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FACTORS TO SUCCEED WITH SOA

*Shared Experiences from Five Organizations moving towards a
Service-Oriented Architecture*

JENNY FRANZÉN



IT UNIVERSITY OF GÖTEBORG
CHALMERS UNIVERSITY OF TECHNOLOGY AND GÖTEBORG
UNIVERSITY
Göteborg, Sweden 2008

Critical Factors to Succeed with SOA – Shared experiences from SOA Implementations

JENNY FRANZÉN

Tutor: Faramarz Agahi

Examiner: Agneta Ranerup

Department of Applied Information Technology

IT-University of Gothenburg

Chalmers University of Technology & Gothenburg University

ABSTRACT

INTRODUCTION:

“By the end of 2007, Forrester expects to see 75% of Global 2000 firms implementing SOA...”

PROBLEM:

“Implementing SOA” and “Broadly adopting SOA”, almost makes it sound as easy as pushing a button. Perhaps “the long journey of gradually moving towards a SOA” would have been somewhat more suitable. After all, as in any extensive change obstacles are likely to arise down the road. Getting carried away, and go shopping your very own “SOA toolbox” may be tempting, bearing in mind the combination of SOA and web services are being marketed as the silver bullet companies have been looking for to magically solve all business issues of today. But even though SOA is expected to provide potential benefits of reduced IT costs through reuse of services and greater business agility, many researchers remain sceptical, saying there are valid doubts about such claims. By unfolding critical success factors in SOA implementations, involving both difficulties identified and lessons learned; SOA can devolve from a utopian buzzword to an earthly concept other companies can relate to, and above all – learn from.

PURPOSE:

The purpose of this thesis is to share organizations’ experiences of having adopted SOA, to learn what factors were essential for succeeding with such an architectural approach. In compliance with this, the aim of this thesis is to provide an answer to the following research question: *What factors are essential to succeed with SOA?*

METHOD:

The research has been founded on both secondary and primary data. Case-studies have been used together with qualitative semi-structured interviews with SAS, Volvo IT, Sandvik, Skatteverket, Sandvik and SEB to build up a descriptive profile of each organization as well as identifying critical success factors.

CONCLUSIONS:

According to SAS, Volvo IT, Skatteverket, Sandvik and SEB – the overall most critical factor to succeed with SOA is *Strong Governance*. Nonetheless, the ability to establish a coherent structure making sure several pieces are managed in symbiosis is in truth the real “key” factor to succeed with SOA. Other closely related critical factors are: *establishing a central governance function, defining principles, standards, contracts, and guidelines, adopting appropriate financial models, assigning ownership of services, communicating the SOA vision, and exercising strong leadership.*

Keywords: SOA, Service-Oriented Architecture, SOA Governance, Best Practises

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TABLE OF CONTENTS

1	INTRODUCTION.....	6
1.1	BACKGROUND.....	6
1.2	PROBLEM DISCUSSION.....	8
1.3	PURPOSE	8
1.4	DELIMITATION	9
1.5	INTERESTED PARTIES	9
1.6	PREVIOUS RESEARCH.....	10
1.7	TOPIC VOCABULARY	10
1.8	DISPOSITION.....	11
2	UNDERSTANDING SOA	13
2.1	THE MOVE TOWARDS A SERVICE-ORIENTED ARCHITECTURE.....	13
2.2	CONCEPTS AROUND SOA	14
3	METHOD	17
3.1	DATA COLLECTION	17
3.1.1	<i>Pre-Study</i>	18
3.1.2	<i>Case Studies & Interviews</i>	18
3.2	COMPILATION AND ANALYSIS OF INTERVIEWS.....	20
3.3	LITERATURE STUDY	21
3.4	AN ABDUCTIVE RESEARCH APPROACH	21
4	FIVE SOA EXPERIENCES	22
4.1	PRESENTATION OF RESPONDENTS	22
4.2	SAS SCANDINAVIAN AIRLINES	23
4.2.1	<i>Critical Factors</i>	23
4.3	VOLVO IT.....	24
4.3.1	<i>Critical Factors</i>	25
4.1	THE SWEDISH TAX AGENCY (SKATTEVERKET)	27
4.1.1	<i>Critical Factors</i>	28
4.2	SANDVIK.....	29
4.2.1	<i>Critical Factors</i>	29
4.3	SEB.....	30
4.3.1	<i>Critical Factors</i>	31
4.4	SUMMARY OF THE ORGANIZATIONS' TECHNICAL MATURITY.....	32
5	SOA IN THEORY	33
5.1	THE IMPORTANCE OF GOVERNANCE.....	33
5.1.1	<i>SOA Governance</i>	33
5.1.2	<i>SOA Governance Model</i>	33
5.2	CENTRAL SOA FUNCTION	35
5.3	PRINCIPLES & STANDARDS	36
5.4	LEADERSHIP.....	37
5.5	THE HUMAN ASPECTS OF SOA	37
5.6	FUNDING & OWNERSHIP OF SOA.....	39
5.7	REUSE OF SERVICES.....	39
5.7.1	<i>Repository & Registry</i>	40
6	RESULTS – SUCCESS FACTORS	42
6.1	EXERCISE STRONG GOVERNANCE	42
6.1.1	<i>Central SOA Function</i>	43
6.1.2	<i>Principles, Standards, Contracts, and Guidelines</i>	43
6.1.3	<i>Funding & Ownership</i>	44

6.1.4	<i>CommunicatING the SOA Vision</i>	45
6.1.5	<i>Leadership</i>	47
6.2	FACILITATE REUSABILITY.....	47
6.2.1	<i>Repository</i>	49
6.3	CONCLUSION OF ANALYSIS	49
7	CONCLUSION	53
7.1	RESEARCH CREDIBILITY	54
7.2	PROPOSALS FOR FUTURE RESEARCH	55
8	REFERENCES	56

FIGURES

FIGURE 1:	DISPOSITION	11
FIGURE 2:	PUBLISH, FIND, AND EXECUTE (MCGOVERN ET AL, 2006)	14
FIGURE 3:	ENTERPRISE SERVICE BUS (BINILDAS, 2008)	16
FIGURE 4:	DESCRIPTION OF RESEARCH PROCESS	17
FIGURE 5:	THE RELATIONSHIP BETWEEN INDUCTION, DEDUCTION AND ABDUCTION, INSPIRED BY (ALVESSON & SKÖLDBERG, 1994).	21
FIGURE 6:	SOA GOVERNANCE FRAMEWORK (CARTER, 2007)	34
FIGURE 7:	ALIGNING CORPORATE, IT, AND SOA GOVERNANCE (CARTER, 2007).....	35
FIGURE 8:	SOA GOVERNANCE MODEL - CRITICAL FACTORS TO SUCCEED WITH SOA	50

TABLES

TABLE 1:	SOA MATURITY	32
TABLE 2:	CRITICAL FACTORS TO SUCCEED WITH SOA.....	53

APPENDICES

APPENDIX 1:	INTERVIEW MANUAL.....	59
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1 INTRODUCTION

This chapter will provide an introduction to the topic by presenting a metaphor people hopefully can relate to and understand, aiming at describing the underlying concept behind a Service Oriented Architecture (SOA). A discussion of the problem area of interest will follow, which in turn will be narrowed down to the purpose of the thesis and the research question. From thereon the delimitation of the problem, interested parties, previous research and a topic vocabulary will be presented.

1.1 BACKGROUND

Try to imagine...

... a city, where a multitude of individual businesses operate, each one specializing in satisfying a particular consumer need. For example, one business sells flowers, one specializes in catering French cuisine, one provides funeral services, and another one sells wine. That is, instead of having one single business outlet providing all imaginable services needed in a community, many business outlets collectively share this task. Although independence is encouraged, all services are requested to adhere to a baseline convention – they all have to be performed speaking the same language. This convention is a standardization of a key aspect of all services, created only for the benefit of making things easier for consumers to communicate with all the businesses when buying their services, and for facilitating communication and collaboration between the businesses.

Let's continue by envisioning a business activity taking place in this community. Picture the task of organizing a party for instance. By an invoking phone call, Susie can gather all the services needed – the flower business, the catering business and the wine business – to bring all the necessary ingredients for a successful party. The next day, David, located in a suburb outside the city, can call the flower business and the company providing funeral services to provide all the necessary ingredients needed to carry out the funeral for his deceased grandmother. Since all the businesses' services are independent and speak the same language, they have no problems to be combined in various different ways and collaborate to execute several different tasks.

With this Service-Oriented approach two rather different “events” (**business processes**) can be put forward by two different persons (**consumers**) located at the same, or disparate locations (**internal/external**). Since the businesses (**providers**) supply independent services speaking the same language (**XML**), they can be invoked for several different purposes serving many different needs. The services possess the capability to be joined together on demand to create composite services, or disassembled just as easily into their functional components (**loosely coupled**). This way, each business' service is not strictly limited to provide services only to a funeral for instance; it can be invoked to serve parties as well (**reused**).

This metaphor attempts to explain the underlying logic behind Service-Orientation in a very simplistic way, nonetheless entailing the features forming the base for an SOA.

After all, SOA is a way of thinking about building software. SOA envisions the implementation of a service platform consisting of many services that signify elements of business processes that can be combined and recombined into different solutions and scenarios as determined by business needs (Erl, 2005). However, the business and the architectural concepts behind SOA are in and of themselves not new. For at least five to ten years, large companies have had such concepts involved in their strategy. But it is with the introduction of web services, a new technology used to realise SOA, this architectural approach has gained ground in earnest (Bieberstein et al, 2006). Web services is a technology enabling an SOA, making it possible for disparate pieces of software to communicate and operate with each other through a collection of technologies, including XML, SOAP, and UDDI – regardless of the platform and the programming language being used (Pulier & Taylor, 2006). Nevertheless, it must be understood that *web services* does not equal a *service-oriented architecture*, it should only be considered as a technical enabler to realise SOA (Channabasavaiah, Holley & Tuggle, 2003).

What makes SOA particularly interesting from a research perspective is partly due to all the attention this architecture has gained in media, not to mention the wide recognition it has received by research analyst companies. Among others, Rudy Heffner, Vice President and Principal Analyst, and Larry Fulton, Senior Analyst at Forrester (Heffner & Fulton, 2007) have stated that:

“...By the end of 2007, Forrester expects to see 75% of Global 2000 firms implementing SOA — but even small and medium-size businesses (SMBs) are broadly adopting SOA.”

In a report published by Gartner, *Positions 2005: Service-Oriented Architecture Adds Flexibility to Business Processes*, the author Hayward (2005) even claimed that:

“There is no alternative to [SOA] and web services as a basis for future software. The issues revolve around the rate of adoption and the purposes for which it is applied.”

Additionally, in the research report *Gartner’s Positions on the Five Hottest IT Topics and Trends in 2005*, Cearley, Fenn, & Plummer (2005), declared that:

“By 2008, SOA will provide the basis for 80 percent of development projects.” “...SOA and Web services will affect every business and IT department.”

These statements indicate that businesses of today “are” – and “are expected to”, broadly deploy SOA. It is a “hit”. But with all the buzzing about the widespread adoption and breakthrough of SOA, what association does it have with reality? How do organizations go about successfully implementing such an architecture? And by far most – what valuable experiences of SOA do these organizations have to share with the rest of the world?

1.2 PROBLEM DISCUSSION

“Implementing SOA” and “Broadly adopting SOA”, almost makes it sound as easy as pushing a button. Perhaps “the long journey of gradually moving towards a SOA” would have been somewhat more suitable. After all, SOA is not a big bang implementation; it should rather be considered as a very long process (McGovern et al, 2006). Furthermore, as in any extensive change, obstacles are likely to arise down the road. Getting carried away, and go shopping your very own “SOA toolbox” may be tempting, bearing in mind the combination of SOA and web services are being marketed as the silver bullet companies have been looking for to magically solve all business issues of today. But even though SOA is expected to provide potential benefits of reduced IT costs through reuse of services and greater business agility, many researchers remain sceptical, saying there are valid doubts about such claims (Bieberstein et al, 2006; Channabasavaiah, Holley & Tuggle, 2003; Gruman, 2006). As for example, Gruman (2006) states it is important to acknowledge that most deployments of SOA are recent; many assessments of long-term viability are still left inconclusive. Even though several large enterprises are reaping the benefits of SOA, there are plenty of others that are struggling (Dimarzio co-author with Benson, et al, 2006). Additionally, Bieberstein et al. (2006) argue that many business issues simply cannot be solved by a specific IT architecture or a certain approach to making business decisions – as long as people are involved, errors are still likely to occur. Consequently, adopting SOA is not solely an unproblematic adventure; many roadblocks have to be overcome to succeed with such a pursuit. Nonetheless, that is not to say SOA is not good, only that it is not unproblematic. Because, even though there is scepticism about the glorification of SOA, many people do agree that it is a natural evolution in technology. One important factor that has driven this development is the move towards process-orientation, a concept introduced by Michael Porter during the 80s. As process-orientation started to gain ground, organizations acknowledged the pressure to integrate best-of-bread applications so that they could serve the needs of the new cross-application processes that were becoming keys to achieve increased efficiency (Woods & Mattern, 2006). This transition in turn had an impact on the models for constructing software. Perhaps explaining why SOA is considered as the obvious follower to procedural, object, and component-oriented programming (Hossam, 2007).

Considering the inevitable move towards SOA and the complexities of adopting such an architecture, it is very important to follow up on, and analyze organizations having implemented SOA to enable sharing of experiences. By unfolding critical success factors in SOA implementations, involving both difficulties identified and lessons learned; SOA can devolve from a utopian buzzword to an earthly concept other companies can relate to, and above all – learn from.

1.3 PURPOSE

The purpose of this thesis is to share organizations’ experiences of having adopted SOA, to learn what factors were essential for succeeding with such an architectural approach.

In compliance with this, the aim of this thesis is to provide an answer to the following research question:

✓ *What factors are essential to succeed with SOA?*

In this context, *succeed* refers to the accomplishment of organizational goals and expectations set up specifically for the SOA investment. *Factors* on the other hand refer to the important components or steps in the process of adopting SOA needed to be managed in order to succeed.

1.4 DELIMITATION

When discussing SOA, many possible associations can be made. The concept of SOA and web services are as previously mentioned not inseparable, they do exist independently of each other and have done so for years. Many companies have implemented services based on the concept of SOA, but realized through another technology than web services. Likewise, companies have implemented many services based on the web service technology, but not adhering to the concept of SOA. In this thesis, focus will be on organizations' experiences of deploying an architecture based on the concept of SOA, being realised through web service technology. This mix has driven today's interest for SOA, and will therefore be of main interest.

This research will investigate SOA from an IT perspective, meaning that only respondents having a technological point of view of SOA will get to participate in this research. Nonetheless, it would have been interesting to take on a business perspective as well, comparing two experiences of SOA that might be a little bit different. However, an increased scope would limit the depth of the interviews, whereas a decision was made to focus only on an IT perspective.

Only organizations having at least four years of experience of SOA will get to participate in this study. A minimum target needed to be assured the organizations have sufficient experience of challenges and problems needed to be overcome to succeed with this architecture. An even higher target would have been possible, but it would have decreased the number of the population significantly, since the mix of SOA and web services have only been around for approximately a decade.

Moreover, the major aim of this thesis will not be to provide a detailed description of "what" SOA is and "how" it works. An impressive quantity of literature written by recognized authors have been dedicated to clarifying the concepts and technical aspects of SOA and web services; and pretty much everything in between. Consequently, interested readers are recommended to consult the rich flora of published literature if they wish to immerse their knowledge about SOA further than the brief introduction to the topic presented in this paper.

1.5 INTERESTED PARTIES

By identifying critical factors that experienced organizations perceive as important to succeed with SOA, other organizations can learn from both their set-backs and triumphs, and develop better strategies to manage the complexities of SOA in the future. That is, organizations already having embraced SOA will get the opportunity to compare their

strategies with other companies, and receive feedback on their respective approach. Equally, organizations interested in moving towards a SOA will get an insight of how they can prepare for success.

1.6 PREVIOUS RESEARCH

Previous research addressing important factors to succeed with SOA do exist. Stating the opposite would be lying. For starters, there exists an impressive amount of useful guidelines, uncovering the mysteries of deploying SOA by delivering best practises in a “step-by-step” format. Bieberstein et al. (2006) have for instance written the book: *Service-Oriented Architecture (SOA) Compass: Business Value, Planning and Enterprise Roadmap*. Marks and Bell (2006) have written a book named: *Service-Oriented Architecture—A Planning and Implementation Guide for Business and Technology*, taking a prescriptive approach to planning and implementing SOA. Other researchers have taken a similar, but yet slightly different approach, focusing more specifically on important ingredients to succeed with SOA. Brown (2007) has written: *Succeeding with SOA – Realizing Business Value through Total Architecture*. Another example is Benson (2006), who has together with several co-authors published *Secrets of SOA: An Enterprise View on Service-oriented Architecture Deployment Revealed*.

Common for all these great and informative books, and many others, are that they ambitiously attempt to address an impressive number of features related to SOA, e.g.: Project Management, Process Management, Project Leadership, SOA Development, Risk Management, Security Management, Reuse, and Governance – all broken down into a number of subheadings. Suddenly, it becomes unclear which ones of all the factors were the most critical. Often it is not possible to focus on everything to 110 % simultaneously, whereas it becomes interesting to know “what” efforts really matters the most. Yet another similarity between these books, and many others, is that the authors are taking a supplier or vendor perspective. They share their knowledge about SOA based on their experience of working at companies developing or selling SOA solutions.

Aggregative, all these studies together inspired me to shape the purpose of this study. I wanted to objectively explore SOA from several different organizations’ perspectives, to learn what approach they have adopted moving towards this architecture. I wanted to discover what factors secured their advances, and what factors were complex to overcome which might could have been dealt with in a better way.

1.7 TOPIC VOCABULARY

For those who may wish to refresh memory a bit, some of the most frequently used abbreviations are presented below with the aim of acting as a topic vocabulary that can be revisited any time needed.

COE = Centre of Excellence
ESB = Enterprise Service Bus
ROI = Return on Investment
SLA = Service Level Agreement
SOA = Service-Oriented Architecture

SOAP = Simple Access Object Protocol
WSDL = Web Services Description Language
UDDI = Universal Description, Discovery and Integration
XML = Extensible Markup Language
HTTP = Hyper Text Transfer Protocol

1.8 DISPOSITION

The thesis has been divided into seven main chapters as can be illustrated in (figure 1). The workflows and stages are briefly discussed and described below.

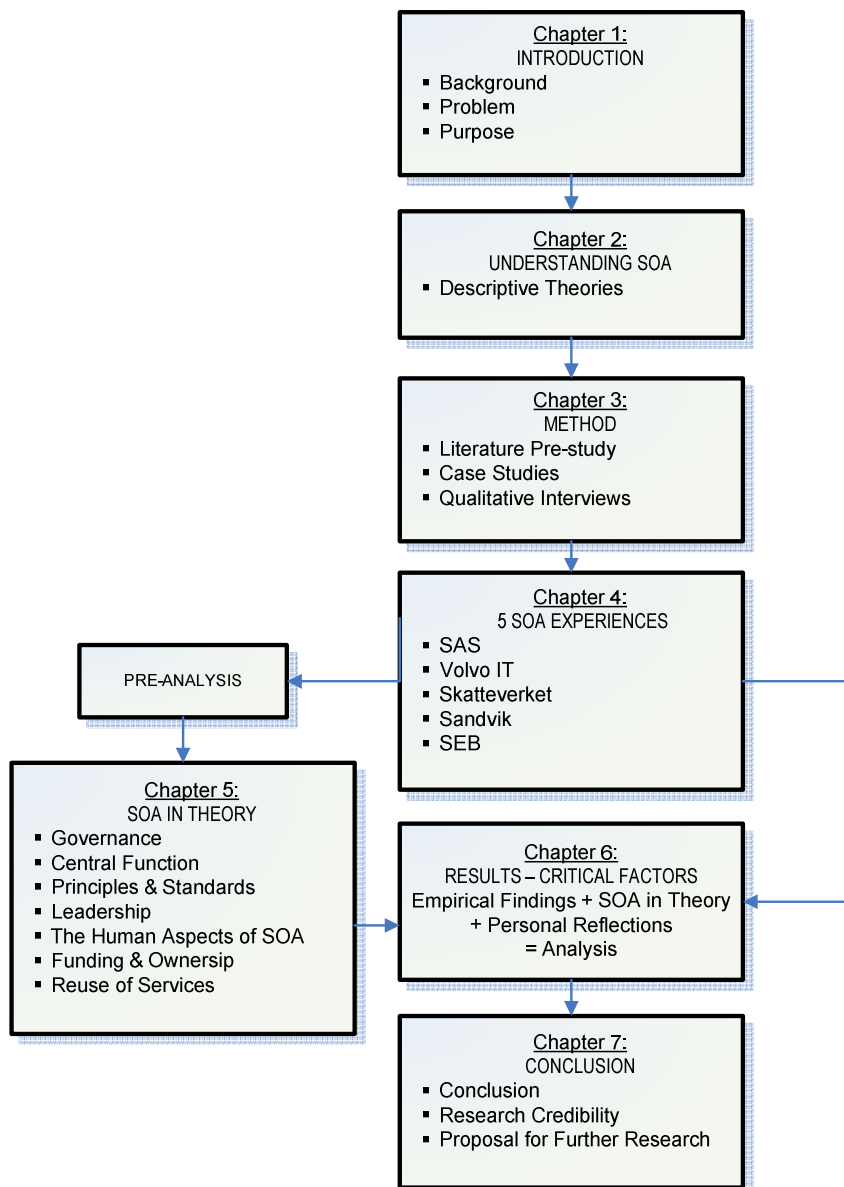


Figure 1: Disposition

In the introduction chapter, the background of the topic is described followed by a discussion of the problem area of interest, later on narrowed down to the purpose of the thesis.

In order for the reader to get the opportunity to familiarize with the topic area and create an understanding of the basics of SOA, chapter 2 is dedicated to provide a brief explanation of the key concepts of SOA.

The main purpose of chapter 3 is to present the research methods applied when collecting the data needed to answer the research question.

The subsequent chapter 4 provides a summary of the qualitative interviews with the five respondents at SAS, Volvo IT, Skatteverket, Sandvik, and SEB.

Based on the empirical findings in the preceding chapter, chapter 5 aims to present SOA from a research perspective by investigating if the critical factors identified have support in established theories.

Chapter 6 analyzes the data collected and discuss the outcome of the thesis based on a comparison between empirical data, established theories, and personal reflections.

Finally, chapter 7 summarizes the discussion in the analysis and presents a conclusion answering the purpose of the thesis. In addition, the research credibility of this thesis is discussed, followed by reflections having originated throughout the research process, as well as a couple ideas for future research.

2 UNDERSTANDING SOA

This chapter presents the theories evolving from the literature study, aiming at providing descriptive knowledge that will enable a greater understanding of the area of interest.

2.1 THE MOVE TOWARDS A SERVICE-ORIENTED ARCHITECTURE

As so often mentioned, businesses of today are required to be agile in order to rapidly respond to changing market needs and opportunities. The demand to increase efficiency, decrease costs, reduce time to market, and expand revenue streams are causing business leaders to evaluate and re-think their execution models (Saha, 2007). Tightly coupled, incompatible, and inflexible IT systems are no longer suitable. The IT architecture has to be agile and able to respond quickly to ever changing business needs (Pulier & Taylor, 2006). To cope with these demands, changes in the way businesses architect their IT environment have become inevitable. As a response to this, architectural IT models have continuously evolved and improved in order to meet the needs of businesses of today. At present, an architecture named Service-Oriented Architecture (SOA) has become widely popular and acknowledged. Linthicum (2007) explains this movement by stating that the benefits driving organizations to adopt SOA primarily comes down to two factors. SOA provides the opportunity for organizations to get a huge strategic advantage by being able to change their IT infrastructure faster than before. This ability to shift the needs of the business quickly, will give organizations a better chance of survival in the long-term. Furthermore, SOA can aid organizations in saving development dollars through reuse of services. Which means, the more services that are reusable from system to system – the greater the return on investment (ROI). Before clarifying the technical details comprising an SOA, the technological development paving the way for this architecture will be discussed first – namely web services.

With the emergence of web services based on XML, a new phase in the evolution of software started. Web services comprise a family of interrelated standards that work together to provide a simple way to allow program functionality in different languages and on different platforms to interoperate. Because every vendor supports the basic web services standards, messages can be passed from one service to another, regardless of the architecture of the underlying application. With the introduction and widely acceptance of web services as a standard, the breakthrough of SOA became a reality. The idea behind SOA was to make it possible to build a series of services that you could recombine each time you needed to solve a new problem. You would not have to constantly start from scratch anymore. By adopting this architecture, the functionality in the layers inside the monolith was set free – no longer tightly coupled to each other, the functionalities could be put to new uses (Woods & Mattern, 2006). As a result, along with the introduction of SOA a new mindset was established for architecting IT, helping businesses transforming IT responsiveness and agility (McGovern et al, 2006).

2.2 CONCEPTS AROUND SOA

An **IT Architecture** is a blueprint that is developed, implemented, maintained, and used to explain and guide how an organization's IT and information management elements work together to efficiently accomplish the mission of the organization (DOC Enterprise IT Architecture Advisory Group, 2004). There exists many different kinds of architectures, SOA is one. SOA specifies a way of thinking about building software, it envisions the implementation of a service platform consisting of many services that signify elements of business processes that can be combined and recombined into different solutions and scenarios as determined by business needs (Erl, 2006).

A **service** is a business process adhering to the concept of SOA, being implemented by web service technology.

Web services is a technology enabling an SOA – regardless of the platform and the programming language being used. This technology makes it possible for disparate pieces of software to communicate and operate with each other, through a collection of technologies including: XML, SOAP, and UDDI (Pulier & Taylor, 2006).

An SOA is based on the interactions between three primary functionalities: a service provider, a service broker (registry) and a service consumer (figure 2). The service provider creates the service and thereafter publishes the service description in a registry. More specifically, the binding information contains the specification of the protocol that the service requestor must use as well as the structure of the request messages and the resulting responses. When services have been published it becomes possible for a service consumer to find the service description in the registry that matches its needs and to use this information to bind and execute the service (McGovern et al, 2006). Consumers of services can play many different roles, they can be developers, architects, analysts, and internal business customers, or they can be external customers or business partners (Marks & Bell, 2006). The communication between the various agents occurs via appropriate transport mechanisms, such as – XML, SOAP, HTTP etcetera (Leymann et al, 2002).

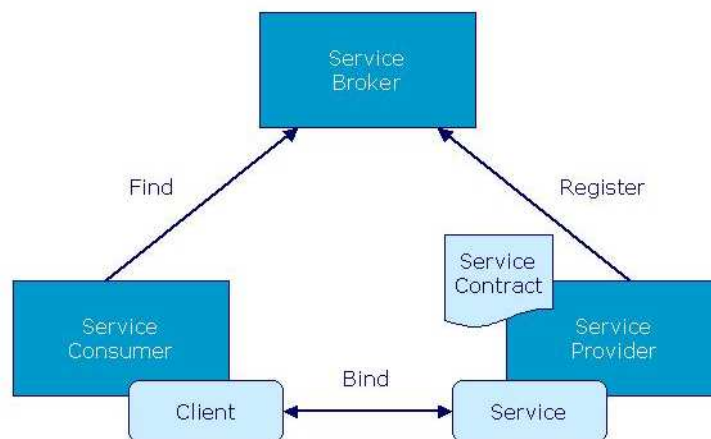


Figure 2: Publish, Find, and Execute (McGovern et al, 2006)

WSDL is an abbreviation for Web Services Description Language, which is the XML vocabulary for describing services in terms of where they are located, and how they can be called. WSDL documents can therefore be said to describe the “what”, “how”, and “where” of web services (Woods & Mattern, 2006).

UDDI is short for Universal Description, Discovery, and Integration. UDDI is a platform-independent directory protocol for describing services and discovering and integrating business services via the Internet. In order for potential clients to easily find the WSDL files, they can be published in a directory. This “Yellow Pages” directory includes metadata that can be used to search for services by name, ID, category, type, and so on (Woods & Mattern, 2006).

A **repository** serves as data storage and makes use of a registry service as an interface to outside parties (McGovern et al, 2006). However, a repository should not be confused with a UDDI-registry. Although a repository includes WSDL files, it should only be considered as an UDDI-like function (Woods & Mattern, 2006).

A **registry** is an enabler of services. It allows for the registration of services, discovery of metadata and classification of entities into predefined categories. Unlike a repository it does not have the ability to store business process definitions, WSDL or any other documents that are required for trading agreements (McGovern et al, 2006).

XML, is an abbreviation for Extensible Markup Language, which is the universal text format for structured information on the web. XML describe what data should look like and its XML tags define the data itself (Woods & Mattern, 2006). According to Carter (2007) XML is the basis for all web services technologies and the key to interoperability.

A Simple Object Access Protocol (**SOAP**) defines a mechanism for the communication with web services over the Internet. It specifies the format of messages that are exchanged between the service consumers, the service providers, and the service directory. SOAP is an important web services standard that describes the message structures passed at runtime to call a web service. A SOAP message is an XML document that describes the operation to be performed and the parameters to pass to the application. One of the main strengths with SOAP as a code wrapper is that a SOAP message is a text file that is generally passed via HTTP or HTTPS and therefore can cross corporate firewalls (Woods & Mattern, 2006).

An **ESB** is a standard-based integration bus that supports synchronous and asynchronous exchanges between disparate applications (figure 3). The ESB is intended to be the backbone of the enterprise architecture – the nervous system that connects all the applications, resources, and components (Khoshafian, 2007).

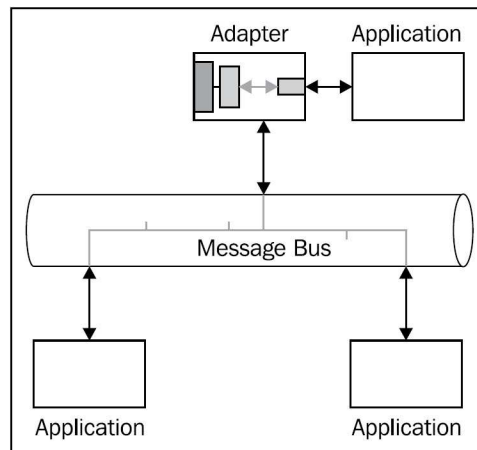


Figure 3: Enterprise Service Bus (Binildas, 2008)

3 METHOD

In this section the applied scientific research approach will be presented and motivated. The research process will be explained in detail in order to develop a comprehension concerning how the data has been collected and how it can be repeated.

(Figure 4) provides a visual overview of the research process adopted in this research. Throughout this chapter, each component in the figure and its pertaining components will be explained and motivated.

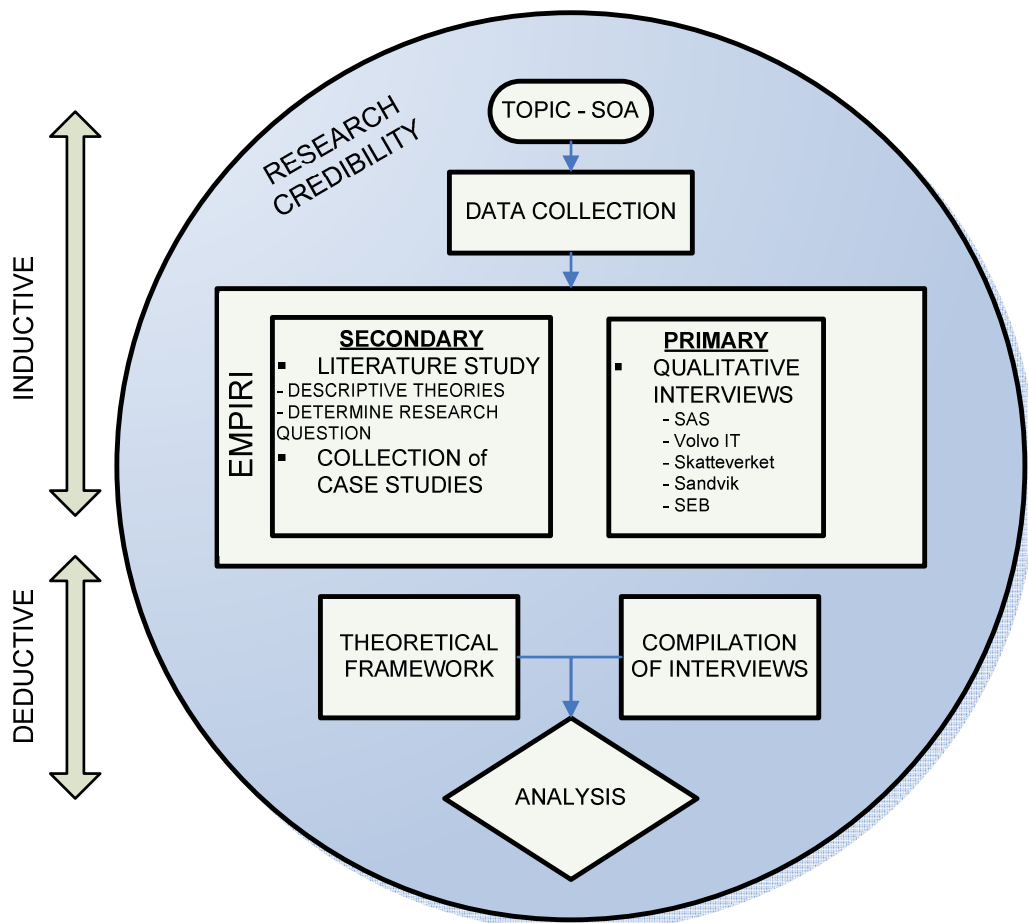


Figure 4: Description of Research Process

3.1 DATA COLLECTION

Collection of data is a very important element in every research, bearing in mind it constitutes the foundation for the entire research. The data employed in this study has originated from both primary and secondary sources of data. Repstad (1993) explains the difference between the two by stating that primary sources of data are closer to the main source than secondary sources, hence being considered to have a higher reliability. Nonetheless, Repstad makes sure to emphasize that secondary data is essential in the

sense that it provides the researcher with the necessary background and context needed to carry out academic studies. In the following sections the scientific approaches adopted when collecting the data will be presented, in concert with the techniques applied for compiling and analysing the data.

3.1.1 PRE-STUDY

In order to build up a conceptual framework of what SOA actually is, and aid in the process of identifying a potential problem area, the research was initiated by the process of reviewing literature from previous research. The aim of the pre-study was to gain a deeper knowledge and understanding about the topic field, thus extending the questioning further before determining the final research question. Secondary sources of data were consulted and scanned through in databases at Chalmers¹, Jönköping International Business School² and Gothenburg University³. A mix between physical books, academic articles, e-books, and news articles mainly served as a knowledge base in this research. Many of the e-books were found by accessing the database Books24x7. The keywords used to search after information about SOA was initially very broad and general e.g. (SOA, Service-oriented architecture, web services). Nevertheless, as the research progressed the keywords were narrowed down to address specific areas of interest e.g. (SOA roadmaps, SOA best practices). Accordingly, Glaser (1978), reproduced in (Merriam, 1988) suggests it to be a good idea to initiate the study by researching the area of interest closely but widely, and then immerse within the specific domain as the research proceeds. The outcome of the literature pre-study resulted in descriptive theories helping the reader to develop an understanding of what SOA actually is.

3.1.2 CASE STUDIES & INTERVIEWS

Having the research question in mind, different alternatives were considered on how to collect the empirical data. One approach being considered was to primarily utilize existing research about SOA implementations as empirical data, such as case studies. Nevertheless, the supply of detailed and comprehensive case studies was quite limited. The varying level of information about each case proved it to be rather difficult to compare them. It also felt risky to let the quality of the case studies control and exert too much impact on the outcome of the research considering that many of them were produced by vendors. However, a selection of case studies created by an independent source called Serviam was found, regarded as being appropriate to serve as a foundation and complement to the collection of primary data. Serviam is a Swedish project aiming at highlighting and collecting experience about IT-services. Some of the organizations having taken a central role in this project are people from: Data Föreningen, Vinnova, KTH, Skövde University, and IT plan (Serviam, 2008).

¹ Chalmers, CHANS is Chalmers library catalogue enabling searches in various databases, books, e-journals and e-books. CHANS can be reached at <http://chans.lib.chalmers.se/search/>

² Jönköping International Business School, Julia is a library resource providing access to various databases, books, e-journals and e-books, it can be found at <http://www.bibl.hj.se/>

³ Gothenburg University, the library resource GUNDA provides access to various databases, books, e-journals and e-books. GUNDA can be found at <http://www.ub.gu.se/>

- Henkel, M. (2004a). *Architectural Case: The Swedish Tax Agency*. Sweden: Serviam.
- Henkel, M. (2004b). *Architectural Case: Sandvik*. Sweden: Serviam.
- Henkel, M. (2004c). *Architectural case: SEB*. Sweden: Serviam.
- Wiktorin, L. (2004a). *Architectural Case: SAS*. Sweden: Serviam.
- Wiktorin, L. (2004b). *Architectural Case: Volvo IT*. Sweden: Serviam.

This choice of approach coincides with Repstad (1993), asserting a combination between primary and secondary sources of data can aid in the process of producing new interesting knowledge. Nonetheless, basing the research solely on primary data would also have been feasible. It would clearly have increased the number of potential respondents. But by selecting respondents participating in SOA case studies, it became easier to ensure that the respondents had valuable SOA experience to share before contacting them. Personally I also thought it would be interesting to follow up on the case studies four years after they had been published, to see how the organizations' adoption of SOA had progressed.

The argument for the selection of case studies were based on the fact that they were all produced during the same period, documented in a similar structure, and foremost by an objective organization having no underlying objective to worship or promote SOA and technical products. Based on the five case studies, describing SAS, Sandvik, SEB, Skatteverket, and Volvo IT's implementations of SOA, potential respondents to assist in the work of collecting primary data were not difficult to identify. Almost all the case studies had been based on presentations by notable people involved with the companies SOA implementations. These persons were contacted by e-mail and asked to participate in this study, all the five companies agreed to partake. Only SEB's respondent had not been involved with the creation of Serviam's case study about SEB, but had great knowledge within the area anyhow.

Only organizations having a Swedish origin participated in the study. An alternative approach, including organizations located in other countries could have been interesting as well. However, the case studies produced by Serviam targeted only Swedish organizations and they were considered as the best alternative since the international case studies found differed in quality, where many of them were produced by vendors. Equally, interviewing Swedish organizations would be interesting since a majority of the literature within the topic field originate from US, discussing American companies' adoption of SOA.

When collecting the primary data with the help of the selected respondents, a qualitative approach was adopted. According to Holme & Solvang (1997) a qualitative method enables a deeper and more complete understanding of the research area and its complex nature in contrast to a quantitative method. It is a research approach generally aiming at transforming information to numbers and quantities from where statistical analysis can be carried out (Holme & Solvang, 1997). Based on this premise, the qualitative method was

considered to be the most suitable approach since questions needed to be asked that returned answers explaining “why” certain factors had been more important than others when adopting SOA – answers that simply could not have been of a measurable or quantifiable nature.

Since personal interviews allow a very high level of interaction, this form of qualitative method was strived after in this research. Nevertheless, according to Ruane (2006), telephone interviews can be the second best choice when respondents are located on remote locations. Given that all the respondents, except for Volvo IT, were located in ex. Stockholm and Sandviken, these interviews were conducted over the phone with the software program Skype and recorded with the plug-in program Call Graph. Thus, only the interview with Volvo IT was carried out in person, also being recorded, but this time through the software program Cool Edit together with a microphone. The main benefit with recording the interviews is that more time can be spent on listening actively instead of being busy writing down answers manually. Recording the interviews will also facilitate the analysis; it will become possible to rewind the tape and listen to the interview over and over again, hence limiting the risk of misinterpreting the conversation (Repstad, 1993).

Bearing in mind the nature of the questions to be asked, the interview questions were sent to each respondent before the interview. That way, each respondent got the possibility to prepare for the interview, and perhaps do some research that might be needed to answer the questions regarding the technical aspects of the adoption of SOA. The interview guide used can be found in (Appendix 1), it has been designed in a semi-structured manner where key topics and issues have been listed. Interviews can be structured at different levels, but semi-structured interviews were considered to be the most appropriate choice since this form enables adaptation to each respondent and interview setting by allowing changes to formulations of questions, reordering of them, and also the possibility of complementing with new questions if needed (Fisher, 2007). Taking into account that I did not know beforehand what factors respondents found critical for a SOA implementation, the flexibility semi-structured interviews provided was essential to adapt and follow up with questions spawned from the respondents’ answers. The idea behind the construction of the interview guide was to start of by asking questions collecting the information needed to provide a description of each organization’s SOA environment. After that, questions specifically addressing the research question were asked, followed by some closing questions that were only asked if there was enough time.

3.2 COMPILATION AND ANALYSIS OF INTERVIEWS

As soon as all the interviews had been performed, the process of compiling and analyzing the interviews started. All the recordings from the interviews were listened to, resulting in summaries transcribed word by word. Only sections that was completely irrelevant for this research was left out. The next step in the process of compiling the interviews was to identify patterns and structure the data into appropriate categorizes. Repeating statements were eliminated and strong quotes that could be used in the analysis was highlighted. After completing this task, a couple of critical factors to succeed with SOA became apparent. At this point, the work of translating the interview summaries from Swedish

into English started. Some grammatical changes had to be done to make the empirical material readable, however the highlighted sentences that were to be used in the analysis were kept as close to the original sentences as possible.

The process of compiling the interviews was inspired by Merriam (1994), recommending that empirical data such as interviews need to be written down and summarized to become more manageable and explicit. This process involves removal of redundant and reoccurring information, and identification of similarities that can be structured according to suitable parameters. She also finds it advisable to organize the information from without some sort of scheme that makes categorization possible.

3.3 LITERATURE STUDY

After compiling and analyzing the empirical data, a couple of critical factors to succeed with SOA were identified. This revelation sparked the search for existing theories that could add another perspective to the outcome of the study, hence adding valuable depth to the final analysis and conclusion discussing the critical factors. The library resources consulted in the pre-study was revisited once more, resulting in a theoretical chapter based on previous research – “SOA in Theory”.

3.4 AN ABDUCTIVE RESEARCH APPROACH

The scientific approach adopted in this research has been a blend of both the inductive and the deductive approach, a mix referred to as *abduction* by Alvesson and Sköldbberg (1994). The reasoning behind the choice of this scientific approach was primarily based on two reasons. First of all, when revealing the factors critical to succeed with a SOA adoption, no pre-determined assumptions or beliefs about what these could be were desired. An open mind was needed in order to minimize the risk of influencing the respondent’s answers in any direction. This was the main argument for adopting an inductive approach in the initial stages of the research. Secondly, as soon as the empirical material had been collected, a shift to a deductive approach was found suitable since it would enable a deeper analysis of the factors identified by relating them to previous research. Strictly adhering to the inductive or the deductive approach could have been feasible as well, but a blend between the two approaches was considered to add the most value to the study, using the strengths of both methods. (Figure 5) demonstrates abduction, compared to the inductive and deductive approaches.

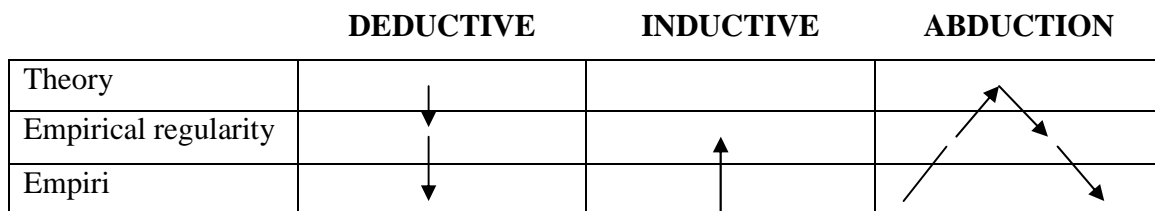


Figure 5: The relationship between induction, deduction and abduction, inspired by (Alvesson & Sköldbberg, 1994).

4 FIVE SOA EXPERIENCES

This chapter will present the empirical material acting as a foundation for this research. Both primary data (qualitative interviews), and secondary data (case studies and complementing material) will add up to each organization's description of their respective SOA experience. The participating organizations are: SAS, Volvo IT, Skatteverket, Sandvik and SEB.

4.1 PRESENTATION OF RESPONDENTS

The respondents interviewed are briefly presented below. Each of them represents an organization having experience of implementing SOA, the companies will be presented in the order the interviews took place.

SAS (Scandinavian Airlines) – Björn Fagerstedt is Vice President of IT Architecture and Program Management at SAS Group IT, a central IT unit dealing with all corporate and airline-wide IT issues, having ownership of all the airlines common systems. Björn is responsible for Enterprise Architecture; including SOA development, integration, IT security and the information architecture. He is also owner of the development project portfolio.

Volvo IT – Lars-Åke Hedbom works as an Enterprise Architect at Volvo IT. Lars-Åke is mainly involved with the work of achieving a better alignment between IT & Business. The last couple of years he has worked specifically with SOA and integration issues, aiming at achieving a greater level of integration between systems. He has also been involved with education, having participated in Dataföreningen's workshops about SOA.

Skatteverket – Håkan Westergren works as a Chief Architect at Skatteverket's IT- and development staff at the Swedish Tax Agency's head office, which is one out of five units. The unit is responsible for the collective IT infrastructure at Skatteverket, and is also responsible for coordinating and controlling all the major development initiatives. Håkan is mainly accountable for coordinating all the architecture areas present at Skatteverket.

Sandvik – Jan Nilsson has until just recently worked as a Chief Architect at Sandvik, being responsible for coordination of the corporate group's Enterprise Architecture. He has been working within Sandvik Systems Development, a stand-alone corporation within the Sandvik group, managing the main part of the IT development. The unit is mainly responsible for the architecture and the work of joining together business needs with IT solutions.

SEB – Anders Jäder is the Head of the Application Architecture and Integration Competence Centre at SEB, two departments belonging to Group IT. Anders has approximately 10-15 years of experience of working with SOA.

4.2 SAS SCANDINAVIAN AIRLINES



Scandinavian Airlines

Respondent: Björn Fagerstedt
Interview: Telephone Interview
Date: 25 April 2008

SAS Group is the largest listed airline and travel group in the Nordic region, offering a variety of air transport and logistics services. The company's 26,000 employees deftly handled 42.4 million passengers in 2007 on 459,922 flights to 152 destinations (SAS Group, 2007).

SAS started using web services relatively early. In 2001, the company implemented one of the first web services in the world and was the first to use Microsoft's UDDI, a dynamic and flexible infrastructure for web services (Wiktorin, 2004a). After participating in Microsoft's E2A.net (early to adopt) program, the company continued working with web services technology in many of their development projects. However, SAS did not start working consciously with web services and SOA until a couple of years later Björn Fagerstedt notes. The appeal for SOA mainly came from the possibility of reusing existing functionality, something not previously being realized with other solutions. Additionally a speedier time to market for IT projects and the opportunity of creating a better interoperability between platforms were considered as important arguments for adopting SOA. The first service being developed was a web application for mobile rebooking and used palmtop computers as clients. This service was made available to external users and used UDDI. Other than that, most of the early web services were developed for internal use, having the provider and the consumer located in-house. Examples of internal services SAS has implemented are: *Web check in*, *Marketing & Sales*, and *Customer Operational Data Store* (Wiktorin, 2004a). Nevertheless, most of the web services are exposed for external use today Björn Fagerstedt points out. An example of an external service is the *Self-booking API* (SAPI) service, containing a set of public web services directed to customers with agreement relations, such as travel agencies ordering SAS products. Services that are included in SAPI are *seat availability*, *reservation*, and *ground transport* (Wiktorin, 2004a). When it comes to the quantity of services SAS has implemented, it is very difficult to give a number Björn Fagerstedt explains – it largely depends on how you chose to define a service.

Regarding the products and suppliers used in their SOA solution, SAS has been using Tibco as a platform and an ESB for some systems, but not all. Within other areas SAS has mainly built the systems on technology by Microsoft. At present no UDDI is used at SAS. Instead they have CentraSite, a repository from Software AG, being responsible for storing information about their web services.

4.2.1 CRITICAL FACTORS

When asked about what factors being essential for succeeding with SOA, Björn Fagerstedt particularly highlighted the importance of governance. He stresses that *it is*

vital to have strong governance of the IT development, and an IT dominance structure present ensuring that the right services are being developed. If not, a chaotic situation is likely to arise were services are developed performing the same tasks. SAS has dealt with this by having a centralized IT function at the top, performing central reviews of all projects, and being responsible for the planning of services in the enterprise architecture. Thus, no departmental units are allowed to control their own IT development.

Another factor SAS has recognized as being important to deal with regards creating a mutual understanding for SOA throughout the organization. *SAS investments are very IT oriented, the awareness about SOA development is quite low throughout the organization and that is a problem* Björn Fagerstedt explains. This is something SAS isn't particularly good at, it impacts the collaboration necessary to create joint efforts towards adopting SOA. For instance, the lack of descriptions of business processes, and the readiness of our business units to work with such processes clearly have constituted a difficulty. After all, real development of SOA is not achievable unless the business stakeholders actively start working with describing business processes and their use of services, otherwise process modelling becomes impossible.

It is difficult to provide a good prescription how to solve this problem Björn Fagerstedt says, *but communication is important of course.*

Furthermore, when a number of consumers exist it also becomes tricky to deal with the amount of different interfaces Björn Fagerstedt has noticed. Should many interfaces be used simultaneously, or for how long should old interfaces exist? It is difficult. SAS has dealt with this at various different ways but generally we *sign an integration contract between the provider and consumer where all the privileges have been regulated.* Among other things, the contract deals with issues such as: how long beforehand a consumer must be warned before changes in an interface can be made, or for how long an interface is guaranteed to remain.

4.3 VOLVO IT



Respondent: Lars-Åke Hedbom
Interview: Personal Interview
Information Technology **Date:** 29 April 2008

Volvo IT is a global company and part of the Volvo Group. Volvo IT provides IT solutions for the whole industrial process from: product development, manufacturing, sales, the aftermarket and administration, including IT operations and infrastructure. In 2007, Volvo IT had 5,000 employees plus 1,900 external contractors located in Europe, North America, South America, Australia, Africa and Asia (Volvo IT, 2008). The entire Volvo Group has approximately 100,000 employees (Volvo Group, 2008).

In order to attain effectively integrated, monitored, continuously improved and optimized value chains, Volvo initiated a Business Integration Strategy in year 2003. The initiative was taken to get directions for how effective business integration can be achieved through the adoption of SOA. The move to SOA was expected to aid the Volvo Group in

realizing its overall strategy: increasing cost savings, achieving business agility, reducing lead times, enabling reuse of IT investments, and ultimately in creating business synergies within the Volvo Group (Hedbom, 2008). The planning and building of competence of SOA started with the participation in several SOA conferences and seminars Lars-Åke Hedbom explains, not to mention the partaking in the Serviam project. These were helpful experiences that later on provided input to Volvo's establishment of the Business Integration Strategy. However, it was not before the establishment of the departments *Global Functional Management/ Application Development Techniques* (GFM/ADT) in June 2004, the investment in SOA became official. GFM/ADT became responsible for the work of preparing the organization for this new architecture by developing a roadmap providing recommendations for SOA in the form of principles and guidelines. Up to now, Volvo IT has mainly been engaged in activities aiming at preparing the organization for SOA Lars-Åke Hedbom explains. The company is still in a very early phase and realizes that it will take long time. The first project implementing SOA all the way is probably the project running in North America. The project started in late 2005, with the purpose of developing an application named *Aftermarket Dealer Interface* (ADI), a portal rationalizing the exchange of information with resellers by distributing it as services instead of as separate applications. Today, Volvo approximately has a hundred web services in use, steadily rising. However, the presence of web service technology is a lot more common. Web services are being developed in almost in every project today, thus not solely for the purpose of obeying to the concept of SOA. So far all the services have been developed for internal use within Volvo or partner networks since security concerns have prevented the establishment of external services.

A couple of years ago, a *Volvo Group Integration Office* (VGIO) was established, an organization within the IT governance group focusing on processes and applications for the Volvo Group. This group became responsible for instituting the *Common Integration Platform* and educating the rest of the organization about this endeavor (Hedbom, 2008). At this moment, Volvo is just about to complete the implementation of the platform, serving as a foundation for future implementations of service oriented concepts and services. So far, the need for a service repository has been identified and defined, but not yet implemented. IBM is the main supplier, providing Volvo with the central integration platform, acting as a superior communication hub between local platforms such as Microsoft, mainframes and SAP. Volvo also has an ESB provided by IBM.

4.3.1 CRITICAL FACTORS

A challenge Volvo IT has acknowledged regarding their effort in deploying SOA, is the lack of governance. *So far, no SOA governance strategy has been defined at top management level, and that is one of the weaknesses I have noticed* Lars-Åke Hedbom says. Instead, *the steering and governance are running on lower levels where there is a possibility SOA develops into an uncontrolled process – more similar to service anarchy than service architecture.* Volvo risks going down that road if not managing this problem Lars-Åke Hedbom explains. *I believe SOA demands a long-term engagement and governance from top management throughout the entire organization, it is absolutely necessary if Volvo wants to benefit from SOA.*

In addition, there are no policies established for SOA at this point, which is something we should have done. Because, *if no formal principles or governance exist, investments in SOA are most likely to result in a waste of money, thus stopping us from reaching our goals. There exist recommendations and principles for SOA, but so far each project is free to decide if they want to follow them or not. Recommendations are simply not enough* Lars-Åke Hedbom points out – *some things needs to be compulsory*. He emphasizes that it is necessary to *set up standards so that everyone works in a similar manner in order to attain good governance*.

Lars-Åke Hedbom further asserts that he has gone through many changes: object oriented and component-based development just to mention a few. But these changes only affected the IT department. The difference with SOA is that it affects a lot more. It affects the entire organization. It is a big reconversion just finding a development process for SOA. Just building a service is not enough; there are more things that need to be taken into consideration down the road. *SOA has not gained the share of attention necessary due to lack of understanding and insight. SOA brings about big changes, something many people have failed to realize. Many people believe SOA is a change solely affecting the IT department – that SOA is solely a technological phenomenon, but SOA affects the entire organization, culture, application development etcetera – which demands governance, standards and guidelines*. Nevertheless, SOA has not encountered any resistance from the business people Lars-Åke Hedbom acknowledges, but we have realized that it will take time before creating an understanding for SOA and a routine were principles are being followed.

Another problem Volvo has faced regards the difficulty of establishing a proper structure for financing the services and assigning responsibility of them. *Ownership and funding of services has been a big problem* Lars-Åke Hedbom declares. *A problem resulting in many question marks; How should we deal with it, Who should pay for the services, How should they be financed, How should they be paid for, How should we subsidize? Questions which we have not exactly run across before, but simply needs to be solved*. It is a big step. By tradition, every business unit has owned their own data systems and been responsible for them. Additionally, the line organization has had more influence than the process owners, an organizational structure that needed to be changed in order to embrace SOA. Today, a shift has become apparent though, were the line organization supply services to the processes – a necessity to succeed with this. Volvo has also started an attempt to divide business unit's systems into different business domains, further being narrowed down into information domains, so that it will become possible to nominate information-, and service owners in the future. It clearly infers a great change for the application owners Lars-Åke Hedbom affirms, considering that they now will have to supply a great deal of services to others. Also when it comes to these aspects, some sort of principles in the form of service level agreement (SLA) is required to deal with exchanges of information between consumers and providers. In addition, funding of services is most likely to be even more complex in situations where services are to be shared with various external organizations.

Strong governance combined with a suitable product has also been recognized as a key to succeed in achieving a higher level of reusable services. So far there are no requirements demanding search after existing services or reuse of them. We do not spend time analyzing how the service can be reused by others, we just build it. But *we have realized that some kind of product will be required in order to find and enable reuse of services. It is necessary to get a tool that can manage and control this. Rules and routines are needed for the process of endorsing services. We need to determine what is allowed to become a service. It might also be a good idea to validate the services before they are published in production, and establish some contracts.*

4.1 THE SWEDISH TAX AGENCY (SKATTEVERKET)



Respondent: Håkan Westergren
Interview: Telephone Interview
Date: 5 May 2008

The Swedish Tax Agency (Skatteverket) is an administrative authority for taxes, national registrations, inventories of estates, and for watching over government receivables (Skatteverket, 2008). This task includes collecting and controlling tax payments from industry as well as individuals in Sweden. The work means that the agency needs to support more than 70 systems that provide information to individuals and businesses, as well as maintaining several large databases with tax information (Henkel, 2004a). Skatteverket has approximately 11,500 employees, located at a hundred locations in Sweden (Skatteverket, 2008).

Skatteverket has worked with SOA since 1996/1997 somewhere, Håkan Westergren recalls. Ever since then, a service-oriented mindset has been utilized when developing business services around the different databases. However, it was not before year 2003 Skatteverket started using SOA with the technical standard we associate SOA solutions with today – namely web services. Skatteverket's decision to adopt SOA mainly developed from the recognized need of solving upcoming and existing needs for integration, along with the possibility of attaining flexibility and process-orientation (Henkel, 2004a). Additionally, SOA would make it possible to phase out mainframes in a secure way instead of replacing them over a night Håkan Westergren points out. Today Skatteverket has a technical platform on place, acting as a foundation when building new services and systems. The aim is to gradually make the platform more and more SOA oriented over time, a process that will not happened over a night. Håkan Westergren estimates that there exist about 1,500 services altogether, depending on how defining a service. That is to say, some of the services are not as loosely-coupled as they are supposed to be in a SOA, they are more technical than conceptually oriented. Furthermore some services adopt the concept of SOA, but are being realized by other technologies than web services. Examples of internal services are national registrations, inventories of estates, and government receivables. External services have not been around as long as internal services, these are mainly involved with information regarding

national registration. Within 4-5 years, Håkan Westergren expects all future development in the infrastructure to be based on services with web service technology.

At present, almost all the core business processes have services being displayed to other areas within Skatteverket or the enforcement service. The vendors providing the basic products to realize SOA are BEA and Oracle, but Skatteverket engages in in-house system development as well. So far Skatteverket has no Repository or ESB.

4.1.1 CRITICAL FACTORS

It is important to have a distinct leadership present when adopting SOA, a person in charge, who has experience, is pragmatic, and practical minded. So far none has had the total responsibility; no person has been in charge of the services being supplied between the different systems. There has been a pretty big mandate within every business unit when it comes to determining what services are to be supplied for each particular area. A more centralized organization with more control over who is responsible for each service is needed. This is something we intend to focus more on in the future, creating a more central function being accountable for the quality of the services so that all the services developed achieve the right granularity and a satisfying level of reusability – a little bit more planning of the services so to speak.

Some sort of organizational unit should also be responsible of establishing a common view, and communicate it to the rest of the organization. Someone needs to be responsible for the “thinking” regarding the architecture and determine how it will develop. Because for some people SOA has only been perceived as technical change Håkan Westergren explains. It is therefore important to explain why we are using SOA and the benefits we hope to achieve by adopting it.

Another thing we have not succeeded with up to now is to standardize information structures and concepts in a harder way. This is one of the explanations as to why we have not achieved a satisfying level of reusability. So far, *it feels as if we have been developing too many services, they have not been reused adequately.* Many times, the person asking for information gets a new service satisfying their particular needs instead of reusing existing ones by combining a couple of services into a new one. In order to solve this problem, more energy needs to be dedicated to the information structure these services supply.

The need for a repository has been identified to facilitate reuse of services. But so far Skatteverket *does not have a technical catalogue that can be used to search after or find services; a piece we still miss with SOA* Håkan Westergren remarks. *As for example, if you need to invoke a service during the development process, it is not possible to connect to a catalogue to see what services already exist, which is one of the weaknesses we are trying to fix.* Nevertheless, I do not consider it to be a major problem. But from a development-, and contractual perspective it would have been nice to gather and organize everything in a catalogue so that there would not be any confusion regarding what services exist, who is responsible for them, and who to sign a contract with if reusing them etcetera. From that aspect it would have been good to have a catalogue.

4.2 SANDVIK



Respondent: Jan Nilsson

Interview: Telephone Interview

Date: 6 May 2008

Sandvik is a global industrial group with advanced products and world-leading positions in areas such as: tools for metal cutting, machinery and tools for rock excavation, stainless materials, special alloys, high-temperature materials and process systems. In 2007, the Group had approximately 47,000 employees and a representation in 130 countries (Sandvik, 2008).

Sandvik is well-known as one of the early adopters of service-oriented design and web service technologies in Sweden Jan Nilsson states. Sandvik started with a service-oriented design as early as 1986 when developing an application aiming at configuring specialized products, both for internal and external use. Nonetheless, it was not before the late 90s Sandvik started with the adoption of SOA supported by web services. Several issues emphasized the need to utilize web services and service-orientation. Among other things, a need to integrate systems on a world-wide level was recognized (Henkel, 2004b). Furthermore, SOA provided an efficient way to reuse functionality, the ability to offer collective services for different or same purposes, and the possibility of speedier development Jan Nilsson asserts. Today Sandvik has approximately a hundred services up and running within the entire corporate group, all being stored in an internal repository. Both internal and external services exist. Examples of internal services Sandvik has implemented are the ones involved with processes such as *get order balance*. External services have primarily been implemented towards external marketplaces, but also as solutions providing suppliers with detailed information about Sandvik's production. Being early adopters of SOA and Web services, Sandvik had to develop their own broker in-house, referred to as Ctalk. But nowadays, this broker is not widely used anymore and has more or less been replaced by Microsoft Biztalk server. Nonetheless, Jan Nilsson points out that the corporate group is not dependent on the Biztalk server. In addition, Sandvik has implemented an ESB.

4.2.1 CRITICAL FACTORS

It is extremely important to have control of the Enterprise Architecture and all the projects being initiated. The projects need instructions regarding what they are allowed to do and not do, Jan Nilsson affirms. *A project portfolio management is therefore of great significance, it will be responsible for the projects running, providing them with a project architecture telling them what services to consume and what services they are expected to deliver and enable to other consumers in the future.* Furthermore, managing and supervising our services in a structured manner has constituted a difficulty, whereas *it is important to have knowledge about structured development. Mutual views of the information, nomenclature, and the business rules that are to be applied on the data in concert with contracts stating what the services are expected to deliver are needed. Additionally, it is essential to perform code-readings of the services being developed as*

well as setting principles of how to develop the services so that they can serve more purposes than simply one specific need.

Unless for the technical services, Sandvik has not been able to achieve the level of reuse they desired. *One probable cause as to why Sandvik has not succeeded in attaining a high level of reuse of services is due to the fact that the services were developed for one single cause* Jan Nilsson explains, *there was not enough time to do the entire homework. We should have engaged in process and information modeling so that it would have been possible to identify all the stakeholders and find a mutual language to speak about this.* The organization needs to be mature in order to achieve reusable services. It has to have control of the processes all the way down to the activities and see the benefits of doing a rigorous initial work. It really pays off in the end.

Another difficulty *Sandvik has experienced is the problem of getting the business side to take on ownership of the processes, because preferably they are the ones who should manage the services. I believe it is important to establish a dialogue discussing what activities they have in their processes etcetera, so that it becomes possible to identify potential services from them* Jan Nilsson states. To deal with the uncertainty of ownership, *we are trying to institute information owners being responsible of the objects, methods, and the services we aim to supply, in conjunction with agreements of what the information should contain.*

To summarize, Jan Nilsson concludes that the key to succeed with SOA is to gain control of the processes and the activities within them, find a common nomenclature and terminology, and to assign a clear ownership of the processes, the information, and services.

4.3 SEB



Respondent: Anders Jäder
Interview: Telephone Interview
Date: 7 May 2008

SEB is a North-European financial group for corporate customers, institutions and private individuals. The group's activities mainly comprise banking services, but also carry out significant life insurance operations. SEB serves more than 400,000 corporate customers and institutions and more than five million customers in Sweden, the Nordic countries and rest of Europe. More than half of SEB's approximately 20,000 employees are located outside Sweden (SEB, 2008).

SEB's interest for SOA partly originated in a recognized need of a secure communication protocol that was platform and language neutral, and an internal architecture that enabled structured access to internal systems (Henkel, 2004c). SEB started with SOA somewhere in the early 90s. But it was not before 1996 when Gartner made a review of their progress by writing an article about the company, it became officially referred to as SOA. The longest experience of SOA through web services comes from SEB Tryggliv Anders Jäder

asserts. Together with key players in the insurance domain, SEB Tryggliv developed a *web service SOA standard* named SSEK in 2004. SSEK is a secure communication protocol specifying how to exchange external web services with other insurance brokers business to business (B2B). Another example of services implemented concerns the process of listing a customers' engagement, which can be everything from accessing products to checking the balance of an account. Anders Jäder estimates that SEB has about 4,500 services up and running throughout the entire organization. Nonetheless, some of them are only service-oriented, that is far from every service can be classified as being a web service. SOA is important for SEB, but web services are only one of many techniques that can be used when accessing and implementing services. SEB has had a repository for storing services ever since 1995, and has also had an ESB for quite some while. When it comes to products and vendors of integration solutions, SEB has a close collaboration with IBM.

4.3.1 CRITICAL FACTORS

Governance has been of great significance for SEB's adoption of SOA Anders Jäder remarks. From the beginning, in generation 1, the company had a proper governance function established within the organization, being phased out a couple of years later. This event triggered a process where the work involving defining and reusing services got out of hand. SEB ended up having many overlapping services optimized for dedicated use rather than reuse. In generation 4, SEB had 4,500 services, which is way too many according to Anders Jäder. *Today SEB is aiming at restoring the governance function and creating a structure managing and validating the exposure of services. At SEB we have named this governance function the SOA Competence Center. This function will be responsible for controlling the exchange of information between systems, and providing a mutual language when communicating.*

Another circumstance that made it difficult to attain reusable services was due to the financial structure. SEB had instituted a model where the provider of the service had to bear the cost of it. Resulting in an unwillingness to share and supply services to other consumers who needed it, since they had to pay for their consumption as well. Today, we are trying to fix this by implementing mechanisms promoting reuse instead of against it. So instead of having a model punishing exposure of services, the solution is to have a model rewarding it by making the consumers pay for the services they use.

As a means to keep track of the services developed and further facilitate reuse, SEB has implemented a repository. Just as in the remaining parts of the organization, an increased level of governance is called for here as well Anders Jäder states. *There should be an organization endorsing all the services being stored in the repository and displaying all the services stored inside of it. That way you get a better process insuring that all the services developed are unique, thus not being redundant. If not, you are likely to get a service which is more or less the same as previous ones, and that is not desirable at all. Some sort of SOA governance organization should be in charge of this set of regulations.*

The concept of SOA will be a challenge for the business side in the future; regardless of if it is a bank or not Anders Jäder believes. *SOA has constituted a major change in the*

organization by introducing consumer and provider relationships where business units are responsible for supplying services to the rest of the organization, services that have been developed by invoking other business units' services to begin with. This is clearly a *conceptual change, requiring collaboration between business units in order to attain a common view of how to build this kind of architecture. To facilitate this change in generation 1, SEB instituted a SEB university, a school teaching the development organizations how to think when designing and developing these concepts.* However, this school does not exist anymore.

Al together, I believe the biggest lessons learned from SEB's SOA experience is that the technology is the smallest problem – governance, control in the shape of financial principles, guidelines, and standards are foremost the biggest and most important matters to deal with Anders Jäder notes.

4.4 SUMMARY OF THE ORGANIZATIONS' TECHNICAL MATURITY

Table 1: SOA Maturity

	SAS	VOLVO IT	SKATTEVERKET	SANDVIK	SEB
ADOPTED THE CONCEPT OF SOA	(2001)	(2003)	(1996/97)	(1986)	(1990s)
ADOPTED SOA WITH WEB SERVICES	2004	2004	2003	Late 90s	1996
ESB	X	X	NO	X	X
REPOSITORY	X	NO	NO	X	X
SERVICES	NA	~A hundred	~1,500	~A hundred	~4,500

5 SOA IN THEORY

This chapter will present theories from previous research acting as a complementary point of reference when discussing the empirical findings in the subsequent analysis and conclusion.

5.1 THE IMPORTANCE OF GOVERNANCE

Questions and concerns regarding IT Governance have been around since the introduction of IT in companies (Van Grembergen, 2004). In fact, all enterprises have IT governance according to Weill & Ross (2004). However, there is a distinction between two different types of governance. Those with effective governance have actively designed a set of IT governance mechanisms such as: structures, processes, committees, procedures, and audits encouraging behaviour consistent with the organization's mission, strategy, values, norms, and culture. As a result, good governance design allows enterprises to deliver superior results on their IT investments, and the opportunity for IT to factor significantly into competitive strategy. In contrast, enterprises that govern IT by default more often find that IT can sabotage business strategy (Weill & Ross, 2004).

5.1.1 SOA GOVERNANCE

Most researchers agree that the value of governance to the success of SOA cannot be overstated – SOA must be governed and kept under control (Carter, 2007; Dimarzio, co-author in Benson, 2006; Mehling, 2008; Hurwitz et al. 2006). According to Carter (2007) governance is a major determinant of the organizational, technical, and behavioural success of an SOA. Governance is so essential that it must be built into the SOA planning and deployment from day one. Woods & Mattern (2006) even note there will be chaos without SOA governance of all service lifecycle processes. A statement that might explain the quote by Gartner Group stressing that the: *“lack of working governance mechanisms in midsize-to-large (greater than 50 services) post-pilot projects will be the most common reason for project failure”* (Thompson et al, 2005).

But what does the concept of governance infer when talking about SOA? Well, explanations aiming at describing the features of SOA governance are many. Mehling (2008) states that SOA governance refers to activities and procedures related to exercising control over services in an SOA environment. It features everything a company uses to ensure SOA is done in accordance with best practices, architectural principles, government regulations and pertinent laws. Likewise, Woods & Mattern (2006) assert that SOA governance and policies provide a management structure, processes, and policies to oversee operations and management of services. In addition, Carter (2007) states that the task of SOA governance is to assist in establishing a process for shared services, facilitating communications, as well as enforcing standards, platforms, and policies.

5.1.2 SOA GOVERNANCE MODEL

Bieberstein et al. (2006) highlight the importance of governance by stating that an accepted and formalized governance model is crucial to successfully achieve business

objectives. A successful SOA project can happen only with the strong support of senior executives, identified funding, and proper empowerment of the SOA governance body. Marks & Bell (2006) state that: “An SOA governance model defines the various governance processes, organizational roles and responsibilities, standards and policies that must be adhered to in an SOA conceptual architecture.” Accordingly, Carter (2007) asserts that SOA governance helps with funding and ownership of shared services, executive commitment to the governance model, and the organizational design—all being critical items in helping companies have successful SOA deployments. To address these issues Carter recommends having a SOA governance framework (Figure 6) monitoring the SOA governance processes. The framework displays the four stages: plan, define, enable, and measure that will be presented in more detail below.

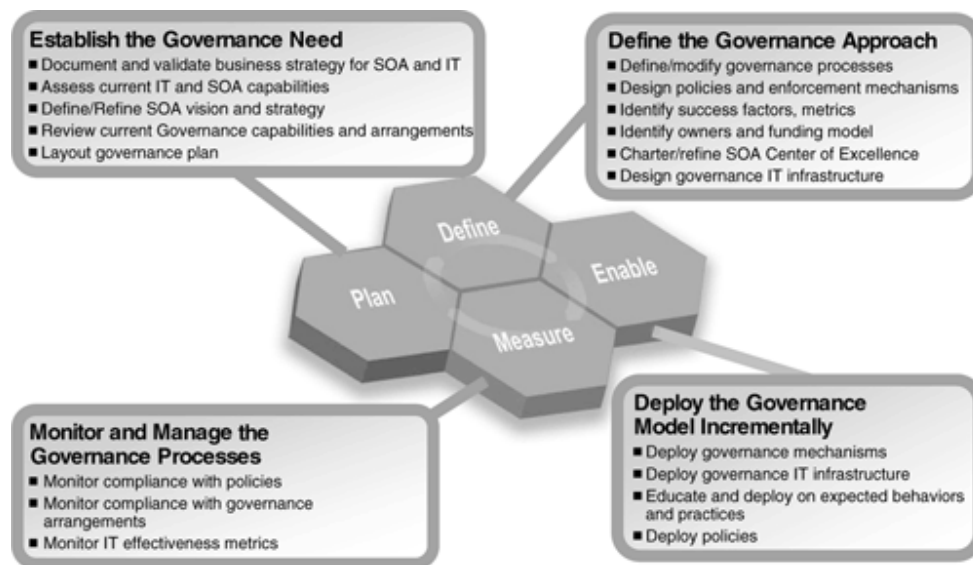


Figure 6: SOA Governance Framework (Carter, 2007)

In the *Plan stage*, the need for governance is established. It entails activities such as documenting and validating the business strategy for SOA and IT, assessing current IT and SOA capabilities, and defining and refining SOA vision and strategy. In short, this phase should result in an overall governance plan being laid out.

The chosen approach is thereafter mapped out in the subsequent *Define stage*. This includes the governance processes, the design of the policies and enforcement mechanisms, and the identification of the success factors and metrics. Additionally, owners and a funding model is identified, as well as a SOA centre of excellence to develop the right skills to both design the governance IT infrastructure and set the right business linkages in place.

In the *Enable stage*, the governance model is deployed incrementally. This includes the governance mechanisms and the deployment of the governance IT infrastructure that were planned for in the Define step. In addition, the education on expected behaviours, practices, and policies in this stage should be thought through.

The *Measure stage* sets up the monitoring and management of the governance process. It is important to ensure compliance with policies and governance arrangements, and to monitor the IT effectiveness metrics.

Although, Carter (2007) points out that a SOA governance framework should not be depicted as an isolated effort from the rest of the organization. She has recognized that the corporate governance and organization are most often not completely in line with the IT governance structure. A problem arising due to the mechanisms being so disjointed. Thus implying, that the CEO has no chance of knowing who is responsible for solving the customer service problem across the organization (Figure 7). Instead, Carter, 2007 envisions a future in which corporate governance, IT governance, and SOA governance do not run separately, but instead work together to drive innovation and competitive advantage that most companies seek. To achieve alignment between business and IT, corporate governance must be the overarching governance model focused on the business's outcomes. SOA governance needs to be part of IT governance, and IT governance needs to drive IT toward business goals. And by aligning the organizational design with a governance structure, the CIOs now will have a view of the funding, ownership, responsibilities, and control that enables them to support the overarching goal.

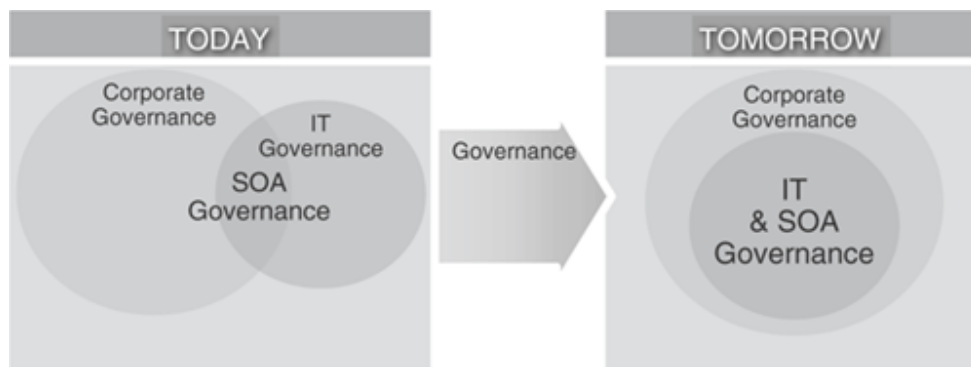


Figure 7: Aligning Corporate, IT, and SOA Governance (Carter, 2007)

5.2 CENTRAL SOA FUNCTION

According to Carter (2007), the best way to handle the need of strong governance is to establish an SOA Centre of Excellence (CoE), which combines the expertise and assets from across your company. An SOA CoE helps companies that have made an enterprise-wide commitment to architectural change, speed the adoption of that change, mitigate risk, and align the transformation with industry best practices.

The SOA CoE accomplishes these goals by leveraging assets and best practices developed from experience across the company with similar enterprise transformations. In essence, the CoE is designed to supply assistance in implementing an SOA in concert with the business design and goals (Carter, 2007). Bieberstein et al. (2006) support this theory by stating it is quite useful to establish an SOA CoE to control the SOA roadmap and to support large and complex projects. The CoE is responsible for keeping the SOA-based implementation aligned with the business requirements on a strategic, tactical, and operational level. It requires authority over technical artefacts such as architecture

blueprints, enterprise templates, and design assets. However, there exist plenty of other suggestions of how the SOA effort should be organized. Brown (2007) stresses, that it is vital to have an active SOA architecture group. Because one of the prime requirements for SOA is that the services must fit smoothly into future projects. That is to say, the outcome of each project must integrate smoothly with those of others. In order to achieve this, someone must have the responsibility to determine how all the pieces will fit together and to shape them accordingly, having the authority to ensure project compliance. This is the role of the SOA architecture group. Hurwitz et al. (2006) on the other hand propose the adoption of a centralized committee focusing on the way the SOA life cycle works for the business. This committee needs to establish strategies for how IT policies are designed. It determines how SOA components are managed and maintained and how to achieve quality of service. According to them, this is the foundation for the governance strategy. Keller (2006) also stresses SOA requires centralization. A key goal of SOA is standardization of services and components. The best way to accomplish this is through a centralized group or small team that manages the architecture. Ultimately, Benson & Kaberon in (Benson, 2006) discuss the benefits of implementing a central SOA function by stating that if the control of the service definitions is done through a centralized SOA governance board, there is a very good chance that the services will get maximum reuse and be very reliable.

5.3 PRINCIPLES & STANDARDS

As mentioned, a key feature of the SOA governance model entails defining and enforcing the policies that are needed to manage an SOA for business success (Marks & Bell, 2006). In consequence, policies are a central concept to managing an SOA (McGovern et al, 2006). Without a coherent policy, each project will go its own way and the result will be incompatibility and costly retooling later on (Windley, 2007). Governance principles and guidelines therefore form the fundamental basis for any decisions. They shape the solution area and define how business and IT units collaborate. Everyone involved should therefore carefully understand and agree upon these principles; from executive management all the way down to individual project personnel (Bieberstein et al, 2006). Borden & Mitlehner co-writers in (Benson et al, 2006) also highlight the importance of establishing policies by discussing how the lack of such may affect reuse of services. The authors stress that without policies and procedures to document a service's definitions and registrations, its lifecycle and how different stages interact; a company can quickly find that overlapping services are being created. Soon, a company may find it is quickly returning to the application environment that SOA was to replace – thereof, failing to obtain an imperative objective of SOA.

However, defining policies as part of the SOA governance model is not enough, policies must be enforced at design time, at publishing and discovery time, and at run-time. That is to say, telling your SOA constituents what your conceptual architecture, vision, and goals are is one thing. Enforcing conformance to your SOA conceptual architecture, vision, and goals is quite a different matter. After all, in order for governance to be effective, it must be built on a foundation of specific enforceable policies that will be used to encourage conformance to the goals, standards, and specifications of an organization's SOA governance model (Marks & Bell, 2006). Likewise, Bieberstein et al.

(2006) have recognized that one of the pitfalls with SOA is to have a governance body having a consultative role, which cannot enforce its recommendations. Windley (2007) specifically points out that the enforcement mechanisms you build into governance are crucial – If you are not enforcing policies, they are just suggestions. As a result, it is vital to make sure that architectural reviews, routine audits, project scorecards, and other measurement activities are tied to natural gating activities such as project planning, project funding releases, and code promotion.

Moreover, SOA calls for strict adherence to certain technical standards when creating enterprise services. Without standardized networking interfaces and semantic definitions, for instance, any enterprise services that an organization builds for itself will be unlikely to integrate properly with any other enterprise services. Without the right policies and incentives in place to make sure that SOA-related standards are employed, SOA's essential value will be lost (Woods & Mattern, 2006). Another tool to govern SOA is Service Level Agreements (SLAs). SLAs help to mitigate risk by clearly stating the responsibilities of the various roles involved in the consumption and provision of services, thus managing expectations and helping to avoid possible contractual disputes (Allen, 2006; Woods & Mattern, 2006).

5.4 LEADERSHIP

Regarding management of the move towards SOA, Linthicum (2007) states it is vital that it is driven by a commitment from the top. Nothing is worse than attempting to do something innovative in a highly territorial environment that spans into those environments. And SOA indeed spans territories. Thus, you need buy-in from the top of the organization, and they must have the political will to embrace change. Therefore, the best advice to succeed with SOA is to get investment and loyalty from the top of the organization, so you have the political power to protect projects, and the influence to convince people of the long-term value and importance of SOA to the enterprise. Anything less will result in failure. Bieberstein et al. (2006) support this conviction, stressing that a successful SOA project can happen only with the strong support of senior executives. Buckingham co-author in (Benson, 2006) explains that in order to create a development culture and environment that is encouraging to software reuse, which is a key consideration in implementing SOA, executive support is often necessary. Senior staff speaking positively about software reuse reminding staff about its strategic perspective is vital. Moreover, Knorr & Rist (2005) state the more allies you have who share the SOA vision, the better. In particular, it helps to have powerful partners in your company's business management who understand the ultimate payoffs of cost reduction and accelerated response to change across the organization. Carter (2007) also makes a comment about the characteristics required of the leader in charge of the SOA effort, stressing that it really takes an innovative IT leader with existing respect of business and a centralized IT organization to drive IT and SOA forward.

5.5 THE HUMAN ASPECTS OF SOA

Surprisingly, one of the most common problems of implementing software is not the complexity of creating a technology solution; instead, it is the problem of developing an understanding of the business needs and of what must be implemented to meet those

(Benson et al, 2006; Bieberstein et al, 2006, Brown, 2007). Hence, SOA governance is as much about organizational issues and how people work together to achieve business goals as it is about any technology (Allen, 2006; Hurwitz et al, 2006). Nonetheless, many people tend to perceive it as one, failing to acknowledge a very important and strategic point: SOA is first and foremost about the design of your business, not the technology (Heffner & Fulton, 2007). That is, SOA is as much a state of mind as it is a technology. It is as much about behaviour and orientation as it is about programming per se. Accordingly, the biggest challenge of SOA is rather ideological than technological. Deploying SOA requires a new way of thinking, and a new way of acting. Hence, bringing about SOA is rather a question of reinforcing behavior and creating culture (Kelly, co-author with Benson, 2006). A viewpoint also strengthened by Howard (2008), stressing people are most often resistant to change, thereof easily falling back on old habits. Hence, implying the benefits of SOA will be lost when people continue creating modern silos instead of agile applications. To deal with this challenge, organizational changes are required, especially to organizational structures, accounting practices and incentive systems. In order to ensure consistent architecture and development knowledge, comprehensive education for IT staff and relevant business partners are also essential.

Except for organizational changes and education, Bieberstein et al. (2006) have acknowledged the importance of regular communication as a means to deal with the corporate cultural changes. Communication between lines of business and technology teams are indeed critical to hurdle the barriers. A common understanding of a structured approach from business to IT is absolutely fundamental for defining the architecture. Marks & Bell (2006) further stress an SOA conceptual architecture cannot be realized unless it is communicated to the constituents of the SOA – to the business users, developers, architects, business analysts, close trading partners, and business and IT executives. Often there is a communication breakdown between business and IT communities due to language, performance, and other barriers. Therefore it is important that the business and IT organizations communicate strategies, standards, best practices, and policies using internal terminology and language that reflects the culture and heritage of the specific organization. Moreover, since SOA determines the architecture of both business units and systems, Bieberstein et al. (2006) declare that both business and IT need to work together to successfully implement SOA. Both business and IT units need a common understanding of the business strategy and objectives. Brown (2007) further states it is imperative that the business and IT communities join forces and work together in order to achieve the objectives of SOA. Together, they must define the business process and system changes required to produce the expected business results. This collaboration is not just to make SOA initiatives succeed. It is vital for any project that is supposed to produce business value. Because, for the most part, failed projects are projects that have either lost sight of the business objectives or failed to focus the business process and system changes on achieving those objectives. Accordingly, Howard (2008) argues that to achieve true collaboration and enterprise-scale SOA success, both business and IT teams will have to be nudged out of their comfort zones and start working with less-familiar parts of the organization.

Finally, Howard (2008) recommends organizations to set up an SOA program office responsible for leading the effort. This office should be in charge of developing an adoption plan and business case, and serve as a primary communication channel between business and IT. The program office should develop new governance processes, policies and best practices to facilitate this culture shift and ensure the overall success of the SOA initiative. This ongoing communication and management is required for a successful SOA initiative.

5.6 FUNDING & OWNERSHIP OF SOA

Other than the organizational changes directly related to the human aspects of SOA, other kinds of changes may be required as well. According to (Carter, 2007) one critical task the SOA governance function has to deal with is the issue regarding funding and ownership of shared services. Allen (2006) states that ownership of services and financial models for funding and charging of services are two of the most challenging cultural aspects of SOA. Dimarzio co-author in (Benson, 2006) asserts that many enterprises today have a financial structure where each line of business owns its IT assets and controls funding of development projects on a cost/return basis. Under this model, the organizational goal is to complete projects quickly and inexpensively and the extra cost of making services reusable is viewed as overhead costs to be avoided, rather than an investment. Thus, no business incentives for departmental units exist to make the additional investments necessary to achieve reusable services. Marks & Bell (2006) have also acknowledged that many organizations budget at the project level, where the project and its funding are subsidized by one business unit. This model creates conflict when SOA seeks the development of shared reusable services across business domains. As a result, a funding model creating organizational incentives to develop reusable services for the greater good of the organization is of importance. Creating such a model will require some creativity, new incentive models, and authority to implement these kinds of changes. Woods & Mattern (2006) asserts that the best way to handle these issues is to address budgeting practices and funding models early on in the SOA process. Providing answers to questions like: Who will pay for building and maintaining services? Who will pay for new shared SOA enabling technology when it is required by a specific project yet will be shared across business units? What does each department owe the other? How will the SOA greater good be funded for shared services and infrastructure?

To deal more specifically with the ownership of the services, Carter (2007) stresses that a key to good SOA governance is the ability to classify services into logical domains and assign owners to each domain. The domain owners are responsible for monitoring, defining, and authorizing changes to existing services and for deciding when a new service in their domain is required. Following this advice will simplify the management and implementation of an SOA.

5.7 REUSE OF SERVICES

One reason as to why SOA has become so popular is due to enterprises seeking to architect business processes from reusable services. A vision, promising that the reuse of services will cut IT costs by avoiding the cost of re-implementing existing functionality in future projects (Brown, 2007). Nonetheless, services orientation does pose challenges

to existing silo-based project structures. Basically, a service encapsulates functionality provided by one business unit so that it can be used by at least one other business unit. In turn, that other business unit is responsible for some other portion of the overall business process. In order for this to work, the interests and needs of these other business units must be factored into the design of the business service, or it will not provide the functionality required. Furthermore, given that services in essence are pieces of business processes; they naturally involve people and information as well as systems. As a result, in defining services, you are structuring and organizing business processes and business organizations as well as systems. Thus, if services are to be reused, they must fit cleanly into multiple business processes and align well with assigned business responsibilities. Hence, they require the total architecture perspective and active business involvement (Brown, 2007). So from a theoretical perspective, all services within an SOA deployment can become universally and heavily reused, thereby saving on development and maintenance cost and boosting productivity – being one of the major benefits with SOA. In practice, however, Dimarzio co-author with (Benson, 2006) points out that reuse is only occurring with any degree of regularity today at lower organizational levels such as within departmental applications. There is not much reuse of services occurring at the business unit or enterprise level where the payback can be much greater. The truth is that SOA is not inherently and automatically reusable; it often requires additional investment in time and money to ensure that the service meets the needs of all potential users, both now and in the future. Hurwitz et al. (2006) has also acknowledged the difficulty of reusing services at an enterprise level, and has provided one explanation as to why “reuse” is so complicated to achieve. It is a common problem among many large companies to have lots of similar programs spread across departmental units. Every time a department wants something slightly different, the department builds its own version of that something so that, across a particular company, you can find multiple versions of more or less the same program – with, of course, slight variations. Many IT shops have policies and procedures designed to prevent this duplication, but when deadlines loom and budgets are tight, it is often easier and faster to write something from scratch that fills the need rather than coordinate with other divisions.

5.7.1 REPOSITORY & REGISTRY

A tool that can assist companies in managing their services and promote reuse is a service repository. A SOA repository is a place where the organization stores information about what is inside each service (Hurwitz et al, 2006). The presence of a central repository enables reuse of its elements. In a repository you can efficiently design services that reuse data types and even entire service interfaces. It is also possible to determine what is missing and model the entities needed to be created. When modelling, people can scan the repository to see if any elements can be reused or adapted. This in turn fosters orderly, robust, efficient development. And of course, it saves time as well. Hence, by having all service objects available in a common repository, you can avoid reinventing the wheel and maximize reuse (Woods & Mattern, 2006). Another tool useful is a service registry. A registry provides the ability to locate services, store service meta-data and provide mechanisms to aid in management and promotion of reuse of services. A tool like this can be a great aid in managing a growing service-based environment (Borden & Mitlehner co-writers in Benson et al, 2006). However, even though the registry and

repository are used in conjunction with each other, they should be considered as two separate SOA components (Hurwitz et al, 2006). Organizations that are experimenting might not put a lot of investment into their registry and repository. However, as companies begin to move from a pilot stage of SOA into real implementations across many different business units, the registry and repository become important factors in both scalability and control of the environment (Hurwitz et al, 2006).

6 RESULTS – SUCCESS FACTORS

In this chapter, the critical factors identified in the interviews with: SAS, Volvo IT, Skatteverket, Sandvik, and SEB, will be summarized and discussed in relation to established theories from previous research. Hence, switching from an inductive approach having no presumptions, to a deductive approach where empirical data is tested against existing theories.

6.1 EXERCISE STRONG GOVERNANCE

All of the respondents agreed that strong governance and control were key factors to succeed with SOA. **SEB** stated that: *Governance has been of great significance for the adoption of SOA.* **SAS** affirmed that: *It is vital to have strong governance of the IT development and an IT dominance structure present, ensuring that the right services are being developed.* Furthermore, **Volvo IT** said: *SOA demands a long-term engagement and governance.* **Sandvik** stressed that: *The key to succeed with SOA is to gain control of the processes.* Additionally, **Skatteverket** pointed out that: *More control over who is responsible for each service is needed.*

This discovery corresponds well with previous researchers' findings, highlighting governance and control as important ingredients to make SOA successful (Benson & Kaberon in Benson, 2006; Dimarzio in Benson, 2006; Carter, 2007; Hurwitz et al, 2006; Mehling, 2008; Woods & Mattern, 2006). Thus, identifying governance as a key factor to succeed with SOA clearly has strong support in academic research, thereby adding credibility to the thesis' result. Coming to this conclusion was not a completely shocking result considering that governance has been on most companies' agenda since the introduction of IT – or at least should have been if standing a chance on a competitive market as Van Grembergen (2004) has noted. After all, governance has been, and will most certainly remain a very important issue also in the future, regardless if it concerns SOA or not. However, I do believe the move towards SOA will bring about new challenges within the field of governance. That is, what has been considered as appropriate governance up to now, does not necessarily suggest it will be sufficient once an organization decides to move towards an SOA. A reflection that at least cannot be completely rejected bearing in mind that all the organizations were aware of the importance of governance, concurrently as none of them were of the opinion they had succeeded in fully implementing a satisfying governance structure for SOA. Despite that, based on the organizations' experience of both success and mistakes, they did share some additional fundamental ingredients they perceived as essential to succeed with this kind of architecture.

To facilitate the discussion, the factors identified have been categorized into the following five topics: central function, principles, standards, contracts & guidelines, funding & ownership, communication, and leadership. They will be discussed in the order of their significance. Also, a discussion will be held explaining how these aspects of governance impacts reusability – one of the major benefits expected when deploying SOA.

6.1.1 CENTRAL SOA FUNCTION

In the interviews with the respondents, four out of the five organizations especially called for a central function or some kind of coordinating unit to govern the adoption of SOA. **SAS** reported that they had a centralized IT function at the top, responsible for reviewing projects and the planning of the services in the enterprise architecture. **Skatteverket** on the other hand declared they intended to create a more central function ahead, being responsible for the quality, granularity, and reusability of services. **SEB** reported that they were about to reinstate a governance function managing and validating the development of services, referred to as the “SOA Competence Centre”. Ultimately, **Sandvik** advocated for the establishment of a project portfolio management, accountable for providing project architecture for the projects running, and informing them what services to consume, and what services to deliver and enable to other consumers. **Volvo IT** did not explicitly mention a central SOA function as an essential factor. Nonetheless, compared to some of the other organizations, Volvo IT actually has an integration office within the IT governance function being responsible for integration initiatives. The only problem seems to be that this unit has not comprised SOA in their strategy. Because Volvo IT clearly is suffering from difficulties of providing direction and governance, enforcing policies, and establishing processes promoting reuse of services. To deal with such difficulties Carter (2007) advocates that organizations have to ensure that SOA governance become a part of IT governance.

When reviewing theory, many researchers have advocated the need for centralization through a coordinating unit when adopting SOA. For instance, Keller (2006) and Benson (2006) believe that the best way to achieve standardization and control of the service definitions is to assign a central group or small team that manages the architecture. To address this need, Bieberstein et al. (2006) and Carter (2007) both advocate for the establishment of a SOA Centre of Excellence (COE). Additionally, Bieberstein et al. (2006) speaks of a central governance council, responsible for reviewing additions or removals of services, as well as changes to existing ones before authorizing their implementations. On the contrary, Brown (2007) calls for a SOA architecture group. He stresses that someone must have the responsibility to determine how all pieces will fit together and to shape them accordingly. Moreover, Hurwitz et al. (2006) stress that centralization is the foundation for the governance strategy, insisting that it is necessary to have a centralized committee focusing on the way the SOA life cycle works for the business.

All together, a need for a SOA governance function has been identified both by respondents and researchers. There exist many proposals as to how it should be defined and referred to, but altogether there is a collective opinion that some kind of organizational unit or group with a holistic perspective should guide and supervise the move towards SOA.

6.1.2 PRINCIPLES, STANDARDS, CONTRACTS, AND GUIDELINES

Four out of the five respondents emphasized the importance of having principles, standards, contracts, or guidelines as important factors to succeed with SOA. For instance, **Sandvik** stated that setting principles of how to develop the services is essential

so that they can serve more purposes than simply one specific need. It is also vital to establish common nomenclature, terminology, business rules and contracts stating what services are expected to be delivered. **SEB** noted that principles, guidelines, and standards are some of the biggest and most important matters to deal with to succeed with SOA. **Volvo IT** even said that: *If no formal principles or governance exist, investments in SOA are most likely to result in a waste of money, thus stopping us from reaching our goals.* Hence, Volvo IT pointed out that it is vital to set up standards so that everyone works in a similar manner, otherwise it will be impossible to achieve strong governance. Volvo IT further explained that there in fact exist recommendations and principles for SOA at this point in time, but the problem is that each project is free to decide if they want to follow them or not. Therefore recommendations are not enough, they need to be compulsory. Volvo IT also emphasized the importance of establishing contracts. Something **SAS** agreed with as well, emphasizing the importance of setting up contracts by stating that it has been tricky to manage all the different interfaces. Something they solved by signing integration contracts regulating all privileges between providers and consumers.

According to several researchers policies are a central concept to managing an SOA (Bieberstein et al, 2006; Marks & Bell, 2006; McGovern et al, 2006; Windley, 2007; Woods & Mattern). Governance principles and guidelines form the fundamental basis for any decisions. They shape the solution area and define how business and IT units collaborate. Everyone involved should carefully understand and agree upon these principles, from executive management to individual project personnel (Bieberstein et al, 2006). Hence, SOA calls for strict adherence to certain technical standards, because without the right policies and incentives in place to make sure SOA-related principles are employed; SOA's essential value will be lost (Woods & Mattern, 2006). Although, in order for governance to be effective, Marks & Bell (2006) and Windley (2007) stress that it must be built on a foundation of specific enforceable policies that will be used to encourage conformance to the goals, standards, and specifications of an organization's SOA governance model – because otherwise they will just be suggestions.

Consequently, defining and enforcing principles, standards, and guidelines are considered as important components of governance, both by respondents and literature. Contracts in the form of SLAs also had support in literature, but were not as frequently discussed or highlighted as the other ones. Bearing in mind the fact that SOA actually does span organizational territories, simultaneously as being a concept many people finds difficult to grasp and comprehend; instituting a mutual strategy and approach getting people to join forces and face the challenges of SOA together may not be such a bad idea.

6.1.3 FUNDING & OWNERSHIP

Two out of five respondents listed funding as a critical factor needed to be considered when adopting SOA, whereas three out of five respondents mentioned ownership. **Volvo IT** explicitly said that: *Ownership and funding of services has been a big problem. When application owners suddenly were expected to expose services to others, existing financial and ownership structures needed to be reviewed and adapted.* In Volvo's case, they had to make some organizational changes to manage the funding and ownership

issues that had arisen. They shifted the power structure by forcing the line organization to supply services to the process owners. Moreover they initiated the work of identifying information-, and service owners, and the establishment of service level agreements between consumers and providers. **SEB** also reported difficulties of attaining reusable services due to their present financial structure. To solve this problem **SEB** announced that they are now trying to establish a financial model rewarding reuse by making the consumers pay for the services they use instead of punishing the business units when exposing the services. **Skatteverket** did not particularly discuss the need for adjusting their financial structure, but rather mentioned the difficulty of assigning responsibility when moving towards a service-oriented architecture. **Skatteverket** recognized that: *A more centralized organization with more control over who is responsible for each service is needed.* Moreover, **Sandvik** acknowledged that they: *Still find it difficult to get the business side to take on ownership of the processes, because preferably they are the ones who should manage the services. As a result, it is important to establish a dialogue discussing what activities they have in their processes etcetera, so that it becomes possible to identify potential services from them.* Another effort to deal with this has been nominating information owners being responsible of the objects. They have also instituted methods, as well as agreements of what the information should contain. **Sandvik** particularly highlighted that: *It is key to assign a clear ownership of the processes, information, and services.*

Several researchers stress that funding and ownership of services are important aspects needed to be considered when adopting SOA (Allen, 2006; Carter, 2007; Marks & Bell, 2006; Woods & Mattern, 2006). According to Allen (2006) ownership of services and financial models for funding and charging of services are two of the most challenging cultural aspects of service orientation. Carter (2007) states that funding and ownership of shared services is a critical task the SOA governance function needs to deal with. Marks & Bell (2006) further stress that a funding model creating organizational incentives to develop reusable services for the greater good of the organization is fundamental to SOA.

Ultimately, both respondents and researchers find it advisable to review present funding and ownership structures to discover if they will be suitable for SOA, or if they will need to be adapted. Failing to do so may otherwise constitute serious impact on the reuse of services ahead **Dimarzio**, co-author with (Benson, 2006) asserts.

6.1.4 COMMUNICATING THE SOA VISION

Four of the respondents admitted the difficulty of communicating what SOA is to the organization, and getting people to understand and embrace the concept of such architecture. **SAS** declared that: *The awareness about SOA development is quite low throughout the organization and that is a problem.* For instance, it has had a bad impact on the collaboration necessary when describing business processes. **SEB** highlighted the conceptual changes SOA has resulted in by discussing how the consumer and provider relationships have changed when business units suddenly became responsible for exposing services to other parts of the organization. Both **Volvo IT** and **Skatteverket** reported that SOA only has been perceived as a technical change for some people. **Volvo IT** explained that: *SOA has not gained the share of attention necessary due to lack of*

understanding and insight. SOA brings about big changes, something many people have failed to realize. However, **Volvo IT** noted that they have not encountered any resistance from business people, but they have realized that it will take time before they will fully grasp the concept of SOA.

When asking how they have dealt with these problems a couple of suggestions arose. **Volvo IT** called for increased governance, standards and guidelines. **SEB** stressed that collaboration between business units was needed to attain a common view of how to build this kind of architecture. **SAS** listed communication as an important factor to achieve awareness and understanding for SOA. Something **Skatteverket** also agreed with by emphasizing the importance of explaining why they are using SOA and the positive effects they hope to achieve by adopting it. Additionally **SEB** and Skatteverket particularly raised the need for a function responsible for communicating the SOA vision. **SEB** stated that a function should be responsible for controlling the exchange of information between the systems, as well as providing a mutual language when communicating. In the initial phases of **SEB**'s adoption of SOA, a **SEB** University responsible for teaching the development organizations how to think when designing and developing these concepts had been established to facilitate the change. In addition, **Skatteverket** stated that: *Some sort of organizational unit should be responsible of establishing a common view, and communicate it to the rest of the organization. Someone needs to be responsible for the "thinking" regarding the architecture and determine how it will develop.*

Previous literature has also acknowledged the complexity of conveying the idea behind SOA to organizations (Benson et al, 2006; Bieberstein et al, 2006; Brown 2007; Heffner & Fulton, 2007; Hurwitz et al, 2006; Marks & Bell, 2006). As Kelly co-author with (Benson, 2006) pointed out – the biggest challenge of SOA is rather ideological than technological – deploying SOA requires a new way of thinking, and a new way of acting. To deal with this conceptual change, many researches have listed communication as an important factor to solve this problem. Marks & Bell (2006) state that an SOA conceptual architecture cannot be realized unless it is communicated to the constituents of the SOA— to the business users, developers, architects, business analysts, close trading partners, and business and IT executives. Bieberstein et al. (2006) stress that SOA indeed involves changes in corporate culture; whereas communication between lines of business and technology teams is especially critical. Moreover, Howard (2008) points out that an ongoing communication and management is required for a successful SOA initiative. He further points out that a central function is needed to manage this, whereas he recommends organizations to set up an SOA program office leading the effort. This office should be responsible for developing an adoption plan and business case, and serve as a primary communication channel between business and IT.

To summarize, respondents' viewpoints and existing theories match up very well, both are acknowledging the challenges of creating an understanding for SOA and how important communication is to attain an awareness of the architecture. Additionally, theories support the suggestion of a central function to communicate the SOA vision.

6.1.5 LEADERSHIP

Another key ingredient perceived as necessary to succeed with SOA by two out of five respondents was the presence of leadership. **Skatteverket** said that: *It is important to have a distinct leadership present when adopting SOA.* Someone needs to be in charge and supervise what services are being exposed between the different systems. Business units should not be allowed to develop their own services freely. Furthermore, **Volvo IT** reported that no SOA governance strategy has been defined at top management level, which is a weakness. Instead: *The steering and governance are running on lower levels where there is a possibility SOA develops into an uncontrolled process – more similar to service anarchy than service architecture.* To prevent that from happening Volvo IT pointed out that management commitment and support from top-management is critical. *SOA demands a long-term engagement and governance from top management throughout the entire organization – it is absolutely necessary if Volvo wants to benefit from SOA.*

Linthicum (2007) emphasizes that the movement toward SOA should be driven by a commitment from the top. Nothing is worse than attempting to do something innovative in a highly territorial environment that spans into those environments without strong leadership. SOA spans territories, without buy-in from the top of the organization, and the political will to embrace change it become impossible to succeed with SOA.

Strong leadership and authority were not widely discussed by the respondents, neither was it by researchers. Nevertheless I do believe leadership and support from top-management are important ingredients to realize all the other factors having been mentioned. Leadership and authority is needed when communicating the SOA vision, enforcing principles, guidelines and standards, supervising and governing the development of services, and providing new financial and ownership structures that will promote reuse of services throughout the organization. Governing these activities will most likely run a great deal smoother when having a strong leader and/or a management group pointing out the direction. Because, when failing to address these critical factors properly, a lower level of reuse of functionality was recognized by the respondents.

6.2 FACILITATE REUSABILITY

When discussing problems related to the respondents' adoption of SOA, the difficulty of attaining a satisfying level of reusability of services was apparent. All of the organizations interviewed confessed they were experiencing troubles. **Skatteverket** said that: *It feels as if we have been developing too many services, they have not been reused adequately.* That is, many times a person asking for information gets a completely new service satisfying particular needs instead of existing ones being reused and combined to form a new service.

Probable causes as to why a high level of reuse had not been achieved by any of the respondents were quite a few. When analyzing the interview material thorough many of the previous mentioned factors did play an important role in securing a high level of reuse.

GOVERNANCE = REUSE

Sandvik stressed that: *In order to attain reusable services the organization needs to have control of the processes down to the activities.* **SAS** pointed out that the presence of strong governance is essential to achieve reusability of services – *If not, a chaotic situation is likely to arise were services are developed performing the same tasks.*

CENTRAL FUNCTION = REUSE

SEB advocated for: *Creating a more central function being accountable for the quality of the services, so that all the services developed achieve the right granularity and a satisfying level of reusability.* A prescription supported by Benson (2006), stating that if the control of the service definitions is done through a centralized SOA governance board, there is a very good chance that the service will get maximum reuse and be very reliable.

APPROPRIATE FUNDING MODEL = REUSE

SEB stated that: *Another circumstance that made it difficult to attain reusable services was due to the financial structure.* Dimarzio co-author in (Benson, 2006) state that when enterprises have a financial structure where each line of business owns its IT assets and controls funding of development projects on a cost/return basis, no business incentives for departmental units exist to make the additional investments necessary to achieve reusable services.

POLICIES = REUSE

Sandvik stated that setting principles of how to develop the services is essential so that they can serve more purposes than simply one specific need [reuse]. Borden and Mitlehner co-writers in (Benson et al, 2006) are stressing that without policies and procedures to document a service's definitions and registrations, its lifecycle, and how different stages interact; a company can quickly find that overlapping services are being created. Soon, a company may find it is quickly returning to the application environment that SOA was to replace

INFORMATION MODELING = REUSE

One probable cause as to why **Sandvik** has not succeeded in reusing services was due to the fact that the services were developed for one single cause. *There was not enough time to do the entire homework. We should have engaged in process and information modeling so that it would have been possible to identify all the stakeholders and find a mutual language to speak about this.* As a means to deal with the inadequate level of reuse **Skatteverket** suggested that *more energy needs to be dedicated to the information structure these services supply.*

None of the respondents mentioned the effect leadership may have on the level of reuse of services. Nonetheless, support for such an assumption was found in the literature study.

LEADERSHIP, COMMUNICATION = REUSE

Creating a development culture and environment that is encouraging to software reuse is a key consideration in implementing SOA. Executive support is often necessary. Senior staff speaking positively about software reuse reminds staff about its strategic perspective (Buckingham co-author in Benson, 2006).

6.2.1 REPOSITORY

Also the need for a tool facilitating reuse of services was identified.

REPOSITORY = REUSE

SEB stated that there should be an organization endorsing all the services being stored in the repository and displaying all the services stored inside of it. That way you get a better process insuring that all the services developed are unique, thus not being redundant. If not, you are likely to get a service which is more or less the same as previous ones, and that is not desirable at all. Some sort of SOA governance organization should be in charge of this set of regulations.

Out of the five respondents SAS, Sandvik, and SEB all had implemented a repository. Volvo IT and Skatteverket had not, but had identified the need of getting one. **Volvo IT** said that so far there are no requirements demanding search after existing services or reuse of them. We do not spend time analyzing how the service can be reused by others, we just build it. But: *We have realized that some kind of product will be required in order to find and reuse services. It is necessary to get a tool that can manage and control this, as well as establishing rules and routines for the process of endorsing services. We need to determine what is allowed to become a service. It might also be a good idea to validate the services before they are published in production, and establish some contracts.* **Skatteverket** stated that: *We do not have a technical catalogue that can be used to search after or find services; a piece we still miss with SOA. As for example, if you need to invoke a service during the development process, it is not possible to connect to a catalogue to see what services already exist, which is one of the weaknesses we are trying to fix.* It would have been nice to have a catalogue so that it would have been possible to gather and organize everything. That would limit the confusion regarding what services exist, who is responsible for them, and who to sign a contract with if reusing it etcetera.

Al together, the challenge of attaining a high level of reuse clearly depends on many different factors, whereas a holistic approach is required to face all of them. A tool that can aid organizations in achieving reusability of services is the implementation of a repository.

6.3 CONCLUSION OF ANALYSIS

According to this research's findings, governance is a key factor to succeed with SOA. Considering that all the respondents had a consensus of opinion regarding the importance of governance, concurrently as gaining strong support in academic research, there are valid reasons to believe governance play an important role when deploying SOA.

Apart from governance, several other factors were highlighted during the qualitative interviews. The respondents at SAS, Volvo IT, Skatteverket, Sandvik and SEB called for *a central SOA governance function – communication - policies, standards, contracts, & guidelines - funding & ownership*, - as well as *leadership*. All being essential parts by themselves, but also as components of a governance structure. Something SEB and Sandvik also highlighted, speaking about these factors in a somewhat larger context.

SEB: *Al together, I believe the biggest lessons learned from SEB’s SOA experience is that the technology is the smallest problem – governance, control in the shape of financial principles, guidelines, and standards are foremost the biggest and most important matters to deal with.*

Sandvik: *The key to succeed with SOA is to gain control of the processes and the activities within them, find a common nomenclature and terminology, and to assign a clear ownership of the processes, information, and services.*

Based on discussions with respondents, and theories from previous research, (figure 7) aims to visualize the relationship identified between each one of the factors and how they in union can form a strong governance structure.

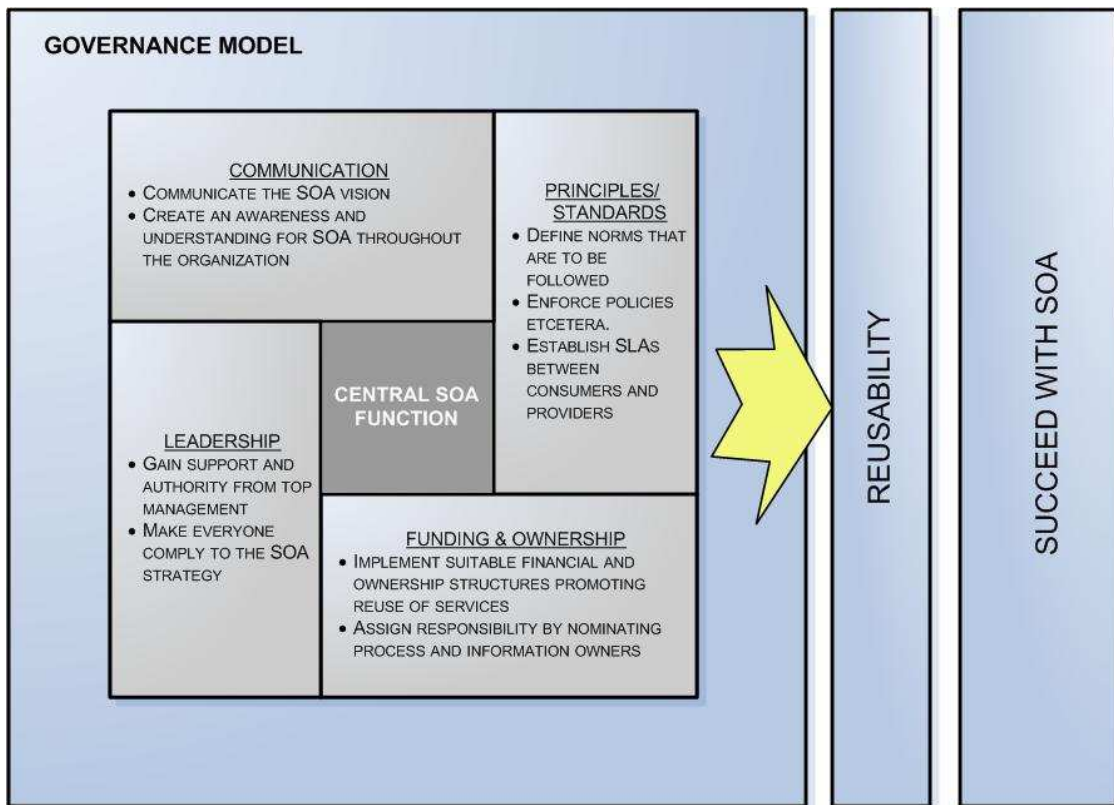


Figure 8: SOA Governance Model - Critical Factors to Succeed with SOA

To succeed with SOA a **central function** is needed to govern, control, and review the process of developing services. It needs to take on **leadership** and authority of the

initiative by defining and enforcing **policies, standards, guidelines, and contracts**. This function should also be accountable for reviewing the appropriateness of existing models for **funding** and **ownership**, by investigating how these may affect the exposure and reuse of services. If new models are needed, this unit needs to occupy the decision power to take actions facilitating the transition. Additionally, this function should inhabit the responsibility for **communicating** what SOA is and how it can bring value to the organization. All stakeholders need to share the same vision and be prepared to collaborate and engage in joint efforts to succeed with SOA, especially since this architecture indeed spans corporate boundaries. By adopting this holistic approach towards SOA and by creating a strategy to address all these critical factors – organizations will be better equipped to tackle the difficulties of attaining a high level of reuse of services and to accomplish a successful adoption of SOA.

When comparing this model to Carter's (2007) SOA governance framework, many similarities can be spotted. For example, the purpose of Carter's framework is to monitor the SOA governance processes, define policies, design enforcement mechanisms, and to identify owner and funding models. A SOA Centre of Excellence is also advocated for, which is a function responsible for developing the right skills to design the governance IT infrastructure and set the right business linkages in place. In addition, Carter remarks that the task of SOA governance is to assist in establishing a process for shared services, as well as facilitating communications. Moreover, Marks & Bell (2006) recognize the need for similar factors, stating that: *"An SOA governance model defines the various governance processes, organizational roles and responsibilities, standards and policies that must be adhered to in an SOA conceptual architecture."* Bieberstein et al. (2006) also stress that a successful SOA project can happen only with the strong support of senior executives, identified funding, and proper empowerment of the SOA governance body.

In conformity with Carter (2007) emphasizing that governance is so essential that it must be built into the SOA planning and deployment from day one, this study has come to the same conclusion. It is probably not advisable to stay in the "experimenting" phase too long. Volvo IT for example, is in the initial phases of adopting SOA thus still learning, but if failing to institute appropriate governance in the nearby future, the company risk losing the control over the development of services completely. Something that e.g. SEB had to experience, ending up with 4,500 services. As a result, gaining control of the move towards SOA should not be postponed too far ahead.

Conclusively, both this thesis empirical findings and previous research recognize that the critical factors identified in this research are all important parts of a SOA governance model. For instance, what much of a difference does it make if Volvo IT starts of good, defining strategies and establishing policies and guidelines; if no one is planning on enforcing them throughout the organization? And what a difference does it make if SEB has an organization endorsing and governing all the services being stored in the repository they have implemented; if the company simultaneously has a financial model punishing business units to expose services to others, and for reusing services already existing?

Simply put, identifying the factors to succeed is indeed significant. But one of the key challenges organizations are facing with SOA is the difficulty of assembling all the pieces needed to build up an overarching governance structure. As a result, establishing a coherent structure making sure all the pieces are managed in symbiosis is in truth the real “key” factor to succeed with SOA.

7 CONCLUSION

According to SAS, Volvo IT, Skatteverket, Sandvik and SEB – the overall most critical factor to succeed with SOA is *Strong Governance*. All the respondents shared the opinion that it is absolutely vital to gain control of the SOA initiative. Bearing in mind that all the respondents had a consensus of opinion regarding the importance of governance, concurrently as gaining strong support in academic research, there are valid reasons to believe governance play an important role when deploying SOA.

Apart from governance, other factors of significance were identified by the respondents as well, as can be depicted in (Table 2). Also these factors proved to be supported in previous research.

Table 2: Critical Factors to Succeed with SOA

CRITICAL FACTORS	SAS	VOLVO IT	SKATTEVERKET	SANDVIK	SEB	
ATTAIN STRONG GOVERNANCE	X	X	X	X	X	5/5
ESTABLISH A CENTRAL GOV. FUNCTION	X		X	X	X	4/5
DEFINE PRINCIPLES...	X	X		X	X	4/5
ADAPT FINANCIAL MODELS		X			X	2/5
ASSIGN OWNERSHIP OF SERVICES		X	X	X		3/5
COMMUNICATE THE SOA VISION	X		X		X	3/5
STRONG LEADERSHIP		X	X			2/5

During the research it became evident that all these factors are closely related to each other. Because, to succeed with SOA a *central function* is needed to govern, control, and review the process of developing services. It needs to take on *leadership* and authority of the initiative by defining and enforcing *policies, standards, guidelines, and contracts*. This function should also be accountable for reviewing the appropriateness of existing models for *funding* and *ownership*, by investigating how these may affect the exposure and reuse of services. If new models are needed, this unit needs to occupy the decision power to take actions facilitating the transition. Additionally, this function should inhabit the responsibility for *communicating* what SOA is and how it can bring value to the organization. All stakeholders need to share the same vision and be prepared to collaborate and engage in joint efforts to succeed with SOA, especially since this architecture indeed spans corporate boundaries. By adopting this holistic approach towards SOA and by creating a strategy to address all these critical factors – organizations will be better equipped to tackle the difficulties of attaining a high level of reuse of services and to accomplish a successful adoption of SOA.

All these factors are by themselves critical for achieving a high level of reusable services, and to succeed with SOA. However, the ability to establish a coherent structure making sure all the pieces are managed in symbiosis is in truth the real “key” factor to succeed with a Service-Oriented Architecture.

7.1 RESEARCH CREDIBILITY

As in any research, this thesis has been carried out with the aim of producing valid and reliable results, produced in an ethical acceptable way. When deciding upon what instruments to apply when conducting a research, Merriam (1994) asserts it is vital to consider how these may affect the validity and reliability of the study. Among others, techniques used for collecting the empirical data, methods adopted for analysis, and the accuracy of the conclusions made as regards to the information retrieved must be regarded.

In order to make it possible for other researcher to replicate this study, or make judgements about its credibility, all the methods applied has been presented and argued for throughout the thesis. Nevertheless, two occurrences in particular may have influenced the credibility of the study. For instance my lack of experience of conducting interviews may have affected the outcome of the interviews, especially the first one since I by then had no way of knowing how the respondents would react to the questions asked, or what kind of answers that could be expected. As for example, I acknowledged already after the first interview the difficulty of getting the information I needed without asking questions that would influence the respondent’s answer. To be able to deal with this in a better way hereafter, a set of back-up questions were added to the interview guide, all being formulated in different ways, but that were all likely to generate answers unfolding critical factors. E.g. I began asking questions regarding *critical factors*, and then continued asking about *experienced problems* and *lessons learned*. A strategy that proved to be very successful since many factors were not revealed straight away, but rather surfaced during the follow-up questions.

Secondly, due to technical difficulties the interview with Jan Nilsson, representing Sandvik, was not recorded. This incident unfortunately made it impossible to transcribe the interview word-by-word as with the other interviews, since the conversation could not be re-created by listening to the recording. Fortunately, the respondent had put together a document answering the questions that were e-mailed to him as a preparation for the interview. This document could therefore aid in the process of compiling the interview.

Apart from these occurrences, there are several aspects strengthening the credibility of this thesis. For instance, no fall outs are present in this research, meaning that all the respondents asked to participate agreed to do so. In addition, as can be depicted in (table 2) the answers by the respondents have little spread, thus providing a rather uniform opinion of what factors are critical to succeed with SOA. Especially when considering that all the organizations represented very different industries. Furthermore, theories supporting the significance of all the critical factors identified in the qualitative interviews could rather easily be found in literature by published researchers.

7.2 PROPOSALS FOR FUTURE RESEARCH

- It would be interesting to test how generalizable the critical factors identified in this research are by performing a quantitative research. By adopting such an approach, it would be feasible to include a larger number of participating respondents than is possible in a qualitative research like this one. Organizations having adopted SOA can be asked to rank a selection of critical factors, including the ones acknowledged in this research, but also other general factors frequently being discussed in academic literature.
- Moreover, it would be interesting to compare IT peoples' perceptions (as in this research) of what factors are critical to succeed with SOA, e.g. with business peoples. Do they share the same beliefs or not?
- Ultimately, to research how the wide adoption of SOA affects strategies within Business Intelligence.

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APPENDIX 1:

INTERVIEW MANUAL

Respondent Name:

Position:

Organization:

Date:

AGENDA:

- Presentation of myself
- Purpose of the thesis
 - Research question
- Structure of interview
 - Background information
 - Technical details behind the adoption of SOA
 - Questions referring to the research question
- My definition of SOA
 - The concept of SOA supported by web service technology

BACKGROUND DETAILS:

1. Can you please make a short presentation of yourself, what your position is and what you work with?
2. When did X adopt SOA?
3. Can you provide a short description of X's SOA environment?
 - a. How does your SOA effort look like today, (as opposed to Serviam's case study on X in 2004?)
 - b. What's the extent?
 - c. Internal/external services?
 - d. Approximately how many services?
 - e. Can you describe any services X has implemented?
 - f. Does X reuse services to a large extent?
 - g. Repository?
 - h. ESB?
 - i. What products and vendors are used?
4. Has X followed any process when developing services?
 - a. Top-down or bottom-up?
5. Why did X decide to deploy SOA?
 - a. What benefits did X expect to attain?

RESEARCH QUESTIONS:

6. Based on X experience, what factors are the most important to succeed with an adoption of SOA?
 - a. Can you explain and describe them?
 - b. Why are they important?
 - c. How have X dealt with them in their endeavor to succeed with SOA?
7. Has X come across any problems when adopting SOA?
 - a. What problems?
 - b. How did they affect X's adoption of SOA?
 - c. How did X deal with them?
8. What are the biggest lessons learned during these years X has worked with SOA?
 - a. For example, have X learned by their mistakes and changed strategy?

CLOSURE:

9. Has X performed any kind of evaluation of the SOA investment?
 - a. Has SOA started to pay off?
10. Does X perceive the adoption of SOA as successful?
 - a. Why/Why not?
11. Does X perceive SOA as a long term solution?
12. Does X have any future plans for further investments in SOA?
 - a. Why not/What are they?

Thank you for your participation and your time!

If any further questions would arise, is it okay if I get back to you with them?

Before publishing, you will of course get the opportunity to review the interview summary, and correct possible misinterpretations if any.