process Architecture formally defined, documented, and governed?
4. Is your Business Process Architecture complete and up-to-date?
5. How are metrics for return-on-investment measured in Business Process Management (BPM)?
6. How agile are your current business processes?
7. What are the current funding practices?
8. What is the current cost model?
9. Who owns the portfolio of processes, applications, and services?
10. Do you have a cost model to charge service consumers for the use of the service?
11. How do you currently define the total cost of ownership (including software, hardware, and future maintenance)?
12. What level of partnership exists between the business stakeholders and the IT stakeholders?
13. How are business service levels measured currently?
14. What is the current practice to transform business SLAs into IT SLAs?
15. Do you have a formal enterprise architecture?
16. Do you have formal governance of your enterprise architecture?
17. Do you have multiple lines of business? Do they need to have their own business processes?
18. Do your lines of business use a common information model? Is the data shared or replicated?
19. Do your lines of business share customers, suppliers, or partners?

Organisation

1. What types of skills are common in your IT staff?
2. How does IT governance relate to your SOA?
3. How is the IT governance related or aligned with the SOA, enterprise architecture, and the organisation’s governance?
4. Do SOA governance processes exist, are they documented, and, if so, are they used for services at design time and run time?
5. Is the interaction between organisations involved in the SOA process defined with clear roles and responsibilities?
6. What are the governance functionalities and responsibilities?
7. How would you describe your IT cost model?
8. What type of SOA training is available in your IT organisation?
9. What is the relationship between the organisation’s development team and the infrastructure team?
10. What SOA and governance authorities exist?
11. Do the organisation’s SOA solutions cross organisational boundaries? Internally? Externally between business partners?

Method

1. What are the current application or systems requirements elicitation and requirements management practices?
2. What design methodologies and best practices are you currently adopting?
3. Do you practice any SOA design techniques?
4. What design tools are in practice today?
5. What is the current practice for service development and management?
6. What is your current project management framework?
7. How is IT project management organised?
8. What are your organisation’s current QA processes?
9. Do you have an active community that works to evolve your SOA methods and practices?
10. Has your organisation developed a repository for best practices and asset re-use?

**Application**

1. What is your current application development style?
2. How common is re-use in your organisation?
3. What types of re-use do you engage in and how is re-usability measured?
4. How are your organisation’s applications/systems integrated?
5. What types of languages does your organisation use?
6. What types of integration technologies have your organisation employed?
7. How is business logic represented within your organisation’s applications?
8. How reliable are your organisation’s business-critical applications?
9. How widely is XML used in your organisation? How sophisticated is its use?
10. What is the rate of change and required time-to-market of your current applications?
11. Are SOA-enabling technologies, such as ESB, shared data environment, or registry, being used?

**Architecture**

1. How would you characterise your architectural topologies?
2. What type(s) of data repositories does your organisation utilise?
3. What is the standard communication style in your architecture?
4. How is integration achieved in your architecture?
5. What methods do you use to develop your architecture?
6. How mature are your services implementations?
7. How extensive is your SOA?
8. What architectural principles define your approach?
9. How extensive and sophisticated is your organisation's use of frameworks in your architecture?
10. How are architectural decisions made in your organisation?
11. Does your organisation use reference architectures?

**Information**

1. Is there a common data model across all applications?
2. Are there independent data models for different applications?
3. Are mapping rules used to convert between different data models?
4. Is there difficulty in moving data from one application to another? For all applications? For only some applications?
5. Does your organisation have a common data model, (or mappings between multiple datamodels)? How is this defined? By programming objects in APIs? By XSD schemas? By
written documents? By other computer-based modelling tools? By other non-computer based modelling tools?

6. Are the data models in the form of Business Object Models, understandable to and owned by, the business, or as IT object models, understandable only to, and owned by, the IT teams?

7. If there are mapping rules across different models, are these understandable to and maintained by the business or by IT staff? Are such mapping rules performed by the infrastructure?

8. Are the data models defined by a language that includes taxonomies, ontologies, or other high-level logical representations?

9. Do you maintain a global directory or database of data objects, with global identifiers? Or do you have mechanisms for mapping these objects between different databases/directories? Are these mechanisms electronic or manual? Are all such objects mapped, or is this done only for certain applications and sets of objects? Are these mappings undertaken automatically by the infrastructure?

10. Do you have mechanisms for looking up global objects by searching on their characteristics?

11. How is the transformation of data between applications achieved? Is an ESB used to perform the transformation? Is this achieved by bespoke adapters as required? Or via a comprehensive set of APIs? Or by calling a service?

12. Are there facilities for performing complex inference in order to map data defined in ontologies from one form to another? Does a master data service exist?

13. Does your organisation have or are you developing a Business Information Model to standardise data and message formats and concepts across the enterprise?

Infrastructure

1. What are your current infrastructure usage guidelines?
2. How are your IT SLAs derived from the business SLAs?
3. Have you defined SLAs around quality-of-service? How is this monitored and measured?
4. Have you defined any SLAs around security and privacy? How is this measured and monitored?
5. What level of monitoring is in place today? What management tools are in place today?
6. What platforms are currently in use for integration?
7. Which assets are placed under version control?
8. What is your current change management process?
9. What tools are used for configuration management?
10. What are considered as your organisation's IT assets (excluding human resource)? How are these assets managed?
11. What does your current operational architecture look like?
12. How does your operational architecture support the non-functional requirements for applications and services?

Questions related to the SOA governance mechanisms

1. We would like to start off by discussing the steering committee
   - Do you believe the committee fulfils an important function? If yes, how? If no, why not?
   - How do you think the steering committee aids Scania to realise SOA?
   - Does the steering committee simplify your work with SOA? If yes, how? If no, why not?
   - Tell me about a situation where the steering committee simplified your work?
   - Tell me about a situation where the steering committee hindered your work?
2. Describe your view of the standards and policies currently in place to govern SOA?
- Are there too many, or too few? What are the risks with having too many/too few standards and policies?
- What functions do they perform?
- What does the lack of following standards and policies lead to?
- Does the policies at Scania help the organisation to realise its goals with SOA?
- Do you follow the standards and policies in place today? If yes, why? If no, why not?

3. How are new policies created?
- Are there processes that you have to go through to create them?
- Who proposes new policies or standards? Can anyone do it?
- How are policies and standards communicated to the stakeholders that are affected by them?

4. Tell me about roles and responsibilities regarding SOA.
- Are they clear? If not, what does the lack of clarity lead to?
- How does Scania ensure that employees within SOA possess the right knowledge of their role and the accompanied relation to other parties?
- If not, what does it lead to?

5. How does Scania ensure that everyone working within SOA possess the right knowledge and skills?
- Do you think it is important to further educate people within SOA? Why/why not?
- Is there any process to educate people about SOA?
- Is there any area related to SOA where education is more important than others? For example; developers, business etcetera.
- How does Scania work to get the organisation to understand the mindset of SOA? If yes/no, what does it lead to?
- Is there any form of knowledge exchange taking place between business and IT? If yes, how? If no, why not and would it be beneficial?

6. Can you describe the collaboration between IT and the business at Scania
- How does Scania ensure that the SOA-centre and the business are collaborating towards SOA?
- Are there formal meetings, processes or the likes? If not, what does it lead to?
- Who are most in charge when it comes to SOA, the business or IT?
- Have decision rights been delegated to the right positions? If yes/no, what are the consequences?
## Appendix 2 - Respondent information

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<tr>
<th>Title</th>
<th>Number of respondents</th>
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<tr>
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<td>III</td>
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<tr>
<td>Business architect</td>
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<td>II</td>
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<tr>
<td>Integration and information architect</td>
<td>I</td>
<td>III</td>
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<td>Group manager Solutions &amp; Strategy</td>
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<td>II</td>
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<tr>
<td>Solution architect</td>
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<td>Group Manager and Product Manager Fleet Management</td>
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